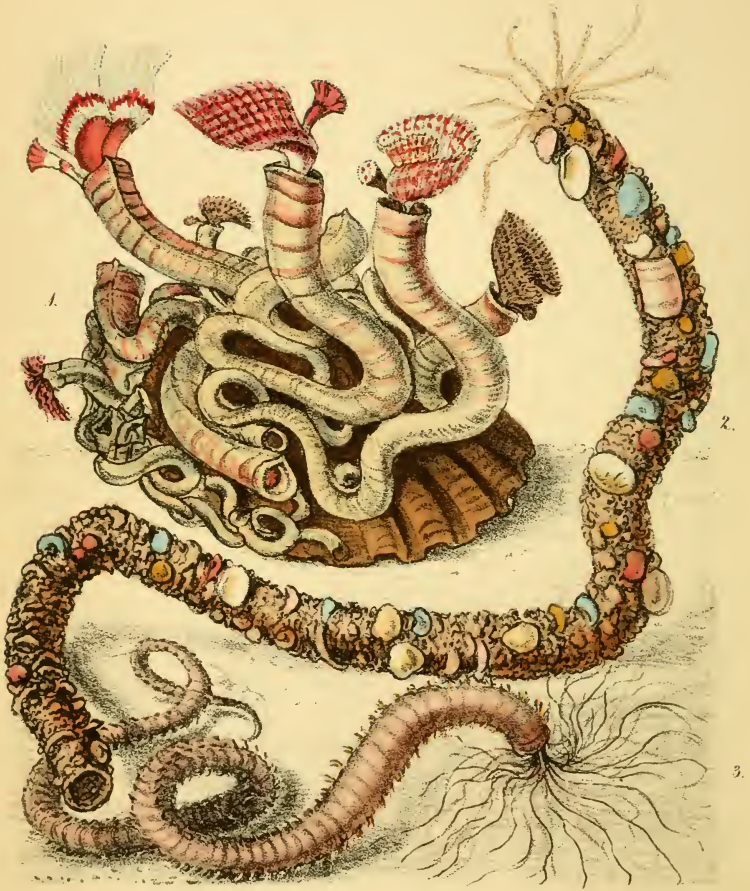

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1. Group of Serpula contortuplicata. 2. Case of Terebellum conchilega, formed of shells, pebbles and sand. 3. Worm withdrawn from case.

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POPULAR HISTORY

OF

THE AQUARIUM

OF

MARINE AND FRESH-WATER ANIMALS

AND PLANTS.

BY

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PREFACE.

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In the Introductory Chapter of this little Work will be found some general observations on the nature and uses of the Aquarium. These are accompanied by a few practical hints for the guidance of those who wish to possess such receptacles. The greater part of the volume, however, is occupied by descriptive accounts of such animals as have been, or may be, observed in Aquaria to greatest advantage. They are arranged in the order of their respective classes; and while the greatest attention has been given to observations of their functions and habits, their physical structure and the places they occupy in the system of Nature have not been forgotten.

The Writer's personal observations of *Hydroid Zoophytes*,

treated of in the Second Chapter, as well as some animal organisms detailed in the Third and occasionally throughout the Work, being very limited, he has not hesitated to introduce passages from the pens of those who have studied in detail the classes to which they belong.

Other parts of the Work contain more original observations and opinions, many of which will be new to the Reader.

As every Work on this subject must however bear, to a greater or less extent, the character of a compilation, the Writer has been less anxious to produce an original book, than to bring together, in an available manner, a large number of facts which will prove interesting to his readers: and whether in his own words, or from the pens of others, he has endeavoured to introduce these facts in an attractive form. Sea Anemones, the flowers of the marine garden, and Madrepores, which may be termed Anemones with coral skeletons, are sure to attract attention for their beauty and curious habits. Then come the Star-fish and Sea Cucumbers, with their strange self-mutilating propensities. The

Crustacean scavengers, Crabs, Lobsters, and Prawns, from the Hermit in his movable cell, to the Common Shrimp burrowing and skipping in the sand, present a strange variety of facts, in their premature changes, their periodical exuviations, and their manner of feeding and living. Mollusca and Fishes have not yet been studied as they will be: but a few notices of them are presented; such as those of the habits of the Nest-building Stickleback, and the Periwinkle with his rasping tongue.

The fresh-water department will afford many pleasing although familiar details, in the metamorphoses, exuviations, and general habits of Frogs, Newts, Water Beetles, and Water Tortoises; with the wonderfully divisible Green Hydra, and the Water Spider with his beautiful air-bell.

The Writer can only hope that enough of pleasant matter will be found to induce his readers to excuse the errors and omissions of which he is but too conscious.

Pembroke Square, Kensington,
May, 1857.

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POPULAR

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INTRODUCTION.

"In hollow of the tide-worn reef,
Left at low water glistening in the sun,
Pellucid pools, and rocks in miniature,
With their small fry of fishes, crusted shells,
Rich mosses, tree-like seaweed, sparkling pebbles,
Enchant the eyes, and tempt the eager hand
To violate the fairy paradise."—*Montgomery.*

NATURE OF AN AQUARIUM.—EXPERIMENTS AND ADOPTION OF PLAN.—THE VESSEL.—SHAPE AND MATERIAL.—FITTINGS AND FURNISHING.—ASPECT AND ADMISSION OF LIGHT.—THE WATER.—PLANTS.—ANIMALS.—TRANSPORT OF SPECIMENS.—CARE OF THE AQUARIUM.

In tide-pools of the shore we see the most picturesque miniatures of ocean life. Surrounded by a reef of small rocks, fringed with overhanging seaweeds and branching corallines, these little nooks afford grotto-like dwellings for animated beings. Crabs are here seen half hiding in the

dark recesses; shrimps are burrowing in the sand or darting across the little bay; sea-flowers are blooming; sea-worms expanding their feathery fans; and barnacles incrusting rocks. Pebbles throw out their long arms fringed with network in many a cast for food; and small fishes glitter in the brine as they seek to elude the stranger's sight.

Could we but transport this little picture to our dwellings—could we place it in our gardens—could we examine the contents at leisure—could we watch the habits of these living creatures in their native element, but far from their native retreats, what an endless source of amusement would it be! Can we do this? Can we raise the grotto, and carry it home, water, rocks, plants, animals and all? No, but we can realize the idea, by collecting the materials and imitating the arrangement, and this will be a "Marine Aquarium."

Imagine again, a section of a river, pond, or lake, with its weeds and rushes flourishing, water-snails creeping on the leaves, and fishes gliding among the stems; suppose this section enclosed within glass walls, and placed in your parlour or conservatory, and you have a "Fresh-water Vivarium."

But while the imitation of a tide-pool or pond may

represent the primary idea of a Water Vivarium, yet the experiments are not all confined to those organizations which keep within shallow waters: even denizens of the deep may be provided with such accommodation as will almost make them feel themselves at home.

Nor is it only for *amusement* that such parlour oceans and lakes are prepared and stocked; they are invaluable as a means of *instruction*. The natures of living beings can never be thoroughly known but by their habits; their habits cannot be well understood unless closely and continuously observed; and if we cannot go down among mollusca, crustacea, and zoophytes to examine them in their native haunts, we can now bring them up to us, to be studied in nearly similar conditions.

The principle upon which Water Vivaria are constructed and maintained consists mainly in balancing animal by vegetable life, thus:—If a few fish were confined in a vessel of water, and the water remained unchanged, they would soon droop and die. The water would not sustain life after the animals had deprived it of its oxygen by passing it through their gills in breathing. If, by means of a fountain-jet, the water can be raised up and returned through the air into the tank, or, in other words, be

aerated, a fresh supply of the vital element may thus be introduced and its power of sustaining animal existence proportionally prolonged.

But it is now found that water-plants, properly acted upon by the light and under other suitable conditions, will, instead of taking from, add to, the proportion of oxygen present, and will thus restore the balance, without mechanical aeration. Thus, tanks of water with plants and animals, as collected by the first experimenters years ago, still exist with their tenants, living and breeding healthily; and although the water has never been changed, it is as clear as when first put in, and as capable of sustaining life.

Experiments and Adoption of Plan.

Although many partial experiments may have been made with a view to keeping animals in water for the purposes of observation, and many interesting details in marine and fresh-water zoology have resulted, we may consider that the first serious and systematic attempt to keep a Water Vivarium, in its true sense, was made by Mr. Robert Warrington, of Apothecaries' Hall. That gentleman's early experiments were communicated to the Chemical Society in 1850, in a paper "On the Adjustments of the Relations

between the Animal and Vegetable Kingdoms, by which the vital functions of both are permanently maintained." Mr. Warrington stated that he placed two small gold-fish in a glass jar, capable of holding twelve gallons of water. Half-filling the vessel with spring-water, and placing some sand and mud at the bottom, with pebbles and fragments of limestone and sandstone, he planted a small *Vallisneria* in the mud and left the whole undisturbed. After a time the water became thick, and a coating of confervoid vegetation obscured the glass. On introducing, however, a few water-snails, he found that they fed on the confervæ as well as on the decaying matter of the older leaves, and soon restored the water to a clear and healthy condition.

The pruning of the old leaves encouraged the growth of off-shoots; the snails flourished on the vegetable matter which they consumed; and the fishes lived healthily in the renovated water, while they grew fat upon the eggs which the scavengers deposited. I could not help regarding with some veneration the veritable tank in which these early experiments were made, with the same water unchanged, when admitted to a view, through the politeness of its possessor, only a few days since.

In the year 1853, Mr. Warrington communicated in the

'Annals of Natural History' the results of his early essays in the way of *Marine Aquaria*, commenced a year sooner. The difficulties here were greater, but have been all overcome by perseverance; and side by side with the fresh-water tank is now to be seen the first marine tank, with marine plants and animals in full health. And this, as being the first, is more interesting than many others which its proprietor has since constructed. Obtaining salt-water from oyster-boats at Billingsgate, which was taken from the middle of the English Channel, Mr. Warrington placed it in a tank, and then introduced red and brown seaweeds, which, not answering the purpose, were exchanged for green weeds, which answered better. Specimens of *Enteromorpha* and *Ulva* attached to nodules of flint or chalk were procured from Broadstairs, and several anemones, with a few periwinkles, introduced with them into a small tank, and then into a shallow pan. A few more were added, and thus a number of living specimens were kept in a healthy condition to the close of the year. The first tanks were made, for fresh-water subjects, with straight sides; and these tanks were, in the first instance, used for the marine experiments; but when these were sufficiently advanced, Mr. Warrington had a new one made

for a permanent Marine Aquarium. In this new tank the back towards the light, and the sides were of slate, and only the front towards the observer was of glass; for it had been found in the first experiments, that too much direct light developed the vegetation too fast, especially that small slimy confervoid growth which obscures the water. The only direct light, therefore, entered from the top. The tank was covered with a light glass shade, to keep out the dust and check evaporation. "With the sea-water obtained in January, 1852," says Mr. Warrington in 1853, "I have been working without cessation up to the present time, agitating and aerating when it became foul during the unsuccessful experiments on the seaweeds, but since then it has been rarely ever disturbed; the loss which takes place from evaporation being made up, as before stated, with rain or distilled water."

Mr. Gosse's experiments in the same line were commenced nearly at the same time, and continued with some success until that gentleman was engaged in conducting the preparations of Vivaria on a large scale for the present magnificent exhibition in the Gardens of the Zoological Society. The popularity of this exhibition, and the interesting researches, published by Mr. Gosse in his 'Devon-

shire Rambles' and 'Aquarium,' have led numbers of private persons and some public institutions to follow the examples thus set. It has now become one trade to supply tanks and vases for Aquaria; and another, to collect and supply plants and animals for stocking them. In the course of my preparations for this Work I have received valuable assistance from the zeal and experience of Mr. Alford Lloyd, of Portland Road, whose extensive collections have been in the most liberal manner placed at my disposal. That gentleman is in correspondence with collectors placed at various parts of our coasts, and constantly receiving new specimens for the supply of private tanks. Those who apply to Mr. Lloyd's establishment will receive information, which may be fully relied upon, respecting the mode of proceeding in the formation of Marine or Fresh-water Aquaria. The following, however, are a few observations which may serve in some degree to assist those who are desirous of commencing so pleasing an occupation. The first thing to be attended to is

The Vessel.

Shape and Material.—Bearing in mind the idea with which we started, of imitating a tide-pool, and desiring to

keep as near to nature as possible, I have no hesitation in recommending for marine-shore objects, the form of tank with a sloping back. The bottom of the vessel should be flat only for about a third of its width, and from that line it should gradually rise towards the back; the front being perpendicular, and of clear glass. The back and sides should be opaque. If in a room near a window, let the back be towards the light, which will then enter only from above, just as it would in a basin of rocks on the shore. Slate is good for the back and sides, and plate-glass for the front. Mr. Warrington is now trying deep rectangular tanks, shaded with green coatings to modify the light, and suited for animals and plants accustomed to deep water. Rectangular tanks are also suitable for fishes, if of any size; and as fresh-water tanks will bear more light than marine, they too may be straight-sided.

Vases and shallow glass pans are also used both for Marine and Fresh Vivaria, and will, for many purposes, answer as well as the more complicated and expensive forms. An Aquarium should be covered either with muslin or a plate of glass.

Fittings or Furnishing.—The bottom should be laid in with sand or gravel suited to the condition they are in-

tended to represent. Some marine animals burrow, and should therefore have a bed of suitable material to gratify their propensity. It is best to use sea-sand for sea-water, and river-sand for fresh-water. Then a few clean bright pebbles give a pleasant appearance, and afford shelter for minute animals. In marine tanks only is rockwork admissible. This must be made according to the taste of the proprietor. Pieces of natural rock, or large stones cemented together, and shaped by any cement that hardens under water, may be used; they should be set up with projecting ledges, and forming hollows and arches, so as to give shelter to those animals which seek it, and present a variation in the position of various growths. Too much formality should be avoided; but, as a rule, the tank would best represent a shore-grotto, if the larger rockwork were placed at the sides and in a half-circle at the back. In a fresh-water tank, a few large stones laid down on the pebbles and sand is all that will be desirable. The ornamentation in this case must consist principally in the plants.

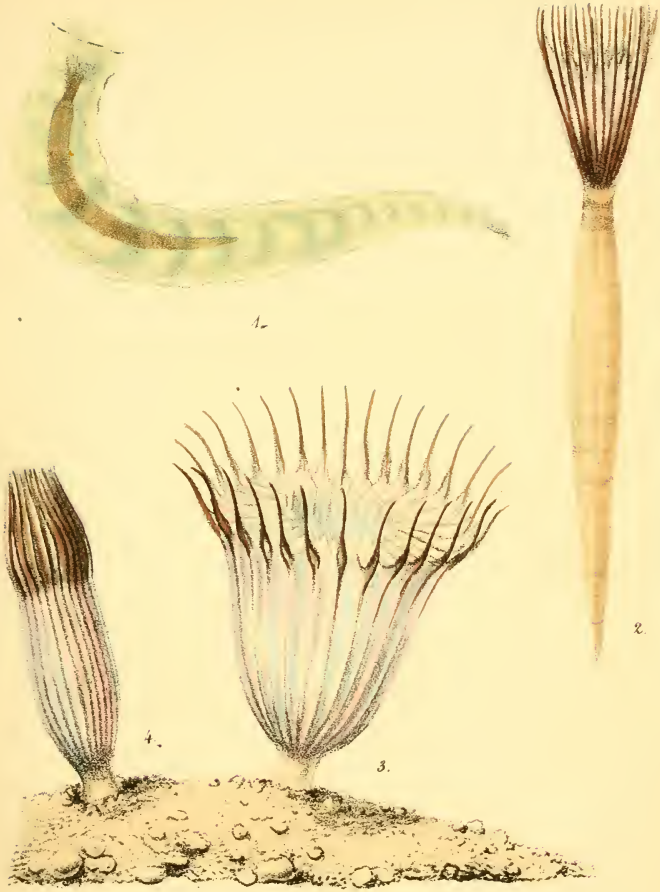
Aspect and Admission of Light.—In visiting the Zoological collection the eye is pained in some instances by the foul and stagnant appearance of some of the tanks. A

green opacity pervades them, which renders them not only unpleasant to the observer, but unwholesome to the living beings confined in them. This arises from the too rapid development of vegetation; germs of confervoid growth accumulate throughout the water, besides what settles down in green and slimy incrustation on the rockwork and glass. When this happens, it is a sign that the light has been admitted too directly and too freely; for this growth is developed by light, and when that is shut off it soon disappears. Light, therefore, in marine tanks should be admitted sparingly and indirectly, and it has recently been found that it is best to pass it through a coloured medium. Thus, by far the best construction and position for a shore-vivarium will be that already indicated,—a sloping back towards the light, and a top of *bluish-green* glass. To represent the comparative darkness of deep water, Mr. Warrington's deep rectangular tank has the top and sides darkened with a deepish blue. This gives a rather ghastly appearance to the objects, but not more so than might be expected from a visit, if we could pay it, to the same creatures in their homes. Fresh-water Aquaria will admit more light with impunity.

The Water.

The great object is to get the water pure: if marine, it should be taken at a distance from the mouths of rivers; that dipped in mid-channel is preferred by professed Aquarians, although I cannot tell exactly why. I should have supposed that water taken from the shore, whence the greater part of the specimens are procured, would be most likely to contain those materials which were most suitable for their support. Artificial sea-water is now much used, and the formula for its preparation is given by several authors. But I do not advise the uninitiated to experiment in its composition. Aquarium dealers sell the necessary powders, mixed in proper proportions, and will give full directions for its use.

It is evident, however, that the artificial water must be at first totally deficient in one very important element, namely, the animalcules with which water in its natural state abounds, and which are necessary for the sustenance of many marine animals. These must be introduced by the insertion of seaweeds, and time must be given for them to act beneficially on the water. Bright and clear river-water is best for fresh Aquaria.



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Amphitrite Egeana. 1, in its transparent case (reduced.) 2 Worm out of its case 3 Head expanded. 4 Head closed.

Plants.

Marine Plants for an Aquarium should be taken attached to the stones or pieces of rock on which they grow. When once the root is detached the plant is dead. The stone should be as clear as possible from sponges; and many other living incrustations are likely to die, and their decay will prove injurious to the water. *Rhytiphlœa pinastroides, Corallina officinalis, Delesseria alata, Chondrus crispus, Polysiphonia, Phyllophora rubens* (Plate XIII.), *Griffithsia,* and *Callithamnion* are recommended for red seaweeds; species of *Codium, Cycladophora, Bryopsis,* and *Ulva* are suitable for greens. In ordinary tanks, the green weeds are decidedly the most healthy, but the deep sea tank on trial by Mr. Warrington is partly contrived to encourage the growth of reds, which are very pretty objects, to the discouragement of the greens, which flourish in the light. It is found that weeds of any kind may be used more sparingly than was at first supposed. After a time the stones in a tank will be found covered with a brownish confervoid growth, which throws off a considerable amount of oxygen, as may be observed by the little quicksilver-like bubbles about it. When a tank is in this condition, larger weeds

may be dispensed with. For fresh-water Vivaria, *Callitriche* or Starwort, *Stratioides* or Water Soldier, *Vallisneria spiralis*, *Anacharis* or New Waterweed (Plate XVIII.), some Water-lilies, and *Eriocaulon* or Pipewort, the Water Ranunculus, *Hydrocharis* or Frog-bit, *Alisma* or Water Plantain, are among the most popular.

Animals.

Fishes.—For private collections at least, the larger kinds of vertebrate animals will not be convenient, but most of the smaller species of *fish*, both marine and fresh-water, will live and breed freely in tanks well supplied with oxygen, and there is no way in which the beauties of their form and markings can so well be seen as through perpendicular, even-moulded glass. Here we see them undistorted by refraction, and can watch their graceful movements without disturbing them. Most of them appear to enjoy their dwellings, if we may judge from their lively, yet not restless bearing. We must remember, however, that they are generally animal feeders, and if put into a vessel with other animals weaker than themselves, they will not live with them quite in the same peaceable manner that cats do with mice in "*the Happy Family*." Some

species are more voracious than others, and more dangerous. Thus, a friend of mine had a tank with a few small fresh-water fish, and among them was a young pike, only two inches long, which attacked, and in fact destroyed, other fishes half as large again as himself.

Reptiles.—Water Tortoises, and Newts, live well in tanks, and are very interesting. They should be supplied with mud at the bottom of their pond; and also, by means of floating boards or pieces of stone rising above the surface, should have the opportunity of leaving the water at their discretion. Frogs do very nicely in Fresh-water Aquaria which are surmounted by a fernery, where they paddle in and out, and dive in the water or hide among the ferns.

Mollusca.—Beginning with the Tunicate order of Mollusca, which are very simple in their composition, we find very pleasing objects presented by several species of *Ascidia*, one of which I have represented (Plate XIII.), probably *A. hyalina*. It is curious to see these apparently lifeless bottles with two necks every now and then shut the openings and jerk out the grosser particles of food, which they have admitted, in the current. Those of the more compound nature are more interesting to the microscopist than to the observer of outward forms. *Conchiferous Mollusca*, or those furnished with

bivalve shells, such as the fresh-water Mussels, or marine Oysters and Scallops, lie very quietly in their burrows, or hang attached by their byssal cords, agitating the water that surrounds them, and filtering it as it passes through from the oral to the anal opening of the tubes; thus exercising a cleansing influence on the surrounding fluid. *Gasteropoda*, or Crawling Molluscs, either with or without shells, give variety and animation to a tank; while Periwinkles in salt-water, and Water-snails in fresh, are useful as scavengers, eating away the vegetable crust which obscures the glass; other Molluscs, such as *Purpura*, *Buccinum*, and *Nudibranchs* (Plate XIV.), feed on animals, and must not be put in the way of any choice living morsels which you may wish to preserve. Cephalopodous Mollusca, or the Cuttle-fish tribe, are too *oceanic* to live long in confinement.

Polyzoa and *Rotifera* are of microscopic interest.

Insecta.—The Water Beetle (Plate XIX.) and Water Spider (Plate XVIII.) are very interesting in their habits, as described hereafter, and seem to live as well in the tank or jar as they would in their natural localities at freedom.

Crustacea are among the most amusing objects in a marine collection. Many of them are useful in picking up scraps of decaying animal-matter from between the stones.

The Hermit Crab (Plate XI.), in his shell surmounted by the parasitic Anemone; the Lobster, moving out of his hole, with a forest of green weeds growing upon his shell; the Prawn (Plate XII.), with his splendid livery and delicately-contrived organs, are all fine objects; while their changes and habits, wonderful as they are, can all be observed freely by means of the Aquarium. Even the common Shore Crab, in its earlier stages of growth, is a good acquisition, if care be taken not to give it too much opportunity for displaying its pugnacious qualities.

Cirrhipedes as yet have only been represented in marine tanks by the common little Acorn Balanus (Plate XI.), which is common enough, living on the outsides of living and dead shells incrusting pebbles and rocks. It is very interesting to observe the way in which they open their opercular valves to throw out their network of cirrhi to envelope the animalcules which come within reach.

Annelida (Plates I., II., IV.) with shelly or pebble-formed tubes and branching ferns of gills, give great variety and beauty to the miniature ocean.

Echinodermata, Starfishes (Plate XVII.), Sea Urchins or *Echini,* and Sea Cucumbers (Plate X.), are very pretty objects, but not generally long-lived in Aquaria.

Acephala.—Jelly-fish will not live well in confinement when full-grown; although some of them, in their early *hydroid* stages, are interesting, and even when mature can be kept living for a few days. They are too oceanic for permanent tenants.

Zoophyta.—The *hydroid* forms, consisting of branched polypidoms, with numerous polypes, are many of them pretty objects, but their chief interest is microscopic: not so the *Actinoid* forms,—the Anemones, or Sea-flowers (Plates VI., VII., VIII., IX.), and the no less flower-like Madrepore (Plate III.); their beauties are palpable, and they present the chief ornaments of our water-garden. Most of them will live in water so turbid as to destroy other animals; and they reproduce in numbers, and transplant themselves at will without interference from the gardener's hand. They will live upon Infusoria without being fed, occasionally seizing a prawn or small fish that may happen to come in their way; but it is well to feed them occasionally with pieces of dried meat, dropped down within reach of their tentacles: they will be likely to flourish all the better for being fed, and it is a very amusing process to feed them.

Porifera.—Sponges, when dragged from their native position, are pretty sure to die speedily; and as their decay is

injurious to the water, it is best to clean off all spongy matter from marine stones on inserting them. *Alcyonium digitatum* (Plate V.) is very pretty, but soon dies.

Transport of Specimens.

Most small animals suited for the Aquarium may be, and constantly are, brought to London from any part of the seacoast, in jars of sea-water, with bladders tied over them; or packed up in bundles of wet seaweeds gathered from the beach. Dealers obtain them in this way. I have been at Lloyd's when many Anemones and other things have been brought in, unpacked, and immediately placed in their proper receptacles, where they have soon made themselves at home, apparently not having suffered from the journey. I think, as a rule, that persons living near London had better let the dealers get their specimens for them: it is a cheaper and safer plan.

Care of the Aquarium.

When the Water-Vivarium is first established, there will naturally occur during the few first days some deaths among animals so recently introduced. It is very important to watch for these occurrences, and to remove the bodies before

putrescence takes place; but if many of them have escaped detection by falling into hollows, or by their minuteness, they will putrefy the whole body of water, to the great danger of the remaining animals. This will be seen by a milky appearance pervading the whole. In such a dilemma, the only way of proceeding will be to draw off and filter all the water, removing the animals, for the time, in temporary vessels. The drawing-off can be effected by means of a siphon, so as not to disturb the sediment. Then, taking out the pebbles and sand, rinse them and wipe out the tank; return the water through a filter, which may be made with a piece of sponge placed at the top of the tube of a funnel. The sponge must not be pressed so closely in as to prevent the water running in a gentle stream. In passing through the air in a very thin column, every drop is brought into contact with it; and this will tend to destroy putrefaction, by chemical combination of the animal matter with the oxygen of the air. After this the probability is that the water will remain clear, and care must still be taken to remove bodies of animals that occasionally die. An occasional partial filtration is a good habit, and a floating piece or two of charcoal may give still further security.

If a green turbidity arises in the water, it is the result of

a too rapid growth of green vegetation, induced by the action of light. This may be corrected by depriving the vessel of light for a few days. I have seen a tank at Lloyd's restored to perfect clearness by being covered over for a short time with dark cloths.

For the purpose of occasional aeration a drip-glass is recommended. A bell-glass perforated, with a piece of sponge lightly put into the hole, is suspended over the tank, and water taken from it is put in and allowed gradually to drip through. A Fountain-Aquarium, with apparatus for drawing the water up into the reservoir, would be a very good contrivance. This would save all the trouble of baling the water out of the tank, at the risk of disturbing the living organizations within it. A small pump, drawing the water through fine holes from near the bottom, would effect the purpose. The unsightliness of the apparatus could be disguised by rockwork, and the fountain, assuming the form of a cascade, might be so placed as to present an elegant object.

In conclusion, it is hardly necessary to recommend this new and popular method of studying Nature, as a prolific source of amusement and instruction. But although I have not in these pages followed the fashion of making Natural

History an occasion for diving deeply into abtruse doctrinal subjects, I may point out the legitimate effect of such studies in the words of Coleridge's 'Ancient Mariner.'

"Oh, happy living things! no tongue
Their beauty could declare;
A spring of love gushed from my heart,
And I bless'd them unaware.

"Farewell, farewell; but this I tell
To thee, thou wedding guest,
He prayeth well that loveth well
Both man, and bird, and beast.

"He prayeth well that loveth well
All things, both great and small;
For the dear God that loveth us
Made them, and loveth all."

CHAPTER II.

SPONGES AND HYDROID ZOOPHYTES.

"New buds and bulbs the living fabric shoots
On lengthening branches, and protruding roots,
Or on the father's side from bursting glands,
Th' adhering young its nascent form expands;
In branching lines the parent-trunk adorns,
And parts, ere long, like plumage, hairs, or horns."—*Darwin.*

NATURE AND HABITS OF SPONGES.—PROPAGATION.—APPEARANCE WHEN LIVING.—GRANTIA BOTRYOIDES.—GRANTIA CILIATA.—EUPLECTELLA ASPERGILLUM.—ZOOPHYTES DEFINED.—CLASSIFICATION.—HYDROID ZOOPHYTES.—HYDRACTINEA ECHINATA.—CORYNE PUSILLA.—CORYNE SESSILIS.—EUDENDRIUM RAMEUM.—TUBULARIA INDIVISA.—SERTULARIA POLYGONALIS.—SERTULARIA ARGENTEA.—ANTENNULARIA ANTENNINA.—PLUMULARIA PINNATA.—LAOMEDEA DICHOTOMA.—LAOMEDEA GENICULATA.—LAOMEDEA GELATINOSA.—CAMPANULARIA VOLUBILIS.—EUCRETIA CHELATA.—ANGUINA SPATULATA.—CELLULARIA CILIATA.

THE term *Zoophytes*, or *Animal Plants*, usually applied to Corals, Sea Anemones, etc., might be applied with greater propriety to a Sponge than to any other being. With its

skeleton, as used for domestic purposes, we are all familiar; and when informed that every fibre of this porous texture is covered with a filmy, gelatinous, and apparently little-organized coating when the Sponge is living, we know nearly all that is to be known of its external character.

Growing fixed to various substances, but most frequently to the roots of seaweeds, the plant-like body seems to vegetate and to hold its place between the animal and vegetable kingdoms. It belongs more properly to the former, but very low down in the scale. There are many species and genera, Dr. Johnston enumerating between fifty or sixty species inhabiting the British coasts. The structure and mineral composition of the skeleton differs as much as the forms, which are well known to be very sportive and variable. Globes, semiglobes, cones, cups, funnels, branches, and flat spreading masses, with different degrees of porousness and flexibility, characterize the various genera and species. The spongy body consists of a horny, or even stony, network, with innumerable interlacing fibres, so woven together as to leave many small openings and a few larger ones. These openings, running into each other, form passages for the free circulation of fluids throughout the body. The jelly-like film which covers all the fibres when the creature is

living, is the seat of all the animal life which the Sponge can boast. It secretes and deposits the substance of the skeleton, and keeps up some kind of action exerted in every part of the body, which, although scarcely perceptible, serves to produce a continuous succession of currents in the surrounding fluids. The living Sponge can be seen, if placed in a glass and examined by a microscope, to imbibe and expel currents of water, which appear to pass into the smaller meshes of network, carrying nourishment into all the recesses of the body, and then to be ejected by the larger holes appearing on the surface; and this is all the creature shows of animated existence, for the filmy flesh does not contract when touched, or show any other sign of sensibility.

The propagation of Sponges is curious; for at the proper season many minute buds may be found adhering to the sides of the passages or openings. These buds are the embryos of the Sponge, gradually increasing in size they become clothed with movable cilia, and when fully developed fall off, and, becoming detached, enjoy a locomotive freedom unknown to their parent. Their motion is effected by means of the cilia, which continue vibrating and produce a current round the little body, which impels it forwards. It is not long a wanderer in the "world of waters;" and whether it

chooses, or drops accidentally into, a suitable position for its future growth, when once fixed it becomes a permanent tenant of the spot.

No doubt can be entertained that the Aquarium, assisted by the microscope, is destined to be the means of greatly increasing our hitherto limited knowledge of these half-animated beings. Mr. Bowerbank's researches in the natural history of the family have already been rewarded by the discovery of many new forms, and by the elucidation of parts of their economy. The large, spreading, fleshy *Pachymatisma Johnstonii*, with its thick skin studded with pores few and far between, has been examined, and the curious spicula (or stars and needles) of flint submitted to the microscope. Mr. Bowerbank has also pointed out that the currents observed as entering the small pores and leaving the large ones are produced by the motion of long fine cilia on the inner surface of the cells, which are constantly vibrating in the required direction, so that the means used for locomotion during the extreme youth of the Sponge are the same as those used for maintaining the principal functions of vitality in the middle life and sedentary old-age of the same creature. It appears too that as the horny skeleton of the Sponge is the support of the very loose, gelatinous animal

substance which covers it, so, in its turn, it is supported by a branched and interlaced crystalline network of flinty stars and needles, which make the framing of the channels and passages composing its mass.

The living masses present various colours to the eye. Some, such as *Cliona*, which lines the inside of some shells, are of a bright yellow colour; others, such as *Halichondria sanguinea*, are of a brilliant crimson hue.

Grantia botryoides,

An extremely minute Sponge, consisting of branching tubes, has been carefully examined under a lens by Mr. Gosse, who thus describes what he saw:—"I immediately transferred it to a glass cell, and applied it to the stage of a compound microscope, with a power of 220 diameters. To my astonishment, a mass of starry crystals met my view, entangled among each other almost as thick as they could lie, by scores, nay by hundreds. For a moment the eye was bewildered by the multitude of slender needle-like points crossing and recrossing in every possible direction; but soon the curious spectacle began to take some kind of order, the crystals were seen to be all of one form, though varying considerably in length and thickness; they are three-rayed

stars, diverging at an angle of 120 degrees; the rays, straight slender needles, perfectly cylindrical, except that they taper to a fine point, smooth and transparent as if made of glass, and highly refractive.

"These spicula appear to me to be held together only by their mutual entanglement and interlacing; their points, in the process of formation, have shot through and among each other, so that it would be almost impossible to extract one from any point without either breaking off its rays or tearing away a considerable portion of its whole surface. The rays shoot in the same plane, and in that plane the stars lie, not quite at random as to their direction, for the great majority have one point directed lengthwise from the mouth of the tube towards the base. There are not wanting however many which point in the opposite direction, and several at intermediate angles. Of course it requires but little divergence from the first-named direction to produce the second; still however the prevalent order appears to be this.

"I cannot trace any fibrous or gelatinous matter in which the spicula are set; but beneath the layer formed by their interlacing points there is a surface composed of round granules of transparent or pellucid matter, set as close as possible, which are plainly seen between the cross-

Sowerby del et lith. Vincent Brooks Imp.

Corals 1. Skeleton of Fungia or Mushroom Coral. 2. Caryophyllaea Smithii; animal expanded. 3. Animal closed. 4. Compound specimen. 5. Dissected skeleton. 6. Tentacles. 7. Oculina prolifera.

ing needles. This appears to be the interior lining of the tube,—in fact, the tube itself, around which the spicula are arranged as a loose outer coating, giving firmness to the whole. I could not detect spicula of any other form than the three-rayed stars; but several of these had one or more of their rays broken short; for from their composition they are very brittle, as I have often proved in other species. The form of this specimen was so irregular that but a poor idea can be conveyed of it by words; it may, however, be roughly described as an elliptical mass, sending forth from one side several tubes, which divide or branch into others."

Grantia ciliata

Is a very minute Sponge, shaped like a bottle; the neck consisting of a dense fringe of spicula set round the opening so as to form a crown. A stream of water, passing always in the same direction through the aperture, gives the form to these neck-spicula, and it has even been found that if these latter are displaced by accident, so as to bruise and distort the crown, the current will restore them to their natural direction after the specimen has remained for a few days in a vessel of sea-water.

Of all the varied forms of Sponge, or rather Sponge-skeletons, with which we are acquainted, no one approaches in elegance of appearance, and delicate regularity of texture, the unique specimen dragged up, on a hook, among weeds by Mr. Cuming in the Philippine Islands. Professor Owen has given it the name of

"EUPLECTELLA ASPERGILLUM,"

Deriving the first name from words signifying "*well plaited,*" and the second, from a wonderful resemblance to a well-known shell, commonly called the "Water-pot." The shell, named *Aspergillum,* is a tube tapering at one end, and having at the other end a disc with holes, like the rose of a garden water-pot, and surrounded by a fringe of small tubes. It is formed by an acephalous mollusc, which, in its early stage, possesses the nuclei of a bivalve shell, the edges of which increase in every direction so as to form the tube spoken of, and in which these nuclei are only seen afterwards, as forming a portion, looking as if they were glued into its side. The *Euplectella,* which measures eight inches in length, bears so near a resemblance in form to the shell, that Mr. Cuming imagined, on first taking it, that he had found a wonderful new species

of *Aspergillum*. Of course, as the nuclei of valves could not be found, and as the whole texture of the tube was an open network of sponge, instead of a tubular lamina of shell, the illusion was soon dissipated. The tube is gently curved, like a horn, but not coming to a point, and at the base it is two inches wide. Here it is covered by a disc of very open network, outwardly convex, and surrounded by a thin projecting frill or plate of plaited fibres. In the wall of the tube there are supporting fibres placed lengthwise, and forming the upright framing upon which the cross fibres are woven. There are three sets of cross-fibres in different directions; two spiral, opposing and crossing each other diagonally, and the third, horizontal. These cross each other in such a manner as to form circular holes, between the upright supports, at regular intervals. Between the diagonal rows of holes, the paries is further strengthened and beautified by diagonal frills resembling that which bounds the terminal disc; at the smaller end the longitudinal supports separate into the minute fibres of which they are composed, and meeting round the orifice blend into a wool-like fluff. A figure of this beautiful object is published, with Professor Owen's description, in the 'Transactions of the Zoological Society.'

The engraving occupied three months of the artist's time. No other specimens have yet been found, but there must be others, and the time may yet arrive when we may see *Euplectellæ* living and flourishing in our zoological tanks!

Hydroid Zoophytes.

The word "Zoophyte," as most of our readers are aware, has been used in a very extended and general sense, to signify those numerous and varied beings which were supposed to occupy a middle position between the animal and vegetable kingdoms. It was applied to many things which were pretty well known in their external characters, but whose real natures were little understood. It was the name of a great miscellaneous group of things which were thrown together, not because they were found to possess qualities in common, but because it was doubtful whether they were animals or vegetables. It is now used in a much more limited sense; so limited indeed that it will scarcely apply to the objects for which it is alone retained by British Naturalists, excepting in the appearance of some. Many of the original group, as well as of the present, bear so great

a resemblance to shrubs, mosses, and seaweeds, while showing some signs of animal life, that it is not surprising that a name should be used significant of both ideas; but at present, those only are retained in the assemblage whose natures have been ascertained to be strictly animal, and not to partake in any degree of a vegetable character. All the true Zoophytes are polypiferous in their structure, and are thus defined by Johnston, who is the great authority on the subject.

"Zoophytes are all aquatic, avertebrate, inarticulate, soft, irritable, and contractile, without a vascular or separate respiratory or nervous system. The alimentary canal is very variable, but the aperture to it is always superior, circular, edentulous, and surrounded by tubular, or more commonly by filiform tentacula. Many are asexual, and it is doubtful whether any species has distinct sexes. The individuals, polypes, of a few families are separate and perfect in themselves; but the great majority of Zoophytes are compound animals, viz. each Zoophyte consists of an indefinite number of individuals, or polypes, organically connected, and placed in calcareous, horny, or membranous cases or cells, forming, by their aggregation, corals, or plant-like polypidoms."

The most simple form of polype is that presented by the *Hydra, Clava,* and others, in which the body of the animal is a simple sac, open at one end, and having the opening surrounded by contractile threads or filaments, called tentacles; while the other end has a sort of sucking disc, by which it adheres to other substances. The cavity of the sac is the stomach; the orifice of the sac represents a mouth; the tentacles surrounding it act as arms; and the sucker at the opposite end may be called a foot, since it secures adhesion when at rest, and acts as an organ of locomotion when the animal requires it. Many of the Zoophytes, including the *Actiniæ,* a few Corals, and the *Hydra* before mentioned, live singly, and throwing out their young through their mouths leave them each to find an independent mode of existence; but some bud out at the sides and form branches, in such a manner that each Zoophyte is a branched shrub, with a common stem, composed of a large aggregate number of individual polypes.

Mr. Gosse divides the Polypiferous Zoophytes into two Orders, thus:—

Internal cavity simple, increasing by germs growing out from the sides,—"*Hydroida.*"

Internal cavity enclosing the stomach, and divided into

compartments by radiated partitions, which have reproductive functions; germs ejected through the orifice of the cavity,—"*Actinoidea*."

It is with the "*Hydroida*" that we shall have to do principally in this Chapter; and instead of going more deeply into their general description, I shall give the history of a few of the most interesting species, which have been the objects of special observation.

It will be necessary however to premise that, in common with the Actinoid Order, the tentacles of the *Hydroida* are furnished with a kind of stinging weapon, in the form of very minute poisoned darts, which can be projected from capsules embedded in the tissues. By means of these the *Hydroida* can not only make their tentacles adhere to the victims, but also benumb and paralyze the latter so as to diminish their chances of escape.

Hydractinea echinata.

A little creature, about one-third of an inch in length, with a club-shaped head and a ring of tentacula, living on old shells in deep water. Each *Hydractinea* is independent; but they live in numbers on the same shell. They are said to be partial to the same shells, such as *Buccinum undatum*,

Fusus corneus, *Natica glaucina*, and *Nassa reticulata*, which are also inhabited by Hermit Crabs. It is also said that, unitedly growing on the rim of the aperture of the shell, they form an extended or overhanging ledge, which enlarges the cavity in which the hermit dwells, and if so, prolongs the period before he will be obliged to seek a fresh and more commodious home.

Coryne pusilla.

This is a minute branching Zoophyte, with a bright red star-like polype at the top of each branch. It is found on stones and seaweeds between high and low water, but the branches are so thin and the star-heads so small that it would only be seen under favourable circumstances. It creeps along the surfaces of the stone or seaweed to which it adheres. Its motions are slow; but it can at will bend any one of its horny, wrinkled, transparent branches, or coil any one of the tentacula which surround the polypes at their heads.

Coryne sessilis

Resembles an upright club, with circles of ball-shaped heads, on slender stems, projecting from it at intervals: these are the polypes, each about the sixteenth of an inch in

length, fixed to the central stem, which is fixed by creeping fibres to the surface to which it is attached. They are transparent, narrow, and terminate in a ball, on which the tentacula are very numerous, as many as forty-five having been counted on a single head. The neck to each head is glassy and wrinkled; they stand out from the stem in six circles, at nearly equal intervals; and the whole Zoophyte, as figured in the 'Marine Zoology,' would form an elegant design for a circular hat-rail.

Eudendrium rameum.

Of the genus to which this tree-like Zoophyte belongs, Mr. Johnston gives the following technical description:—

"Polypidom rooted by creeping fibres, erect and variously branched, the fibres cylindrical, tubular, filled with a soft pulp. Polypes hanging from the extremity of every branchlet, non-retractile, roundish, somewhat pedicled, naked and fleshy; the body encircled with a zone of filiform tentacula; the mouth central and sub-tubular.

"Eudendrium" is from two Greek words signifying the adjective *well* and the noun *tree*.

E. rameum is found on shells and stones in deep water, at Shetland, Scarborough, Northumberland, Whitehaven,

Dublin Bay, Cornwall, Aberdeenshire, and near Liverpool. It is so exactly like a leafless tree in appearance, that, until closely examined and the polypes seen, it would be taken for a plant by any one not thoroughly acquainted with the nature of Zoophytes. It grows from three to six inches high, and is thus spoken of by the late Sir J. G. Dalyell:—

"This is a splendid animal production, one of the most singular, beautiful, and interesting among the boundless works of Nature. Sometimes it resembles an aged tree, blighted amidst the war of elements, or withered by the deep corrosions of time. Sometimes it resembles a vigorous flowering shrub in miniature, rising with a dark brown stem, and diverging into numerous boughs, branches, and twigs, terminating in so many hydræ, wherein red and yellow intermixed afford a fine contrast to the whole.

"The glowing colours of the one, and the venerable aspect of the other, their intricate parts often laden with prolific fruit, and their numberless tenants, all highly picturesque, are equally calculated to attract our admiration to the Creative Power displayed throughout the universe; and to sanction the character of this product as one of uncommon interest and beauty.

"A very fine specimen of the *Tubularia ramea* (*Euden*

drium rameum) was recovered from among the rocks of a cavity in the bottom of the Frith of Forth, at about one hundred and fifty feet from the surface. It had vegetated in such a direction that it was detached quite entire. Being transferred to a capacious vessel of sea-water, I found it rising seven and a half inches in height, by a stem about nine lines in diameter near the root, then subdividing into several massy boughs, besides many lesser branches. Numberless twigs, terminated by thousands of minute hydræ of the palest carnation, clothed the extremities, which were ten inches apart. The root diffused itself irregularly, by a multitude of mossy-like fibres, which might be circumscribed by a circle two inches in diameter. It is to be observed, that the stem and higher rigid portions consisted of irregular bundles of tubes; but about two inches of the highest were in verticillate arrangement. Though composed of bundles of tubes below, the absolute extremities, bearing the hydræ, resolve into single tubes, each with its animal.

"Many parasites invested this splendid specimen. Masses of the pure white and deep orange *Alcyonium digitatum* hung from the boughs; *Sertulariæ*, *Sponges*, and *Algæ* were profusely interspersed, all proving, by their obvious successive generations, the great antiquity of the *Eudendrium*.

"Other specimens have occurred, of a similar aspect and conformation, chiefly from four to six inches high, but none above nine. One beautiful and luxuriant specimen, four inches high and diverging four inches, might have been circumscribed by an ellipse two inches and a quarter across. By gross computation, 1200 hydræ, deeper coloured than peach-blossom, decorated this latter specimen. The head, or hydra, of this Zoophyte is deciduous."

"Full many a gem, of purest ray serene,
The dark unfathom'd depths of ocean bear!
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air!"

Tubularia indivisa.

In this Zoophyte, the polypes are fixed at the end of tubes which do not branch, but each one, or nearly each one, of which proceeds directly from the creeping fibre by which it is attached.

The genus *Tubularia* is thus defined by Johnston:—"Polypidom horny, fixed by a creeping fibre, erect, fistular, and unbranched; the tube filled with a semifluid medulla. Polypes placed at the extremities of the tubes, non-retractile, fleshy, furnished with two circles of filiform, smooth ten-

tacula; one row surrounds the middle of the heads, and the other is placed round the mouth. Bulbules clustered, shortly pedicled, placed within and at the base of the lower tentacula; embryo not always the same, being sometimes in the form of a *Beroë*, sometimes of a hydra."

This *Tubularia indivisa* is the largest of its tribe in Great Britain. The tubes, on which the hydra-heads are placed, grow some five or six inches long on shells and stones in deep water. They look like scarlet flowers on the ends of long twisting worms. They congregate in clusters of thirty or forty specimens, and make a splendid nosegay of living and moving flowers. The tubes are horny and transparent, showing the reddish liquor through them, and the polypes at the end have two rows of tentacles."

We must again hear the eloquence of Sir J. Dalyell:—

"The yellow, fistulous stem, full of mucilaginous pith, is rooted on a solid substance below, and crowned by a living head, resembling a fine scarlet blossom, with a double row of tentacula, and often with pendent clusters of grapes, embellished by various hues, wherein red and yellow predominate. Fifty, or even a hundred and fifty, are at times crowded together; their heads, of diverse figures, shades, and dimensions, constitute a brilliant, ani-

mated group, too rich in nature to be effectively portrayed by art."

The *Tubulariæ* may be kept for observation in sea-water, and a very wonderful and beautiful provision be watched. In a few days, dispirited by captivity, the flower-heads will generally drop off, and the observer naturally expects the straw-like pipes, on which they were placed, to wither and droop. It is not so, however; but the wound, caused by disseverment, heals at first, and afterwards a new head, formed no doubt principally of the pith which fills the tube, rises to the top, assumes the globular form and bright colour, puts forth its first and second row of tentacles, opens its mouth, and is ready for anything that Providence may place within its reach. In this way several successive heads may fall, and a fresh one will supply its place.

If, then, we see with admiration the flowers of the field and garden, which, beautiful as they are, still give no signs of sensation or voluntary movement, how much more shall we be delighted with these no less beautiful objects, endowed as they are with sentient vitality, and adding the grace of motion to those luxuriant charms which meet the eye! And, if we add to this the exhibition

which they afford of the restorative power of Nature, we must be destitute of feeling, if our praise of creative wisdom fall short of enthusiasm.

Sertularia polyzonias,

Or *Great Toothed Coralline.* The following is Dr. Johnston's definition of the genus *Sertularia:* "Polypidom (or Coral-house) growing in the shape of a plant and fixed by its base, variously branched; the divisions or branches formed of a single tube, denticulated or serrated with the cells, and jointed at regular intervals: cells alternate or paired, biserial, sessile, urceolate, short, with everted apertures; ovarian vesicles scattered. Polypes hydraform."

The general appearance of this Zoophyte, is that of finely serrated, and variously branched, minute sticks or straws; and it is only on minute examination that we find that one being pervades the whole; that the notches are cells; and that each cell is filled by an arm or branch of the animal ending in a polype, furnished with a bunch of tentacula. In this species the cells are short, smooth, and truncated; while here and there appears an ovarian vesicle of a rounded form, and spirally grooved, much larger than the ordinary cells. In *Sertularia rugosa*, on

the contrary, the cells and vesicles are similar in shape and only differ in size. The cells of some *Sertulariæ* are in pairs, some alternate, some at irregular intervals.

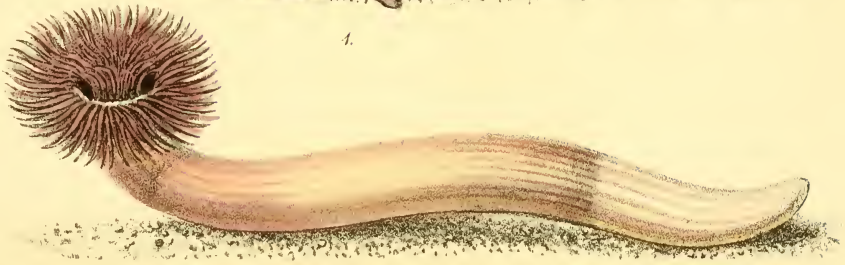
Sertularia argentea

Is a fine, feathered, bushy polype, sometimes called the Squirrel's-tail Coralline, which is found growing on the rock-oysters at Sheppey and Sheerness. The ramifications are in tufts, arranged spirally round the stem; an arrangement which gives a peculiarly graceful air to the whole polypidom, which sometimes reaches several feet in length. But when its upper branches reach this length, much of the vitality of the under branches is impaired through age, and these earlier parts die and become worn; in this state they fall away and leave the lower part of the stem bare.

The following experiment on the dead and dry polypidom of a *Sertularia* will be found interesting, showing a degree of elasticity in the horny substance of which it is composed :—

"About two years ago I detached two specimens of *Sertularia* from an oyster-shell: they were about $1\frac{3}{4}$ inch high, the side branches being from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length.

1.



2.

Sowerby del. et lith. Vincent Brooks Imp

1. Edwardsia vestita, clothed with its leathery coat. 2. Edwardsia withdrawn.

Having broken off with the *Sertularia* a piece of the shell to form a base for it to stand upon, I placed it within the doors of a bookcase to keep it from the dust; about two or three months afterwards I took it to a tub of rain-water for the purpose of washing off the saline incrustations, and, after rinsing it several times, I observed the branches begin to assume a more rigid appearance, and the stem, which had been previously lax and drooping, became perfectly upright and rigid. If any part was drawn aside, it immediately regained its position, and in this state it remained nearly a day before it began to droop again. I repeated the experiment a few weeks back, with the same results."—*J. Bladon*, 'Zoologist,' i. p. 34.

Antennularia antennina.

This is a pretty Coralline, the branches of which are finely serrated and ciliated, and have a beautiful feathery appearance.

The genus is thus described by Johnston:—"Polypidom plant-like, horny, simple, or branched irregularly; the shoots fistular-jointed, clothed with hair-like, verticillate branchlets; cells small, sessile, campanulate, unilateral; vesicles scattered, unilateral. Polypes hydraform." *A. an-*

tennina "grows in clusters in the sand, or on stones lying in the sand, rooted together by numerous fibres matted with a mixture of broken shells and sand, pretty generally distributed. We have not found it on the Ayrshire coast, if it is distinct from *A. ramosa*. It has however been got by the Rev. Mr. Urquhart, at Portpatrick; and we have remarkably fine specimens from Dr. Beverley Morris, from the coast of Yorkshire; from Dr. Scouler, from Dublin Bay; and from Major Martin, from Lough Swilly. These last were very handsome, but the stems smaller and more compact than usual, and the branchlets shorter."—*Landsborough*.

It often grows to the height of a foot, and it appears jointed in rings like the long antennæ of the Lobster. "Each articulation is surrounded by short capillary branches, which when magnified have the appearance of sickles, and bend towards the main stem. Along the inside of these are placed minute sockets, which support small open denticles (cells) of a cup-shape, which are of so tender a nature that they are scarcely visible but in recent specimens. Between the minute hair-like branches we have observed, on some specimens, small egg-shaped vesicles, fixed on footstalks, with their openings, or mouths, on the side of the top of each, looking towards the middle stem."—*Ellis*.

Plumularia pinnata,

Belonging to another genus of feathery Corallines, which is thus described by Johnston:—"Polypidom plant-like, rooted, simple or branched, the shoots and offsets plumous; cells small, sessile, unilateral, usually seated in the axillæ of a horny spine; vesicles scattered, unilateral. Polypes hydraform."

Mr. Gosse has made this beautiful Zoophyte the subject of some interesting observations, which will be best detailed in his own words, nearly entire. "A tuft of weed, that I had pulled off from the side of one of the rock-pools, and brought home screwed in a bit of paper, was almost covered with the elegant plumes of *Plumularia pinnata*. I put it into sea-water as soon as I arrived at home, after it had been out of the water about eight hours, carried within my hat. When I came to examine it, many of the polypes appeared alive, though contracted. Many of the lower stalks were nearly denuded of branches, except at their tips; but were densely crowded for the most of their length with ovigerous vesicles. These are placed in a single series, on the upper side of the arching stems, as thickly as they can stand, about twenty-five on each. By a single series I mean that they are all seated on one side of the stem, and all point the same way,

with an occasional exception, for they are two, three, or four abreast. Their substance is hyaline, but the contents are opaque and flesh-coloured. Their shape is sub-oval, larger at the tip; but the sides are fluted, so as to form about six rounded angles, and as many furrows. Near the tip, several divergent tubercles or blunt spines are given off. The tuft alluded to I put in a glass vessel made of the chimney of an ordinary lamp, with the bottom closed by a plate of glass: this was about half-full of sea-water. In three or four days, examining cursorily with a lens, I was surprised to see the bottom crowded with young polypes growing erect from every part; they were there by hundreds. I detached a few for more particular examination. Each consisted of an irregular, dilated, glossy plate, adhering to the bottom; from some point of which sprang up, erect, a slender tube, with one or two joints, and terminating in a cell of the same form as those above described. The medullary core permeated the tube, and was developed into a perfectly-formed polype inhabiting the cell and freely expanding from it. The tube, the cell, and the polype, were of the same dimensions as in the adult. Some of the cells already showed, in the form of a tubercle budding from their bases, the commencement of a new joint of the lengthening polypidom.

"Along with these, on the floor of the glass vessel, were many minute animalcules, of an opaque-white hue, somewhat *Planaria*-like, which crawled slowly and irregularly, protruding the anterior portion of the body in a blunt point, but often contracting the whole outline into a subglobose form. These worm-like animalcules I found to be the primal form of the young polype; and though I have not been able to trace the metamorphosis through every stage in the same individual, the facts I have observed leave it indubitable.

"I took two thin plates of glass, and suspended them by threads in the vessel, near the bottom, horizontally, with a view to obtain some of the embryos rooting themselves thereon, which I might afterwards take out, to watch their progressive development under the microscope. Meanwhile I secured the first step in the inquiry, by opening with needles some of the crowded vesicles of the adult polypidom, from which I obtained some of the minute white worms. In two or three days I drew out the plates of glass and put them in shallow cells of sea-water, fit for the stage of the microscope: I found upon them the young animals in various stages. Some of the worms were yet vagrant, and crawled freely about the surface; others had selected their position and were adherent, but still retained their power of

motion to such a degree as enabled them to change their form by protruding certain portions of their outline; others were contracted into a globule, fixed and changeless, with the matter produced in the form of a creeping rootlet."

"The next stage that I observed was that in which the adherent mass had become shelly, as I presume; for the marginal portions were perfectly transparent and colourless, and the opaque granular matter had retired to the centre, where, irregular in form, it had given rise to a tube. This tube had already formed one joint: its extremity was closed and rounded, and had not yet begun to dilate into a cell. The medullary matter proceeding from the granular mass at the base, passed through the lower portion of the tube as a central cord, but completely filled the terminal moiety. Another specimen had proceeded so far as the formation of the cell, the bottom of which was filled with the granular matter, as yet amorphous, no trace of the polype being yet discoverable. This was the most matured phase of the development that appeared on the experimenting plates of glass; but the transition from this state to that of the young polypes, already described, at the bottom of the vessel, is short and obvious; and the progress from one of them to a perfect polypidom is a matter of increase and aggregation.

There is however a hiatus in this chain. I should have particularly wished to see one or more specimens between the condition of the adherent globule, and that of the formed and growing tube; but of this intermediate stage my glass plates presented no specimen. And whether the water in the shallow stage-troughs, to which I removed the plates for microscopic examination, afforded insufficient nutriment, I know not; but I could not find that any individual specimen continued to grow after removal from the larger vessel; and they shortly gave evident tokens of death and decay."

Laomedea dichotoma.

The genus *Laomedea* is thus described by Johnston:— "Polypidom rooted by a creeping fibre, plant-like, erect, jointed at regular intervals, the joints ringed, incrassated, giving origin, alternately from opposite sides, to the shortly-pedicled cells; cells campanulate; vesicles axillary; polypes hydraform."

L. dichotoma rises to the height of a foot, or even two feet. The stem bends angularly, and gives off a short branch at each bend. The cells are shaped like bells, and their stems ringed, three times as long as the bells. The polypes are of a red colour. "This Coralline," observes

Ellis, "is found in great abundance on the south-west coast of England, and seems most curiously contrived, from its structure, to resist the violence of the waves, all its joints being furnished with springs. Its vesicles are formed so as to yield easily to every violent impulse of the water, without injury, from their being placed on footstalks like screws."

Laomedea geniculata.

This *Laomedea* is a numerously branched polypidom, bearing on its fronds the most beautifully delicate, cup-like polypi, which, by means of their cilia, move about in a very rapid and playful manner. Each polypus is like a tiny shallow glass vase, with a foot by which it is attached to the frond, and fringed with threads all round the disc. *Laomedea geniculata* is interestingly described in the 'Devonshire Rambles:'—"The little creatures [*i. e.* the cup-shaped polypi] are very active and lively, making their way rapidly through the water by a sort of flapping motion of all the marginal threads together; an action which, when viewed in profile, could not fail to remind the observer of the flight of a flagging-winged bird: but so exquisitely delicate is the tiny creature, so transparent, so shadowy, that a friend to whom I showed it aptly called it the soul of the Zoophyte.

There is something in it also which reminds me of the pappus of a dandelion floating on the breeze."

This Zoophyte has the power of throwing off the polypi; or rather, the little polypi are able to detach themselves and still to dance merrily in the water. "Immense numbers of these tiny sylph-like creatures were successively produced from the *Laomedea* in the glass jar, so that the water at length seemed quite alive with them; but I could not find that a single individual either became stationary, or changed its form, or grew. In the course of a day or two they all died."—Perhaps a salutary example to young people in too great a hurry to become independent of parental care.

To describe one of the polypes more particularly, it seems most to resemble an inverted umbrella with a netted disc across its diameter; on the convex side is a central fleshy protuberance forming the foot. The flatter disc is divided by four angles, between each of which are six thread-like tentacles,—twenty-four of them altogether,—which play about in all directions. Placed at equal distances, on the margin, between the tentacles, are four pairs of very eye-like globes, which however, from their structure, are believed to be rather organs of hearing. Altogether, these little polypi have the appearance of miniature *Medusæ* or Jelly-fish.

Laomedea gelatinosa.

This polypiferous animal is, like the former, provided with cup-shaped cells placed on ringed, springy necks, protecting the polypi which fill them. As the cups are very transparent, a favourable opportunity is given for observing the economy of the structure. A slender and transparent tube springs up from creeping, thread-like roots, sending out branches at intervals on both sides. These branches are ringed, or constricted in such a manner as to appear tied in as it were by very fine threads, at places close to each other, so as to make the rings very narrow. At the end of each branch is a miniature wine-glass, or hyaline cell, perfectly transparent and beautifully shaped, containing the polype, in which each branch of the fleshy centre terminates. The flesh is jelly-like, hollow in the centre, and runs like an inner pipe through the stem and branches of the polypidom, until it reaches the cell at the end of each. In the hollow part of the fleshy pipe is a fluid containing moving granules, the precise nature of which is not accurately ascertained.

When the fleshy tube reaches the end of each branch, and arrives at the neck of the cell, it passes through a perforation which exists in a partition which runs across, near the

bottom of the cell: it now thickens out into a polype, dilated at the bottom, and dividing, on arriving at the rim of its cup, into a star of many rays, hanging over its sides all round its aperture. In case of irritation, alarm, or discontent with the fluid in which it is placed, the polype can collect its star-rays, or tentacula, into a bundle and withdraw them into the cup.

Campanularia volubilis.

"This very minute Coralline," says Ellis, "arises from small irregular tubes, which adhere to and twine about other Corallines, particularly the Sickle Coralline. Exceedingly small tubular stalks go out from this tubular stem, which supports little bell-shaped cups with indented brims. At the bottom of each, where they join to the stalks, the microscope discovers to us a very minute spherule or little ball, as in some drinking-glasses."

Eucratea chelata.

A minute, irregularly branched polypidom of very interesting structure, formed by the continual addition of cells, springing each one from the upper and outer rim of its predecessor. The formation of a new branch, how-

ever, commences in a spinous projection from the lower rim, and this afterwards expands into a cell to which others are added. The polype in each cell is protected by an elastic membrane, which retracts into its very depths when the polype is projected, but, when that is withdrawn, forms a projecting rim, or lappet, beyond the edge of the cell. The polype is protruded in through an opening in this membrane, in three circular slides, like the joints of a telescope. The top, or head-joint, is crowned by twelve ciliated arms; the second, edged by a scalloped frill, and the third, or basal joint, has a projecting point. The whole is most exquisitely formed, and of a most delicate, filmy transparency.

To observe the course of the digestive system in very minute animal frames is very difficult, requiring the adjustment of a high power, to the medium in which, to produce the continued actions of life, the object must be placed. In order to assist in the observations, a colour has been introduced into the element, which, being readily imbibed by the polype, is seen in circulation through the body.

There is a continued motion of cilia going on, which enables the polype to bring a current of nutritious substance within its power, as well as to throw off any dis-

agreeable intruding bodies. When the ciliary action is insufficient to effect this, the little filmy creature will succeed in getting rid of the offensive object by suddenly withdrawing and jerking itself sidewise, or by bending in one of its ciliated arms, and sending it out with a fillip-like motion.

Anguinaria spatulata.

Snake-headed Coralline.—This little Zoophyte winds up a seaweed as the ivy does the oak. It consists of a stem with cells thrown out at intervals on bended stems. They are of a flattened, oval form, and not unlike the head of a snake, open at one side. Each "snake's head" forms the habitation of a polype, which, when it throws out its own head, presents a circular crown of tentacula. The neck of the cell-stem is marked with rings, while the swollen head is dotted. The mechanism of the cell is very curious, being furnished with a little door, which, closing when the polype is retracted within its cavity, and held firmly down by muscles, gently opens on its hinges and turns back as the living film passes out and spreads its crown of feelers. All the time it keeps out, the door is folded back, again gradually closing as the animal retires. If a piece of bladder were stretched over a half-

circle of bent cane or wire, it would give the idea of the door or valve we are describing, only on a very large scale; the bladder answering to the almost impalpable membrane, and the circular frame answering to the horny rim of the door. Sometimes, however, patient observers have seen the polype retreated far within his cell, and still holding the door wide open, so as to permit the free circulation and inhibition of the watery element, but with the spring ready to be drawn back on the approach of danger. The *Anguinaria spatulata* is found not uncommonly twining like a "gentle evergreen," about small sea-weeds at low water, near the Devonshire coasts.

Cellularia ciliata.

The Ciliated Cellularia is parasitic in its habits, like the *Anguinaria*. There is a kind of tubercle on the outside of the cell, which is open at one end, with a movable valve, presenting an appearance in form resembling that of a flower of *Calceola*. It has also been compared to the head of a bird, the valve answering for the lower mandible of the beak. This valve opens and shuts with a sudden, snapping motion; and the edges of the upper and lower mandibles are both armed with tooth-like points.

It seems not yet to be ascertained what is the nature of these excrescences; what functions they perform, or what relation they sustain with the polypi, or their house. In truth, from the fact of *not all* the cells being provided with them, and of other polypidoms having generic characters in common with this species, showing no signs of possessing or requiring these excrescences, a doubt is justly suggested, whether they may not, after all, be independent and distinct, although parasitic organisms, consisting of what would look like an animal, all head and mouth, swaying to and fro, snapping its jaws and seeking what it may devour. On the other hand, its occupation *may* be that of a useful member of the polypidom, auxiliary to the seizure and imprisonment of wandering animalcules for the purpose of feeding the polype in its cell.

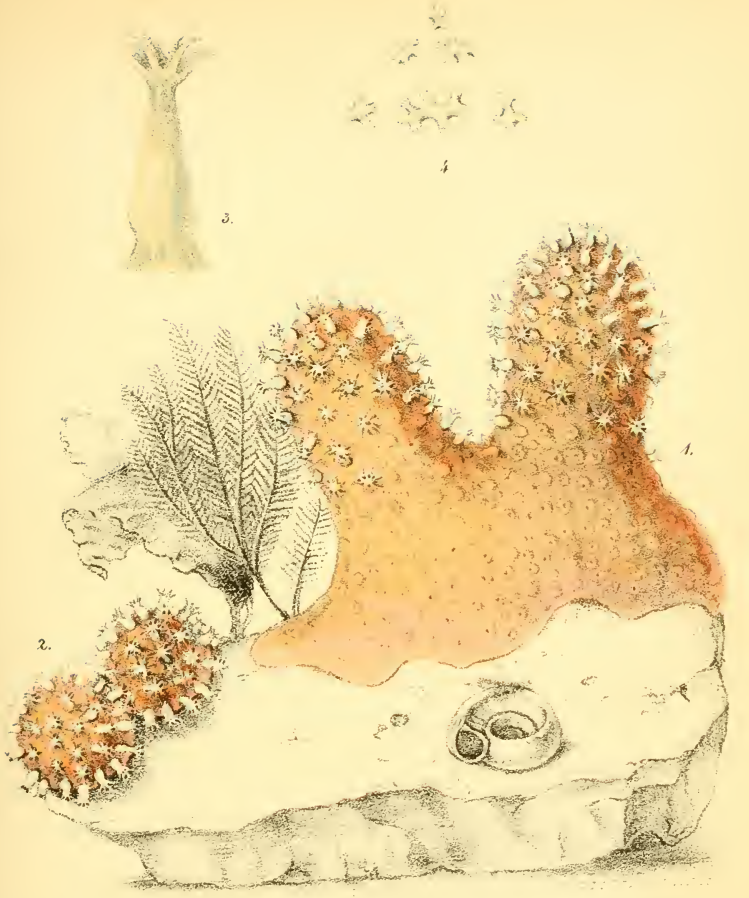
All these interesting forms, to be appreciated, require the most careful observation by means of the microscope, with the objects in a living state. The day for dried specimens has now gone by, and it may soon be a common every-day amusement to examine this class of Zoophytes in glass vessels, and trace their admirable structures in the same manner in which only the Ellises, the Johnstons, and the Gosses have hitherto been privileged to do.

CHAPTER III.

SEA-FEATHERS, SEA-PENS, AND SEA-FROTH.—PENNATULA PHOSPHOREA.—VIRGULARIA MIRABILIS.—PAVONARIA QUADRANGULARIS.—GORGONIA VERRUCOSA.—KINGFISHER'S NEST OR MERMAID'S GLOVES.—ALCYONIUM DIGITATUM.—ALCYONIDIUM HIRSUTUM.—INFUSORIA AND FORAMINIFERA.

The three families—*Pennatulidæ, Gorgoniadæ, Alcyoniadæ*—are included by Gosse in the sub-order *Alcyonaria*. The family of *Alcyoniadæ*, which contains *Alcyonium digitatum*, of which we shall speak presently, appears to partake much of the nature of Sponge, only that the fleshy masses of which it is composed, send forth distinct and beautiful polypi. It differs from the other two families, *Pennatulidæ* and *Gorgoniadæ*, in not having, like them, a central axis; but instead of that axis, the flesh contains scattered calcareous spicula, similar to those Sponges.

In the Hydroid Zoophytes, it was observed that the horny skeleton formed, as it were, a case, or external support to



Sowerby del et lith. Vincent Brooks Imp.

Alcyonium digitatum 1. A two lobed specimen with polypes expanded. 2. Young of the same. 3. A polype magnified. 4. Internal spiculæ

the fleshy part of the animal and its polypes; while in the Asteroid groups, included in the families of *Pennatulidæ* and *Gorgoniadæ*, the skeleton consists of a central horny or calcareous axis, around which are arranged the polype-bearing fleshy parts.

Pennatula phosphorea.

Dr. Johnston thus describes, in technical terms, the genus:—"Polype-mass free, plumous, the shaft subcylindric, naked beneath, pennated above; pinnæ two-ranked; spreading, flattened, and polypiferous along the upper margin."

"Nature," observes Lamarck, "in forming this compound animal, seems to have desired to produce a copy of the exterior form of a bird's feather."

And truly, if you imagine a bird's feather four or five inches long, but of a fleshy substance, plumed broadly at the feather end and naked at the quill end, very elegant in form and of a delicate pink colour, you have before you an image of our *Pennatula:* yet this also is a living animal. Along the upper edges of the pinnæ are placed the polype-cells, in rows, containing the polypes. The pinnæ are obliquely curved backwards, and each one is capable of an independent action. All the external part of this Zoophyte

is fleshy, including the central stem; but through the centre of the latter runs a calcareous column, which serves to strengthen and support the whole. This forms the rudiment of a true Coral, and constitutes a bond of union between the Sea-Feather and the Asteroid which forms that beautiful Coralline known in commerce as the "Precious Coral," of which red ornaments are made.

Cock's-Comb, Sea-Pen, Sea-Feather, are the names by which the *Pennatula* is known; the former, on account of the colour and general appearance of the upper pinnæ; the latter, because of the resemblance which every one must see on glancing at the object.

Pennatula phosphorea is unattached: it does not grow fixed to any object, like *Gorgonias*, etc., but is planted in mud, with its pinnæ exposed. And now comes the question, whether it is capable of moving from place to place through its bed, or of raising its body and swimming through the water. Some naturalists have held that it is capable of both motions; others say that it cannot move voluntarily at all. Its general habits certainly appear to be very stationary; and we have no direct evidence, derived from actual observation, that the animal is provided with locomotive power or instinct. Yet some authors assert that it swims about freely

in the sea, using its pinnæ in exactly the same manner as fishes use their fins; others say that the motion is effected by alternate contractions and expansions of the thick part of the central mass, as well as by a combined action of the polypes.

When placed in a basin of sea-water, as many specimens have been by acute observers, they have never been observed to exercise this supposed power of swimming, but have remained quietly lying, polypes upwards or downwards, just in the same position in which they were placed. In this condition however the whole body has become very considerably distended with water, increasing to several times its natural dimensions; and that is the only approach to motion betrayed by the *Pennatula* when in captivity. Sir G. Dalyell remarks that the distension that takes place does not reduce its specific gravity sufficiently to produce an equilibrium with the water; "thus the animal cannot swim."

It seems to me that the appearance of the body is such as to favour the notion of a creeping movement, which could be easily effected by a slight action of the lower edges of the pinnæ; and this is just the motion which would most probably be missed by observers watching for it, in the case of animals confined in a narrow basin. For it is doubtful

whether they would be provided with exactly the same kind of bed which they had been accustomed to, and which was most suitable to any movements they might desire to make.

On one subject there is no question. There is no doubt that, when irritated, Sea-Pens throw out a strongly phosphorescent light. When the animal is touched or pressed it gives a luminosity, commencing at the point of contact and proceeding up towards the pinnæ. If the upper part of the specimen be irritated, all parts below the contact remain unaffected, while those above it emit phosphorescence.

A beautiful result is obtained, although perhaps cruelly, by throwing a *Pennatula* into fresh water, when it emits and scatters brilliant sparks in every direction.

Virgularia mirabilis.

Very nearly allied to *Pennatula*, but very much more slender and elongated in form; sometimes growing to the length of five-and-twenty or thirty inches. It is of a straw-colour, and growing all along on each side of the long stem are polypiferous masses, each divided into six or seven lobes or fingers, and at the end of each finger a most beautiful eight-rayed star polype. The pinnæ are not placed on each side of the stem exactly opposite to each other, but each

one against the space between the two on the other side. They are beautifully transparent, and have the power of contracting, so as to lie up closely imbricated upon each other, pressing the stalk; but they can also expand and lie out, so as to leave open spaces between. Mr. Harvey says, "The polypes are objects of great beauty, and their form may be very well seen after death; for though capable of retractation within the cell, the tentacula have no contractile power, and may be made to expand in their full extension by merely pressing upon the cell. The polype thus displayed is an eight-rayed star, the rays curved backwards, channeled and elegantly pectinated along each margin. In the centre is the mouth, with prominent lips."

The same question occurs as to the habits of this Asteroid as arose respecting those of *Pennatula*. But one curious motion has been observed in the former when captive, which does not take place in the latter: it is that of the animal twisting itself spirally round its central axis, and afterwards relaxing again into a straight line. The bone running through the central axis is very slender,—said to be not a thousandth part of its length in diameter. "Each organ," remarks Dalyell, "of this remarkable object has a distinct

action, free of all the other parts. Each lobe, each hydra, each of the pectinate tentacula, and each of their prongs, can move at will, while the whole of the rest of the Zoophyte is quiescent; therefore, in a specimen with the bone extending eighteen inches, above a million of separate fleshy parts are under the common control of the Zoophyte." It is of course very difficult to understand where can be the seat of this common control, or in what manner the central power of volition can be exercised. But when we reflect that the only motions of which this animal is known to be capable are a kind of excentric twist round its own axis, and a certain amount of puffy inflation of its parts, it does not present a very favourable view of separate government. It is rather calculated to remind us that too much independent action among individual members of a body politic is unfavourable to the development of corporate power: we will not point to practical illustrations of this.

Pavonaria quadrangularis.

This is another of the living rods of the ocean. It is invested with a fleshy skin, and has rows of polypes along its sides; those at the lower part of the rod are in a single

row on each side, but higher up they come in twos and threes, until at the thicker and more bulbous part they form oblique rows of four, five, or six in a transverse row. The flesh is of rosy hue. Each polype is a flower of eight petals or tentacula. This, like *Pennatula*, gives out a phosphorescent light when irritated.

Gorgonia verrucosa.

The generic characters of *Gorgonia* are thus described by Johnston: "Polype-mass rooted, arborescent, consisting of central axis barked with a polypiferous crust; the axis horny, continuous, and flexible, branched in coequality with the polype-mass; the crust, when recent, soft and fleshy, when dried, porous and friable; the orifices of the polype-cells more or less protuberant."

We should much like to see this Zoophyte, whose central stem is composed of beautiful branching red coral, growing in the Zoological tanks. Those fair beings, who in ancient pastoral numbers were courted by lovesick swains with promises of

"Coral clasps and amber studs,"

might then see the living founders of a favourite ornamental production gathered round and concealing the co-

veted centre, but displaying in themselves beauties greater than any they could hide.

Or even if we could transport the branching and netted *Gorgonia flabellum*, or "Venus's Fan," from its native haunts in the West Indies, and see its branches incrusted with animated fibre and lively polypes waving in the rippled waters, and crowning the rockwork of an Aquarium, we should be adding a desirable variation to the already varied picture. But notwithstanding the fact of broken pieces being dredged up near our coasts, it appears certain that Venus's Fan has never been seen living in this country. Those species that we can point to as our own, although interesting, are not so beautiful as those which are met with abroad. The same principle however may be observed throughout,—a branched, tree-like form rooted to the rock by a spreading disc; through the stem and every branch a horny or bony central axis; axis covered with a fleshy incrustation; flesh containing, at intervals, polypes in cells.

Gorgonia verrucosa

Is shrub-like. It grows to the height of a foot, and spreads out like a fan to an equal width. It is branched; but as the branches do not cross into each other, as in *Gorgonia*

flabellum, it is not netted. The axis is horny, black, smooth, and shining. The living flesh incrusting the axis is flesh-coloured and soft, but when dead dries into a brittle crust. The polype-cells are numerous; they form, at least in dried specimens, those wart-like excrescences from which the species derives its name "*verrucosa*," from *verruca*, a wart. These warts, when their crust is dissolved, are found to contain the contracted remains of eight-rayed polypes.

As *Gorgoniæ* are deep-sea Zoophytes, it will be long ere we can arrange the admission of light, and other circumstances, in our tanks, so as to suit their habits: ultimately it will no doubt be done. We may yet hope to see both foreign and English Sea-Fans making miniature forests in limited allotments of their native element.

Alcyoneæ.

The following definition of the family, from one of the Cyclopædias, may serve to convey a general idea of the economy of these curious Zoophytes. "*Alcyoneæ*, a group of marine productions somewhat similar to the Sponges, but more distinctly belonging to animated nature. We are indebted to Pallas, Gärtner, Savigny, Spix, and Lamouroux,

for what is known of their singular structure. Both in the fresh and dried state they are of much greater specific gravity than the Sponges, and frequently emit a disagreeable odour. They vary much in form, some being in a shapeless form or crust, and others lobed, fingered, branched, or with rounded mushroom projections. The interior substance is spongy or corky, surrounded by tube-like rays enclosed in a leathery sort of membrane. The tentacles or arms of the animal inhabitants of these productions are eight or more. The cells in which the animals lodge are round, unequal in diameter, and about a sixth of an inch in depth.

"The *Alcyoneæ* are found in all seas and at various depths, subsisting, it would appear, on marine plants; they do not however seem to like places which are often left dry by the ebbing of the tide, and hence we have never met with them recent, except about the low-water mark of spring tides, and they seem to delight in places sheltered by rocks from the sweep of currents or the agitation of the waves, and where the light is rather obscure. They are found therefore to be more numerous in deep water."

Alcyonium digitatum.

The Alcyon, or Kingfisher,—fabled to have formed its nest

of the foam of the sea, and to have been favoured by Neptune so far as to be permitted to hatch its eggs while the waves were kept unmoved for the purpose,—gives its name to this Zoophyte (Plate V.). It is a curious-looking spongy substance, growing attached to the rocks, in lobes of a buff or fleshy colour. When taken fresh from its element its surface is nearly even, but an attentive examination shows it studded with star-shaped depressions. But if a specimen can be taken living and placed in salt-water with the piece of rock on which it has been growing, it will presently put forth polypes from these depressions, which project from the surface in the form of beautiful little flowers with star-like petals. Its appearance in this condition is very elegant, and a microscopic examination of the polypes and of the interior presents new beauties to the view. Each polype is a delicate white tube, nearly transparent,—at least sufficiently so to render visible the interior organs: each is enclosed in a cell, from which, when fully protruded, it is seen to taper gradually towards the opening, where it is expanded into a flower with eight petals; very slender filaments, arched outwards and with ringed circumferences, fringe the edges of the petals. The truncated stomach, the bended and twisted threads edging the divided septa of the surrounding part

and connecting the stomach with the interior of the polype, the vibrating cilia covering every part of the inner lining, the current of globules passing up and down along the pellucid skin, and the curiously arranged coral-shaped spicula, not unlike those of more decidedly spongoid bodies, are all admirably and minutely described in the 'Naturalist's Rambles on the Devonshire Coast.' As, in nature, the polypes on a mass are never all exserted at the same time, we have shown in one part of the figure (Plate V. fig. 1) the polypes fully exserted; in another part some of them partially withdrawn, others only showing the starlike petals; and in other parts of the specimen its appearance when the polypes are withdrawn and the edges of the cells closed over them.

Mr. Gosse, speaking of *Alcyonium*, says, "Darkness is more essential to its comfort than constant immersion. It is more careless of exposure to air than of exposure to light. The size and development of the masses are in proportion to the obscurity of their residence. Even in these cavernous recesses we only see half-grown specimens, and those consisting of one or two lobes. When left by the tide these hang down to a great length, the base shrunk to a slender, skinny column, with a white fleshy lump at the tip, from which depends a large drop of clear water; but no sooner

does the sea return to their level than they retract themselves, their bodies become plump and pellucid by the absorption of the sea-water into their system of aqueducts, and the numerous little pits that had appeared on the surface swell and protrude into transparent star-like polypes, rendering the aspect of the whole as beautiful as it was before repulsive." (*Gosse, Tenby.*)

Alcyonidium hirsutum.

"All round the margins and smooth sides of the basin, under water, grow numerous specimens of the Stag's-horn Sponge-polype. These are so characteristic of the pool, and so remarkable, as at once to claim attention. They have much the aspect of a Sponge, being downy, growing in irregular rounded masses, and of a subpellucid yellowish-olive hue; but to the feel the substance is more solid and fleshy, something between jelly and cartilage. It is frequently three or four inches in length, springing from a minute point of attachment, and much branched or lobed, resembling a deer's horn." (*Gosse, Tenby.*)

Plate V. represents *Alcyonium digitatum* with two young lobes, a single polype magnified, and some of the spicula.

Infusoria and Foraminifera.

Since the great work of Ehrenberg on the 'History of Infusoria, Living and Fossil,' a great number of these infinitesimal creatures have been discovered to be the young of other animals, and others proved to belong to the vegetable kingdom, although gifted with a kind of spontaneous motion; and as many of the others are yet undetermined, it seems possible that the *Infusoria*, as a class, may come to be dispersed over various parts of the system. As affording food to many marine animals whose habits and organization render them entirely dependent on such provision, they are indispensable parts of the mighty scheme of Providence; and in the Aquarium their existence will be duly appreciated, although scarcely perceptible to the eye.

Every current drawn towards the patient *Anemone*, or agitated by the ever-repeated ciliary action of other marine animals, brings into the proper channels many tiny and almost invisible living creatures, which afford rich nourishment to the fortunate recipients, many of which have no means of securing more tangible objects, or of devouring them if secured; and many others live mainly upon the *Infusoria*, although quite capable of seizing and en-

joying a Shrimp or a Mollusc, once in a way, for a *bonne bouche.*

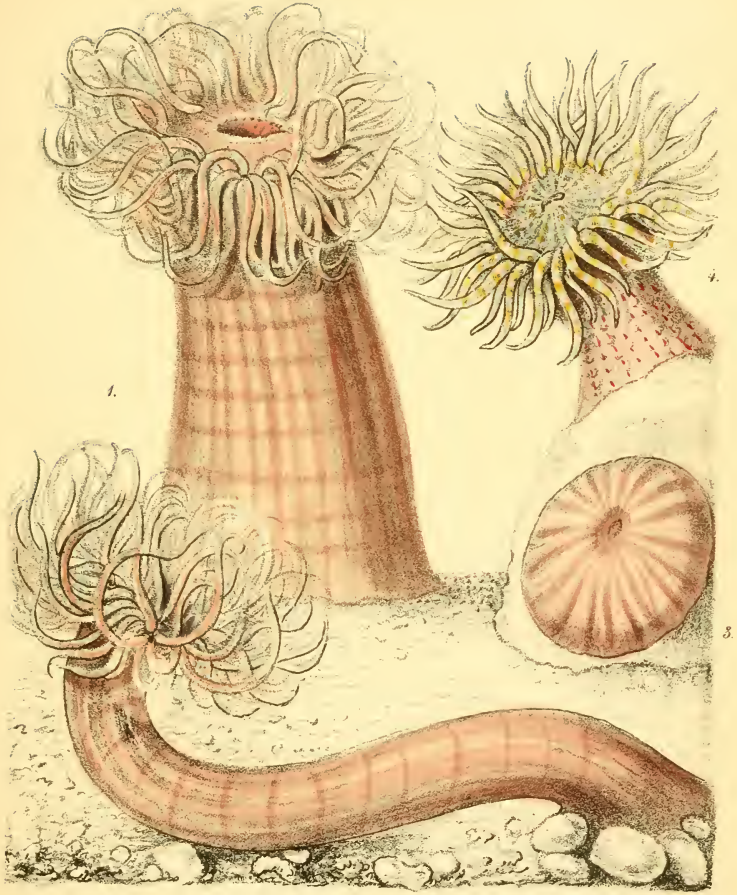
Foraminifera, as a class, differ from *Infusoria* in this respect, that they are a defined group in themselves, not distinctly connected with any other, but possessing characters which are recognizable and distinguishing. Formerly indeed they were considered as belonging to the very highest class of *Mollusca,* namely *Cephalopoda,* for, although very minute, the shells in many instances take very exactly the forms of Nautilus, Ammonite, etc., and are divided like those shells into chambers. They are now believed to be much lower down in the scale, and in recent systems take their humble place among the *Polypi.*

They are all microscopic, glutinous animals, divided into segments, arranged either in a line or rolled spirally; they are clothed with a shell having numerous orifices, through which pass contractile filaments, which are very long, branched, and used for locomotion. The recent species, although few in our seas, are numerous in warm climates; yet all those living now are insignificant in numbers compared to the enormous multitudes of them which crowded the ancient seas. Large mountains are formed almost entirely of their fossil remains. The great stratum on which

Paris is built is composed, to a great extent, of their shells. Hundreds of thousands of specimens may be counted in an ounce of sand!

The *Foraminifera* may be seen in a living state by taking up seaweeds and branching Zoophytes, in favourable parts of the southern coasts, at or near the edge of the tide. If these are shaken over a vessel of water, the *Foraminifera* will first drop to the bottom, but will afterwards be found—by help of a lens—crawling about or sticking to the sides of the vessel. Many of them may also be picked up by careful research among the patches of drifted sand and shells which the tide will sometimes leave upon the shore. Some of them are like flasks or bottles, and others like twisted *Serpulæ;* some are like *Nautili,* others like jointed branches of coral. The principal genera are,—*Lagena,* the flask-shaped form with a neck; *Entosolenia,* also bottle-shaped, but the neck doubled back as it were within the body; *Rotatia,* whose shell consists of a spiral arrangement of swelled lobes; *Polystomella,* shaped like a Nautilus; and some others.

According to Dujardin, who has rather minutely examined the history of the *Foraminifera,* they have not any distinct organs of locomotion, although the film-threads thrown out



Vincent Brooks Imp.

Snake-headed and Clubbed Anemones. 1 Sagartia anguicoma. 2 The same extended. 3 The same closed and flat. 4 Bunodes clavata.

through the pores serve that purpose, and even the means of respiration are indistinct or non-existent.

The life and death of these myriads of tiny, insignificant, and lowly-organized beings, in past ages as well as in the present, have no doubt fulfilled important functions in the general economy of Nature. Certainly the great results, visible and tangible, presented to us in the shape of mountain masses,—composed, not of grains of sand, but of what were once living creatures infinitesimally small,—strikes us with wonder at the strange contrast; while the profusion of life continually supplied and expended in supporting life in higher forms, by giving food to many a larger animal, whose

> "Restless tongue
> Calls daily for its millions at a meal,"

may well give rise to reflections of a serious kind, painful perhaps, though not unprofitable.

> "'T was wisdom, mercy, goodness, that ordained
> Life in such infinite profusion,—Death
> So sure, so prompt, so multiform."

CHAPTER IV.

SEA-ANEMONES, OR ACTINIADÆ.—TENACITY OF LIFE.—REPRODUCTION OF PARTS.—DOUBLE-HEADED SPECIMEN.—POWER OF STINGING.—FOOD.—MORALIZATION, OR PURPOSELESS EXISTENCE.—CHANGES OF FORM.—CLASSIFICATION.

"Pray, Mr. Stanhope, what's the news in town?
Madam, I know of none; but I'm just come
From seeing a curiosity at home;
'T was sent to Martin Folkes, as being rare,
And he and Desaguliers brought it there:
It's called a Polypus!—What's that?—A creature,
The wonderfullest of all the works of Nature.
Thither it came from Holland, where 't was caught
(I should not say it came, for it was brought.)
Tomorrow we 're to have it at Crane Court."*—*Sir C. Williams.*

THE first and only Marine Aquarium possessed by many is the basin of sea-water in which they have, perchance, while young, placed that wonderful polypus which they have taken

* Where the Royal Society held its meetings and kept its Museum, from 1710 to 1782.

on the rocks, and which they have heard called a "Sea-flower." Probably it is the commonest of common species, which has been named *Mesembryanthemum*, from its resemblance to the many-petalled flower of that name. It is well for the early Aquarian, if, when he first takes the living flower from the rock, he is unacquainted with its nature; but seeing only a round leathery hemisphere fixed on a stone, and puckered in at the centre, he has just conjectured that it might be a living animal. In that case his delight and wonder will be great when his captive, little by little, expands before him, and exhibits one after another of its curious characteristics. Every alteration in shape, attitude, and dimensions, will excite astonishment, and create a desire to know more of this surprising creature.

A first view of the common *Actinia* in its contracted state is not particularly inviting. It is generally of a dull liver-colour, or fading green, and presents nothing to the eye but a raised half-circular mass, with a puckered hole in the centre. This is the outer covering of the polypus. It is of a leathery substance, and capable of contraction and expansion at will. Presently this mass will be seen gradually to rise a little, and the puckered folds at the central hole to smooth out. The next things to be seen, when the hole is

wide enough, are the tips of delicately-coloured petals, which, on examination, are found to be rounded, cylindrical, and transparent. These continue to be more and more fully seen, until they separate so as to disclose a small inner surface in the centre; and we find that this inner surface is part of a rounded disc, and that the petals are arranged in several rows so as to fringe the outer edge of the disc. Here we have the flower fully expanded; and on looking at the now visible edge of the outer coating, we find that it is studded, behind the petals, with a row of bright rounded tubercles, like blue beads. The central hole is of course a mouth, leading to a central stomach; the cylindrical petals are tentacula, or arms, by which prey is seized; and the exact use of the blue beads, which exist only in the *smooth anemone*, is not yet fully ascertained.

Now if, with this flower before him, with its petals out, the observer will put a small water-insect, or piece of meat, within reach of one or two of the outer tentacles, he will see that they adhere to it as it were by a kind of electric touch; and there is an agitation among a few tentacles in its immediate vicinity, which bend towards the object and try to reach it, in support of those which first had hold of it. Meanwhile a firmer purchase is obtained by those tentacles which

touched the morsel first, till it is completely surrounded, and if living, overpowered. It is passed along from hand to hand (if the expression may be permitted) among the tentacles, until that side of the disc coils over towards the mouth, into which it is soon sucked and disappears. If on the contrary no food be given to the *Actinia*, and he become hungry and dissatisfied with his situation (as is very likely to be the case) he will probably turn his stomach inside out, just as a man may turn out his pockets to show that he has nothing in them. I remember being immensely astonished when from the mouth of my specimen appeared several balloon-like inflations, which gradually enlarged and presented a most beautiful appearance, a kind of transparent bladder, delicately ribboned. After this happens the poor creature will not live long.

When we have specimens of *Actiniæ* in glass tanks, they sometimes fix their basal disc against the inner surface of the sides, so as to show its structure to the observer from without. This disc may be regarded as the animal's foot, for he uses it just in the same manner as Gasteropods use their crawling base, and effects his very slow movements by stretching out a portion of the rim and drawing the other after it, little by little. Its disc form and sucker-like character, enables it

to cling firmly to rocks and other surfaces; while amid boisterous tempests agitating the waters, his extended body bends to the waves, and his many arms are active in search of food. The edge of the outer covering will be distinguished by a darker colour and more opaque texture, from the rest of the disc. From it, radiating towards a common centre, are opaque white lines; some reaching the centre, and others, shorter, between them. If at any height in the body of the animal a cross section be made, these same lines will appear; showing them to be edges of vertical plates, of a different substance from the rest of the body. The spaces between these plates and the central stomach are filled up with translucid jelly-like flesh, which is capable of being greatly swelled with water. If a section were made of a Single-starred Madrepore, such as *Caryophyllea Smithii*, or the Mushroom Coral of the Pacific, the same arrangement of radiating plates would be observed; only in these instances they are hard and calcareous,—in short, *coral;* while in *Actiniæ* they are only a kind of gristle, and, being of a firmer texture than the flesh, give support and firmness to it. This is the essential difference between *Actiniæ* and Single-star Corals. The latter however are fixed, while the former, as we have seen, are locomotive.

Let us inquire what is the difference between this group of polypes called "Helianthoid" and that which contains the Hydra and the other "*Hydroid*" polypes. It is this: that while the former are composed of all the distinct parts which we have been enumerating,—the outer covering, the basal and upper discs, the vertical plates, the fleshy substance between them, the central stomach, and the lipped mouth; the latter is a simple bag, open at one end and fringed with tentacula,—mouth, stomach and all in one,—so simple indeed that it may be turned inside out and yet perform the same functions.

When describing the fresh-water Green Hydra, we shall have occasion to speak of experiments made on that wonderful creature, in the way of cutting up in pieces to observe its power of reproducing parts. Similar experiments have been made, although not to so great an extent, with *Actiniæ*, and with a similar result. An *Actinia*, for instance, has been cut across the centre, and instead of forming, as might be expected, a new basal disc, it put forth, at the severed part, a new set of tentacula, surrounding a new mouth, so that the creature seized and devoured food at both ends. New tentacles are soon supplied for any that are accidentally or designedly mutilated.

At Mr. Warrington's I saw what appeared to me a very curious phenomenon,—an *Actinia mesembryanthemum* with a double head, both heads on the same plane; the body seemed to be entirely one, with an oval basal disc, and no sign of separation up to the very edge of the leathery covering; but the upper disc formed two complete circles, surrounded each by its proper set of tentacles, and each with its central mouth. It is observed, that when a considerable morsel of food is presented to an ordinary *Actinia*, some slight agitation may be observed even among the most remote tentacles, as if they were in some degree conscious of what was going forward, and held themselves in readiness to give assistance if required. But in order to show the complete duality of the upper part of his two-headed specimen, Mr. Warrington fed first one, then the other, in my presence. When the morsel was brought near the tentacles on the outer part of one circle, and they were busy securing it, the other tentacles of that circle showed some degree of alertness; but not a feeler of the other circle stirred. When the twin head received its *bonne bouche*, we could then see both independently engaged in securing and devouring their meal. We have heard of twin babies turning out to be a capital speculation in the family of some

working man, by exciting a kind of admiring sympathy, productive of charitable contributions; and I more than suspect that the twin *Actiniæ* make a very good business of their peculiarity; for of course every visitor must see both heads fed, and by this means, by the kindness of their possessor, they get many and many a morsel which but for the happy partnership they would not have enjoyed.

Much has been said respecting the power of stinging possessed by these animals, and by Polypiferous Zoophytes in general, in consequence of which they are called "Sea-Nettles," and by the French "Orties de la Mer." The experience of those who have handled them differs greatly; and of course the power will differ in different species under different circumstances. Thus the *Anthea* possesses it in a greater degree than most others of the family. It is exercised by means of fine darts pervading the body, and is connected with a great power of adhesion. In the 'Manual of Marine Zoology' it is remarked that "most, if not all, of these polypes have the power of arresting, by a touch of their bodies, other animals much higher in rank than themselves, and of instantly benumbing them, so that they may be sucked in and devoured without resistance. This power resides in the highly elastic threads or wires, which are

doubtless connected with a subtile poison, and are ordinarily coiled up in oval capsules, but are, at the will of the animal, projected with surprising force: these capsules are lodged in vast numbers in the flesh of the body, but especially in the tentacles."

There is an old stanza referring to the common terrestrial stinging-nettles, which will not apply to these "Orties de la Mer:"—

"Tender-handed stroke a nettle,
And it stings you for your pains:
Grasp it, like a man of mettle,
And it soft as silk remains.
'T is the same with common natures:
Use them kindly, they rebel;
But be rough as nutmeg-graters,
And the rogues obey you well."

But the case of polype stinging-nettles is different; for being sheathed in their cases, ready to dart forth on irritation, pressure does not break the polype-stings, but only causes them to be shot out in greater force.

In general, the "sting" is not felt by the human hand, although a sensation of "stickiness" is produced. Those wonderful little threads which dart out of their capsules and penetrate with surprising subtlety many objects of contact, perhaps find the skin of the human hand too tough to

wound. Mrs. Pratt, in her 'Seaside Chapters,' observes that the touch of the very same *Actinia* will affect different persons in a different manner. Having placed a specimen in a vessel which she often touched, she found the tentacles crowding round the finger and producing a very slight sensation. The same specimen being touched by another person communicated a tingling which was felt up the whole arm! Some persons felt nothing; others felt as if stung by a nettle.

Altogether the Anemone must be a formidable tenant of the sea, and is a rather dangerous inhabitant of the tank. Firmly adhering by its base, it puts out its arms in quest of prey. Nothing, once in contact with an arm, can escape its deadly touch. Small *Mollusca*, *Radiata*, and *Crustacea* are drawn to the central vortex, and swallowed in spite of the most vigorous resistance. Small fishes and crabs are seized and devoured. Creatures larger than the natural extent of the Anemone's body are pressed down into the same accommodating and extensile carpet-bag. If you have any choice specimens belonging to other tribes, endowed with powers of locomotion likely to bring them into thoughtless contact with the foe, do not place it in a tank with Sea-Anemones.

Foreigners boil many kinds of *Actiniæ* for the table, and

find in them a very pleasant dish. The texture is something like calf's-foot jelly; taste and smell resembling that of crab or lobster. Eaten with sauce, they are savoury. The author of 'Devonshire Rambles' gives an amusing account of the manner of his first becoming acquainted with Actinian dainties. "The next morning," remarks that gentleman, "I began operations. As it was an experiment, I did not choose to commit my pet morsels to the servants, but took the saucepan in my own hand. As I had no information as to how long they required boiling, I had to find it out for myself. Some I put into the water (sea-water) cold, and allowed to boil gradually. As soon as the water boiled, I tried one; it was tough, and evidently undone. The next I took out after three minutes' boiling; this was better; and one at five minutes was better still, but not so good as the one which had boiled ten. I then put the remaining ones into boiling water, and let them remain over the fire boiling for ten minutes, and these were the best of all, being more tender, as well as more inviting in appearance. I must confess that the first bit I essayed caused a sort of lumpy feeling in my throat, as if a sentinel guarded the way, and said, 'It shan't come here.' This sensation, however, I felt to be unworthy of a philo-

sopher, for there was nothing really repugnant in the taste. As soon as I had got one that seemed well cooked, I invited Mrs. G. to share the feast; she courageously attacked the morsel, but I am compelled to confess it could not pass the vestibule; the sentinel was one too many for her. My little boy, however, voted that 'tinny was good,' and that 'he liked tinny,' and loudly demanded more, like another Oliver Twist. As for me, I proved the truth of the adage, 'Ce n'est que le premier pas qui coûte;' for after the first defeat my sentinel was cowed. I left little in the dish." Afterwards, frying them with egg and butter-crumbs, they were found far superior to the others, "all prejudice yielded to their inviting odour and appearance, and the whole table joined the repast with evident gusto." Thus, eating or being eaten, the sea-flowers fill up their appointed place in the world's economy.

Active, fearless, and powerful as the *Actiniadæ* are in the means adopted to secure their food when it comes within reach, they are but sluggish creatures and show but little instinct in their general habits. They will remain for hours, and even days, in the same position; and when they do move, it is at an almost imperceptible pace; perhaps an inch in an hour. When removed from their site and

placed at the bottom of a vessel, they take a good while to consider whether they shall fix themselves on another; and a still longer time in effecting their purpose. When on the look-out for prey, they never lengthen their tentacles to reach it unless it come in actual contact with them. Dr. Hamilton, a pastor of the Scotch Church, in a little work called 'Life in Earnest,' has happily seized upon this apparent laziness of the Zoophyte, in rebuking those who are satisfied with living in the world without a definite object.

"Those of you, who are familiar with the shore, may have seen attached to the inundated reef a creature, whether plant or animal you could scarcely tell, rooted to the rock as a plant might be, and twirling its long tentacula as an animal would do. This plant-animal's life is somewhat monotonous, for it has nothing to do but grow and twirl its feelers, float in the tide, or fold itself up on its foot-stalk when that tide has receded, for months and years together. Now, would it not be very dismal to be transformed into a Zoophyte? Would it not be an awful punishment, with your human soul still in you, to be anchored to a rock, able to do nothing but spin about your arms or fold them up again, and knowing no variety, excepting when the receding ocean left you in the daylight, or the

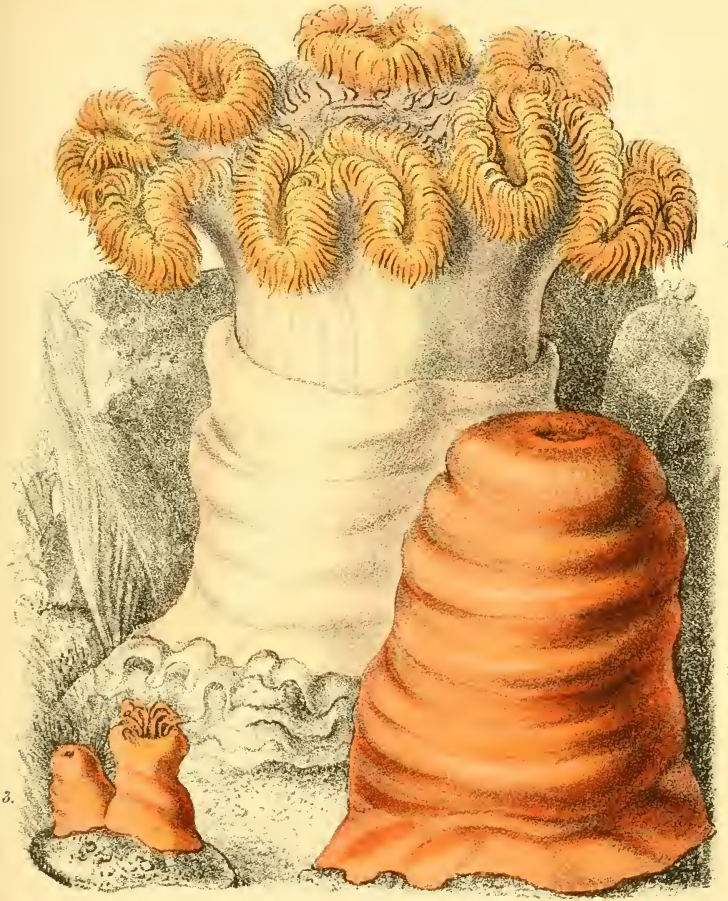
returning waters plunged you in the green depths again, or the sweeping tide brought you the prize of a young Periwinkle or an invisible Star-fish? But what better is the life you are spontaneously leading? What greater variety marks your existence, than chequers the life of the Sea-Anemone? Does not one day float over you after another just as the tide floats over it, and find you much the same, and leave you vegetating still? Are you more useful? What real service to others did you render yesterday? What tangible amount of occupation did you overtake in the one hundred and sixty-eight hours of which last week consisted? and what higher end in living have you than that polypus? You go through certain mechanical routines of rising, and dressing, and visiting, and dining, and going to sleep again: and are a little roused from your usual lethargy by the arrival of a friend, or the effort needed to write some note of ceremony. But as it curtseys in the waves, and vibrates its exploring arms, and gorges some dainty *Medusa*, the Sea-Anemone goes through nearly the same round of pursuits and enjoyments with your intelligent and immortal self! Is this a life for a rational and responsible creature to lead?"

We may say to the last question, "Perhaps not;" but it

is nevertheless a very good sort of life for an Anemone to lead, for it is that in which God has placed it, and it fulfils the end for which it was created.

I have not yet alluded to the habit of elongation possessed by most of the *Actiniæ*, and consequent great variation of shape. We have seen specimens of *A. anguicoma*, for instance, vary from a flat closed disc, scarcely thicker than a penny in the centre, to a worm-form three or four inches in length, with an open flower at the top. *A. bellis* is very apt, after elongating its body till near the top, to spread the upper disc so as to give the appearance of a trumpet. The habit of elongation is more frequently practised at night or in darkness; but may often be observed in the daytime among specimens in Aquaria.

One circumstance remains to be noticed; it is the manner in which the young are produced. They are thrown out from the mouth of the parent, one at a time. They glide about its body for a little while, or float freely in the water, but soon come to an anchor, and may be seen growing in groups not far from the secondary author of their being. Young *Actiniæ* are very beautiful objects, showing the characteristics of the species to which they severally belong, with more transparent delicacy than is seen in older



Sowerby del. et lith. Vincent Brooks Imp.

1. Plumose Anemone Sagartia dianthus expanded
2. Variety of the same, closed. 3. Young of the same

specimens. In the newborn young of *A. gemmacea,* the beautiful markings of the tentacula are distinctly conspicuous. Young Sea-flowers, jerked from the parent's mouth and colonizing near it, are among the most exquisite objects of an Aquarium.

Actiniadæ, as a family, are not however exclusively confined to creatures of the form I have described in this and the preceding chapter. There are considerable variations among different members of the group. There are some which have no adherent bases, but which possess other characters in common with true *Actiniæ;* some with tentacles scarcely retractile, others with knobbed tentacles. Other variations distinguish the different genera of the family, of which the following is a summary.

All *Actiniadæ* are divided into those which are *adherent* and those which are *not adherent.*

Adherent Actiniadæ are divided into those whose tentacles are retractile, and those which have non-retractile tentacles.

Adherent Actiniadæ with non-retractile or scarcely retractile tentacles are divided into two genera:—

1. With a simple circular base.—*Anthea.*
2. With a lobed and annular base.—*Adamsia.*

Adherent Actiniadæ with retractile tentacles have the tentacles knobbed, truncated, or conical, and are divided into the following genera :—

1. Tentacles knobbed.—*Corynactis.*
2. Tentacles truncated.—*Capnea.*
3. Tentacles conical.—

   Emitting filaments.—*Sagartia.*

   Not emitting filaments :—

   Warted : *Bunodes.* Smooth : *Actinia.*

Non-adherent Actiniadæ are divided into the following genera :—

1. Body tapering downwards; tentacles simple, equal, retractile.—*Hyanthus.*
2. Body cylindrical, with a rounded base; tentacles non-retractile, those of the outer circle long and those of the inner circle short.—*Arachnitis.*
3. Body worm-shaped; animal forming a protective sheath.—*Edwardsia.*
4. Body pear-shaped, with a posterior orifice.—*Peachia.*

Each of these genera will be more fully described when studying their representative species in the following Chapter.

CHAPTER V.

SEA-ANEMONES.—THEIR DIFFERENT KINDS.

SEA-ANEMONES, CONTINUED. — DIVISIONS INTO GENERA. — SAGARTIA. — BUNODES. — ACTINIA. — ANTHEA. — ADAMSIA. — ABNORMAL FORMS OF ACTINIADÆ. — CORYNACTES. — HYANTHUS. — CAPNEA. — ARACHNITIS. — EDWARDSIA. — PEACHIA.

If Sea-Anemones were all of one kind, one colour, one form, one uniform habit, however exquisite that one colour and form might be, its constant repetition would tire the senses, and having seen one or two specimens we should soon cease to admire the rest. It is so with flowers: it is so with beauty of every kind. If our ladies were uniformly fashioned after the strict model of beauty as set forth in the statues of Venus, it is doubtful whether they would find so many admirers as they do now, with their charming variety of feature, complexion, and expression. No tiresome sameness marks our sea-flowers, but every one

presents some variation from others of its class. Each individual varies in itself; assuming now one shape, then another; now displaying one tint, then setting forth another in a different part of his body. Each specimen shows some slight peculiarity by which he may be known from others of the same variety. Each species has a range of variation, reaching perhaps from pale green to dark purple. Each genus presents distinct forms and characteristics in its species; and the genera differ from each other in striking peculiarities. Clustered in crowded colonies on sea-rocks and in pools on the beach; enriching the sands and pebbles with starry flowers, bright and variable, as rich and varied in form and tinting as any terrestrial flowers that can be produced for prizes on a gala day; there are the *Anemones*. The more we know of them, the more we shall admire their structure, economy, and transcendent loveliness.

We will now pass in review a few of the most remarkable and interesting species of true *Anemones*.

They are divided by modern writers into three distinct genera, namely, SAGARTIA, BUNODES, and ACTINIA. The latter name is retained for the genus containing our common species; it being a rule in nomenclature, when it is

found necessary, on account of an increased number of species and increased knowledge, to divide a genus, that the original generic name should be attached to the first species to which it was applied.

There is one peculiarity in those species which are now placed under the generic name *Sagartia*, which is not observed in the others, and which forms a fair line of separation: it is that they have long threads or filaments contained in the soft parts of their bodies, which, when irritated or frightened, they throw out through pores in their skin. I have seen these threads thrown out to the length of an inch or more, and coiled up together at the ends. They contain filiferous capsules of the same kind as those contained in the tentacles.

The genera *Bunodes* and *Actinia* are separated upon less important grounds; namely, that the outer covering of the former is rough and warty, while that of the latter is smooth.

Sagartia anguicoma.—(Plate VI. fig. 1, 2, 3.)

The "*Snake-locked*" *Anemone* is one of the most pleasing objects of a Aquarium collection, on account of the extreme gracefulness of its numerous, long, transparent, twirl-

ing tentacula, which have the appearance of a number of delicate worms, clustering and twisting about each other. It is very remarkable, even among the changing sea-flowers, for the extent of its changes in form. Now it is an almost flat button fixed to a piece of rock; now it is an upright cylinder, with a many-threaded head; and now it is a narrow worm three or four inches in length. It has been observed that its greatest tendency to elongation is in the dark. Its body is of a light buff colour, marked with irregular lines of brown, or interrupted light bands running down lengthwise. The disc, when expanded, is wide, mottled, and speckled with brown and white, with one or two dashes of pure white reaching from the mouth to the edge. The tentacles are in about five rows, of which the outermost are shortest and most numerous. They are all very long, flexible, and tapering; each with a delicate line of brown on each side. The longitudinal plates are conspicuously seen, on account of the general transparency of the flesh, and the filaments are seen twisted up in the spaces between. It is very pleasing to see in some dark corner of the tank, against a dingy background of rock, a specimen of this, with its Medusa's head displayed. Perhaps it is a rather young specimen, of the lighter and almost

white variety; the darkness of the background beautifully setting off its pellucid feelers.

Sagartia troglodytes.

It is so named from its habit of choosing holes suited to its size, in which it lives, and into which it withdraws when disturbed; or it will bury itself in sand, producing and displaying its head above the surface, or at the head of its hole. The people classically known as *Troglodytes*, reported to have lived in caves and burrows, near the Gulf of Arabia, have suggested the name of this interesting species.

Sagartia bellis.

The *Daisy Anemone* also delights in hollows and fissures, into which it can withdraw and defy the collector who approaches it in its native haunts. The body of this *Actinia*, when fully expanded, is generally thinner in the middle than towards either extremity. In that condition, its sucking disc is expanded, and its oral disc spread out like the mouth of a trumpet. Sometimes the body is formed into a kind of cup at the upper end, and the disc hollowed into it. However deep the hole in which the *Daisy Anemone* lives, he must stretch out his body to reach the surface, so

as to expand his disc beyond it, and he does so, sometimes, to the extent of three or four times the diameter of the body. The disc, being very thin, is sometimes extended in different directions, so as to vary considerably from a circular form, and has sometimes been described as *lobed*. The tentacles are very numerous and small; they are arranged in five or six rows; the innermost rows are the largest and least numerous; they are generally erect; the successive rows declining more and more, till the outer row lies nearly flat on the edge. Beginning at twelve tentacles in the inner circle, the number in each circle doubles, so that the whole would amount to between seven and eight hundred. Those on the outer rim only form a short fringe of minute feelers, not the sixteenth of an inch in length. From between each tentacle runs a radiating line to the centre, which gives a beautiful starry radiation to the whole. The colours of *Actinia*, or *Sagartia bellis*, are as follows. The lower part is white; a little higher, it becomes pink, which gradually assumes a purple hue. The upper part of the body and the disc are palely spotted. The surface of the disc is brown, sometimes mottled with grey. The tentacles partake the same colour, but are variegated with bands of white or grey, and sometimes speckled.

Mr. Gosse has given the following account of his examination of the tentacles of this species. "I cut off, with a fine pair of scissors, the tips of one or two, and submitted them to the microscope upon the compressorium. As soon as the pressure began to flatten them, it became apparent that the tentacle was composed of rather thick gelatinous walls surrounding a tubular centre. The wall was filled with a vast multitude of very minute granules, of a rich sienna-brown hue, and almost globular in form; all being quite alike in shape, colour, and dimensions. These escaped by thousands, on the increase of the pressure, from the tip of the tentacle, where was evidently a natural orifice forced open by the pressure, but ordinarily, as I suppose, kept firmly closed by muscular action. The gelatinous walls of the tentacle contained, imbedded in their substance, a goodly number of those highly curious organs known as filiferous capsules. They are in this case very minute, being about one twelve-hundredth part of an inch in length, almost linear and slightly curved. The pressure being continued, each of these little organs suddenly shoots forth from one end, to a great length, a slender, highly elastic thread, which had hitherto been coiled up spirally within its cavity. The expulsion of this thread is effected

by a proper organism, excited by the pressure on the tissues of the tentacle, but not forced out by the compression of the capsule itself. It is supposed that the adhesive touch of the tentacles resides in these little organs, and that poisonous fluid accompanies the emission of the thread, since the mere contact of a tentacle with any small animal appears at once to paralyze it, however lively it may have been but a moment before."

Sagartia nivea.—(Plate IX. fig. 3, 4.)

The *Snow-white Anemone* is one of the most exquisite tenants of the sea or the tank. It grows in tidal pools under the weeds. The body is of a yellowish-brown colour, the disc pale, and the tentacles of the purest white. A variety occurs, however, in which the outer coating assumes a bright orange complexion, while the disc is chocolate-coloured, and the tentacles pure white. A fine specimen of this variety, seen floating in one of Mr. Lloyd's Aquaria, presented a splendid object. The specimen was transferred to the gardens of the Zoological Society.

Sagartia rosea.

The *Rosy Anemone* has the same habit as *S. bellis* and

S. troglodytes, of ensconcing its body in a hole, and spreading out its disc beyond its edges. The body contracts into a globe, wrinkled and studded with white glands; its general colour is brown, sometimes inclining to red. The fringe of tentacles is of a bright rose-colour. The mouth is four-lobed, and forms a cross; the edges of which are crenated with white. The disc is pale fawn, or olive, slightly silvered.

Sagartia candida

Is white in every part, excepting a rosy line round the rim of the outer coating, and pinkish spots at the base of the tentacles.

Sagartia parasitica.—(Plate XI.)

The habits of the *Parasitic Anemone,* in connection with the Hermit Crab, are so interesting that in spite of his comparatively small share of beauty, he secures a fair share of attention. It is a large species, attaining the height of three or four inches without diminishing the bulk of its cylindrical column. Its outer covering is rough and warty; it is of a dull greyish sandy colour, with stripes of brown or purple running down lengthwise, which are wider than the spaces between. The disc is expansive, and sometimes

hollowed. It has numerous rather small tentacles, which are marked with cross brown bands.

Such is the Anemone which loves to ride on the back of a crustacean bearer. Although *S. parasitica* will sometimes fix himself on a stationary stone, or an empty shell, he more generally chooses a *Buccinum*, inhabited by the *Pagurus Bernhardus* or Hermit Crab, which blunders along among stones, rocks, and seaweeds, with his double burden, the uppermost of which does not seem daunted by the dangers of his passage. The Anemone generally keeps his disc expanded when he receives a concussion which would make most of his brethren "hide their diminished heads." No species throws out with more readiness than the *parasitica* those long adhesive threads which are characteristic of *Sagartiæ*. In his case they appear to be particularly tenacious and offensive, and the author of the 'Aquarium' relates an instance in which a single thread, although detached from the *Actinia*, adhered to a little fish on which it had been darted, so firmly, and appeared to cause so much agony that it died. The thread was probably detached from the *Actinia* by the fish's action; for, as a rule, the threads are withdrawn through their pores, and remain coiled up ready for use on the next occasion.

Sagartia dianthus.—(Plate VII.)

The arrival of a large number of magnificent specimens of this *Plumose Anemone* at Lloyd's establishment while I was there, tempted me to figure them as well as I could in one of our Plates. There were two varieties; one all orange; the other pinky-white with pale orange tentacula. It is a very large species, of a smooth, transparent, jelly-like texture, and remarkable for the beautiful manner in which its disc coils and puckers up into lobes, fringed with overhanging feelers. At a distance, it looks not unlike a cauliflower-head, and presents an object that may be admired, but scarcely portrayed. The young are very pretty, and show all the characteristics of their progenitors.

Bunodes crassicornis.

We now come to those *Actiniæ* which do not jerk forth filiferous threads, but which differ from the true *Actiniæ* in being rough and warty. The *Thick-horned Anemone* is remarkably so. It is a remarkably fine species, and one of the largest, if not *the* largest, of the British species. Sir J. G. Dalyell says:—"No species is equally diversified in colour and aspect. Red is usually predominant. The sur-

face of many, however, is variegated, red and white, like a rose, or with orange and yellow intermixed. One occurred almost totally white, another wholly primrose-yellow. It may be truly affirmed that the diversities baffle enumeration and description." The variety which has the thick tentacles white, with bands of pink, is a very splendid sea-flower. *Bunodes crassicornis* sometimes agglutinates to its outer coat an extra coating of sand and gravel as an additional protection.

Bunodes gemmacea.—(Plate VIII.)

The *Gemmaceous Anemone* is remarkable for the rows of gem-like and pearly warts, which are arranged down the body, and the strongly marked white bands which cross the tentacles. The warts are round, well-defined, larger on the upper part, diminishing downwards towards the base. There are some rows of principal ones, and between them are rows of smaller ones. Generally about half-a-dozen rows at equal distances are white, so as to produce a conspicuous radiation when the animal is closed: it is then globular. The ground-colour is sometimes delicately rosy pink, sometimes of an ashy grey; altogether, unlike the generality of *Actiniæ*, it shows almost as much beauty

when closed as when open. We can hardly, however, exaggerate its beauty in the latter condition. Every tentacle is a series of gems; their upper side has a dark ground-colour, across which are pearly white, bluish, and greenish bands. And even the very youngest displays all the characters of its parent, excepting that the tentacles are fewer in number.

Bunodes clavata.—(Plate VI. fig. 4.)

Nearly white, with sulphur markings; tubercles outside, with a pink spot in each.

Actinia mesembryanthemum.

In the last Chapter but one, speaking generally of *Actiniæ*, we had occasion to describe some of the characters of this species, which is the commonest on our British shores. It is smooth outside, and is remarkable for having a row of beads on the inner edge of the outer coating, or between it and the tentacula.

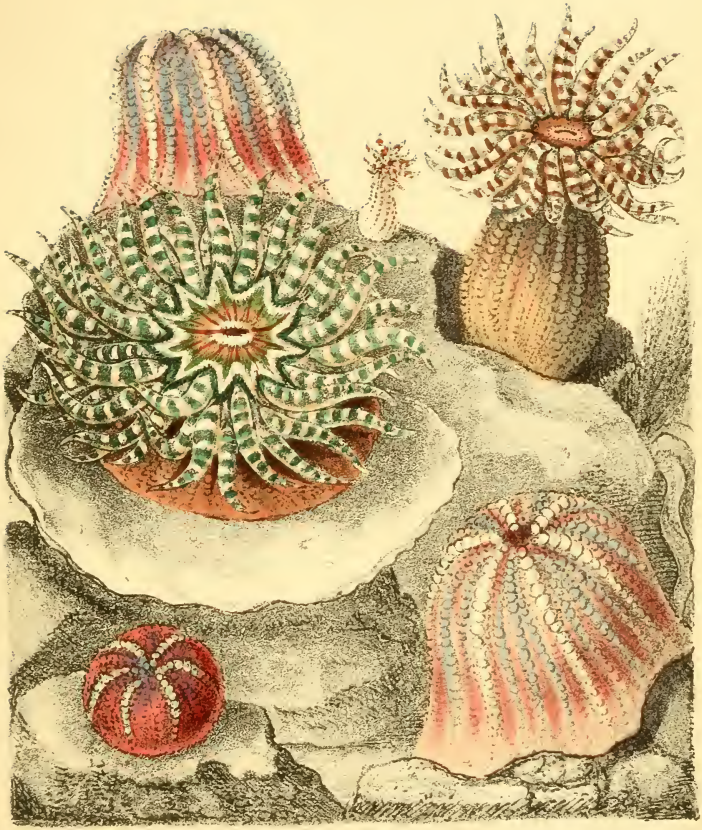
In Plate VI., *Sagartia anguicoma* is represented in three forms, including extreme extension and extreme depression. *S. clavata* is fig. 4; *S. dianthus* occupies Plate VII., show-

ing the two most beautiful varieties, and young. Varieties of *Bunodes gemmacea* fill Plate VIII. *Sagartia parasitica* is seen on the *Buccinum*, with the Hermit Crab, in Plate XI.

Anthea cereus.—(Plate IX. fig. 1.)

The genus *Anthea* is thus described:—"Body adherent, cylindrical; tentacles numerous, scarcely retractile within the body, their bases united in clusters."

This Actinoid Zoophyte does not appear to differ very materially from the ordinary form of his order; but its long tentacular arms are united in clusters on the disc, and seem incapable of being wholly withdrawn into the body. Although Mr. Gosse relates an instance in which a specimen in his possession did retract his tentacles, so far as only to show the tips on one occasion, the rule appears to be that they are not withdrawn. And as they had never, previously to this instance, been seen withdrawn, it was assumed by observers that they could not be so. In the instance of which I shall speak presently, in which an *Anthea* allowed his tentacles to be "held in suspense" by air-bubbles, I remarked to the keeper that it would be inconvenient if the animal wanted to "shut up shop." The man



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Gemmaceous Anemone (Bunodes gemmacea)
expanded and closed.

seemed rather to pity my ignorance, and told me that such a thing never occurred. In fact, at that time, I had seen very few Zoophytes, and had never read Johnston.

The manner in which these long and slender purple-tipped arms coil and recoil, spread themselves out, and feel about for a passing *bonne bouche,* is very amusing. They are exactly like a great number of snakes confined by one extremity and free to move about at the other. Each tentacle is about an inch and a half long in specimens of medium size, although I have seen them considerably longer in fine specimens. They have great power of adhesion, easily holding anything they touch. They are said to possess a stinging power, but this does not appear to be well authenticated; indeed those who have tried them with their fingers have not experienced any sensation, excepting that of adhesion. *Antheas* are very voracious, and very clever in securing prey. Many a beautiful Prawn in the tanks has fallen a victim to the handy use of their long arms. If but a small part of a limb be but touched by one of them, and the smallest purchase obtained, the other arms soon crowd round to help the first in securing the prey, which is soon entangled among them, and, in spite of all it can do, is drawn irresistibly into the fatal gulf.

The Antheas in the tanks of the Zoological Society are numerous and fine, particularly that variety of *Anthea cereus* which has its tentacles very long and slender, of a greenish tint, or buff with pink or purple tips. These tentacles do not seem to be arranged in symmetrical circles, but hang in a kind of irregular bunch, turned and twisted in all directions. It is but rarely that they are seen apparently motionless, and even then a near and steady gaze will detect a slight action in the extreme tips of a few of the most distant. In general there is a slow, graceful twirling among all the anthers, excepting when some living animal swims, or is pushed sufficiently near to attract attention. Then all the anthers twirl and coil in the most grotesque combinations, and look like a twisted knot of small snakes engaged in mortal combat. In the sea, attached to the rocks, these Antheas would appear as fixtures, and on being removed, the rock beneath them presents a hollow, as though they had corroded or eaten away a space corresponding to the size of their foot, like the limpets and some Cirripedes. This would appear to indicate a very sedentary, stationary life; but the habits of the creature when in captivity do not well correspond with this indication; for, in the tank, he shifts his position rather fre-

quently, and although, when observed, the motion is not quite perceptible, yet in the evening you may leave him seemingly fixed at the bottom of one end of the tank, and, in the morning, find that he has crawled up to the top of the glass sides at the other end. When seen through the glass a curious view is afforded of the broad circular disc which constitutes the base of his stem, and which corresponds with the foot of the Gasteropodous Mollusca,—in fact, it is his organ of locomotion. It is generally nearly white, or partaking slightly of the body tint, as seen through its transparent, jelly-like substance. From nearly the centre to the circumference, radiate opaque thread-like lines which increase in number near the outer edge. Those who have seen sections of Star-corals would at once recognize the resemblance of these fibres to the bony plates constituting the skeleton of the latter.

The *Anthea* has the power of swelling out parts of its body into lobes, which assist it in crawling. In doing this it spreads out a portion of the disc on the side towards which it is travelling, gets a firm hold by that portion, and then draws up the rest to it; repeating the process until the distance is accomplished. It will sometimes come to the edge of the water, and keeping its attachment by part of

its foot to the sides of the glass, turn over the other portion to a plane with the surface of the water; so that half the body and anthers are suspended by a dry portion of the disc from the air, and the other half by the more solid attachment to the glass; but it cannot, like the Water-snails, float on the surface wholly in this inverted position. The tentacles present a very beautiful and animated appearance when the body is partly suspended. They are moved about in the most graceful curves, and while each separate tentacle seems to have a will and spirit of his own, yet a harmony of motion, and unity of purpose, is seen to pervade the mass.

In watching the tanks at the Regent's Park, I noticed a circumstance showing the very quiet and patient habits of the *Anthea*. A very large, healthy specimen, fixed to a piece of rock near the bottom of the water, with his tentacles beautifully tinted, lay twirling some of them with a gentle and graceful motion, quite active enough to show that the Zoophyte was alive and wide awake. Several disengaged threads of confervæ had been drawn up from the bottom by means of numerous bubbles of air. On their way up, some of them being attached to the bubbles at both ends, had looped round some of the longest of the

Anthea's tentacles, whose dead weight, apparently without any voluntary resistance, was sufficient to arrest any further progress of the rising shreds. Thus, suspended in mid-water, were the globules of air holding up the loops of conferva, and these loops keeping the tentacles of the *Anthea* suspended in an unnatural position above the body,—a position very similar to that of the arm of a rider passed through one of the looped bands hanging by the side of a carriage window. The least effort, or contraction of the limb, would either have broken the loop, or have drawn it down, and released the air-globules which suspended it; but no, our *Anthea* preferred "taking it easy," and, although his tentacles were awkwardly bent, he seemed inclined to rest them as they were. Well, I watched a little while longer then, but no movement. Leaving the tank for a while I returned after two or three hours. There were the same tentacles, of the same *Anthea*, hanging by the same threads, in the same position. Well, surely when the Zoophyte shuts up for the night, he will burst his bonds. Oh no, I forgot! The *Anthea* must be supposed never to shut up, for Johnston says, "tentacula . . . incapable of being retracted within the body." On returning the next morning, there were still, in the same relations to each

other, the bubbles, the green threads, the *Anthea* and his arms. Shortly after, however, the animal managed by slow degrees to shift his entire position, and take his place in another part of the tank.

Adamsia palliata.

The "*Cloak Anemone*," although of the same nature as *Actinia*, is very different in form. Instead of being a symmetrical body with upper and lower circular discs, it is an enveloping body with linear and one-sided aperture. Like the *Parasitic Anemone*, it attaches itself to empty shells of *Buccina*, or "*Whelks*." Taking its place on the body of the shell opposite its mouth, its disc spreads out at each side; one lobe reaching towards the notched part of the mouth, and the other towards the spire. Passing the notch on one side, and the spire on the other, it begins to invest, at each end, the outer lip of the shell's mouth. Continuing to spread round, the two ends meet and become united by a cicatrix, or seam. Having spread broadly in investing the mouth, it has very considerably retracted the opening. On the side where it first settles, remains the mouth, which is long and narrow, and fringed with a row of short, scarcely retractile tentacula. As a broadly ex-

panded disc could not rest at angles with the vertical edge of the aperture, the *Adamsia* forms an incurved ledge, or bent extension of the edge, of a horny substance secreted by itself, thus making its own bridge and passing over it at the same time,—a very surprising instance of instinctive adaptation of a creature to its circumstances, which will be made further interesting when we find that there is another creature, whose convenience is greatly cared for in the arrangement. The shell thus enlarged in volume, but decreased in its opening by the *Adamsia* and its horny ledge, forms a most happily contrived case for the dwelling of a Hermit Crab, *Pagurus Prideauxii*. These two tenants of the old deserted mansion are generally found in company, and probably contribute to the supply of each other's wants. The Hermit supplies the deficiency of locomotive power in the Anemone, by travelling about in search of food for himself. Small fragments of his food may also fall to the share of his humble house constructor; and it sometimes happens that, a large morsel being seized by the latter when the former is in want, the Hermit, acting upon the principle that "might is right," may compel his weaker companion to divide the spoil. *Adamsia* is generally of a reddish-brown colour, becoming pale and cream-coloured near

the mouth. It is striped with bluish lines and marked with purple spots.

Anthea cereus is figured in the position described above, at the top of Plate X.

Abnormal Forms of Actiniadæ.

Corynactes Allmanii.

This curious little animal differs from the more normal *Actiniæ* in having the tentacles short and headed with bead-like globes. It is very beautiful and very variable in the position and shapes it assumes. *Corynactes* are found in tide-pools in great numbers, and displaying a great variety of colours, and hanging from overhanging ledges with their coronets of knobbed tentacula.

Being of a very thin substance, they are capable of contraction to a very small flattish button. When extended and expanded, the edge of the disc is seen to be crenated and brightly coloured; but when more fully expanded, the disc spreads beyond the diameter of the body so as to bring the tentacles over the rim. The tentacles, like those of the British Coral, *Caryophyllea Smithii*, are short cylindrical bodies, with round heads; they are arrayed in two

circular rows near the edge, and two other circles, less complete, towards the centre; in all the rows amounting to eighty or ninety to above a hundred.

In *Actiniæ* generally, a morsel of food is laid hold of by the tentacula and brought towards the mouth; but when the *Cornyactes* feeds, the lips of the mouth expand until their circle reaches the morsel held by the tentacula. The opening sometimes extends to the whole width of the body, so as to show the very bottom of the stomach; and as soon as the lips reach their prey it is soon drawn into the basin, and sunk into the vortex.

Corynactes Allmanii is commonly of a pale roseate hue, with the rim of bright scarlet, or bright green, and the tentacles are generally white.

The thread- or sting-darting capsules are large in the *Corynactes* compared to those of some other *Actiniadæ*. They are oval, and the thread, infinitesimally thin, is coiled up in its cell, ready to be unfurled or jerked forwards when required. Its extreme thinness may be imagined when we find a thread the eighth of an inch in length, coiled in more than a dozen spiral folds.

They have also a smaller set of capsules, the threads of which are furnished with a brush of minute hairs.

Capnea sanguinea.

The genus is described as having the body invested in a lobed skin, the base of which is very much dilated; it is reflected so as to form a kind of frill near the upper edge. Tentacles truncated, in a single row, short, and, when expanded, shaped like the embattlements of a tower. *C. sanguinea* is of a bright vermilion colour. It changes its proportions as to width and depth, but generally preserves a tubular or cylindrical form.

Iluanthus Scoticus.

Iluanthus is thus described by *Forbes*:—"Body cylindrical, tapering to a point at its extremity, free? Tentacula simple, retractile, surrounding the mouth." It is a free *Actinia*, about an inch and a half in length, fixing itself in the mud by its narrow end: from this habit it is called the "Mud-flower."

Arachnitis albida.

This is another very curious abnormal form. The genus is thus described:—"Body adherent, or free at will; cylindrical with a rounded base; mouth surrounded by non-retractile tentacles (about sixteen) in two series, the outer

ones very long, the inner short: it either swims like a *Medusa* or adheres in deep water." The tentacles of the outer row are very worm-like and long, like those of *Anthea* and *Cereus*, and probably enable the animal to swim through the water.

Edwardsia vestita.—(Plate IV.)

In a communication made in 1841 by the late lamented Professor Forbes, and published in the 'Annals and Magazine of Natural History,' an account is given of two interesting marine animals found in the Ægean Sea.

One is the animal now before us, and the other, a curious Annelide. "The depth of the bay," says the Professor, "is generally from seven to ten fathoms, the bottom sand and seaweed, chiefly *Zostera*. At the entrance of the bay there is deeper water, from seventeen to thirty fathoms, with a bottom of Corallines. The animals different according to the bottom and depth. . . . There are also a number of sandy bights, which, in places where streams run in, are crowded with *Cerinthia;* in others, are inhabited by great numbers of *Testacea* and *Foraminifera*. In these sandy nooks live two animals, the one an Annelide, the other a Polype, so remarkable on account of the peculiarities of form

and habit, that I have thought it might prove interesting to transmit this short notice."

The Polype was afterwards described as *Edwardsia*. It is a free, worm-shaped *Actinia*, which constructs a leathery tube to live in. The cylindrical body terminates obtusely at one end, and in a flower-like disc at the other. In the centre of the disc is a circular mouth surrounded by numerous short tentacula springing from its inner margin. Round the outside of the disc is another row of larger tentacula, very much like those of an ordinary *Actinia*. The tentacles are never withdrawn into the mouth, but are often reduced by contraction to very small dimensions. Mr. Forbes observes, that the body can be greatly lengthened so as to assume the form of a tapering worm, or *Holothuria;* and that it is protected by a membranous tube, which is itself strengthened by an incrustation of gravel and shells in the manner of a *Terebella*. It can move freely up and down in this tube, and sometimes, leaving it altogether, construct another. When out of the tube, our *Edwardsia* crawls along very much in the manner of a worm, but with the disc expanded, and perhaps using the tentacles at its margin as organs of locomotion. It soon secretes a quantity of glairy matter, to which shells and sand adhere,

and which soon becomes thickened and opaque. It is a very voracious feeder. Mr. Forbes further remarks, that "In the habit of protecting itself by sand and gravel, it resembles *Actinia viduata* and some other species, none of which, however, construct a regular tube. In its being free and having no adhesive disc at its posterior termination, reminds us of *Iluanthus*, a genus of *Actiniadæ*, which I discovered three years ago on the Scottish coast, and which I described and figured in the 'Annals of Natural History.' It is evident the animal I now describe fills up an important gap among the polypes, and leads to analogical consideration of the greatest interest to the philosophical zoologist."

The Annelide, found at the same time, will be described in its place, under the name applied to it by Chénu, of *Amphitrite Ægeana*. But it is a very curious fact, that both these forms, differing from all other forms in their respective classes, discovered at the same time and place, by the same illustrious naturalist, as presenting each a new link in the chain of beings, should both prove to be natives of our coasts, and find their way at the same period into our own collections. The Annelide did so by accident, having appeared spontaneously growing among the pebbles of

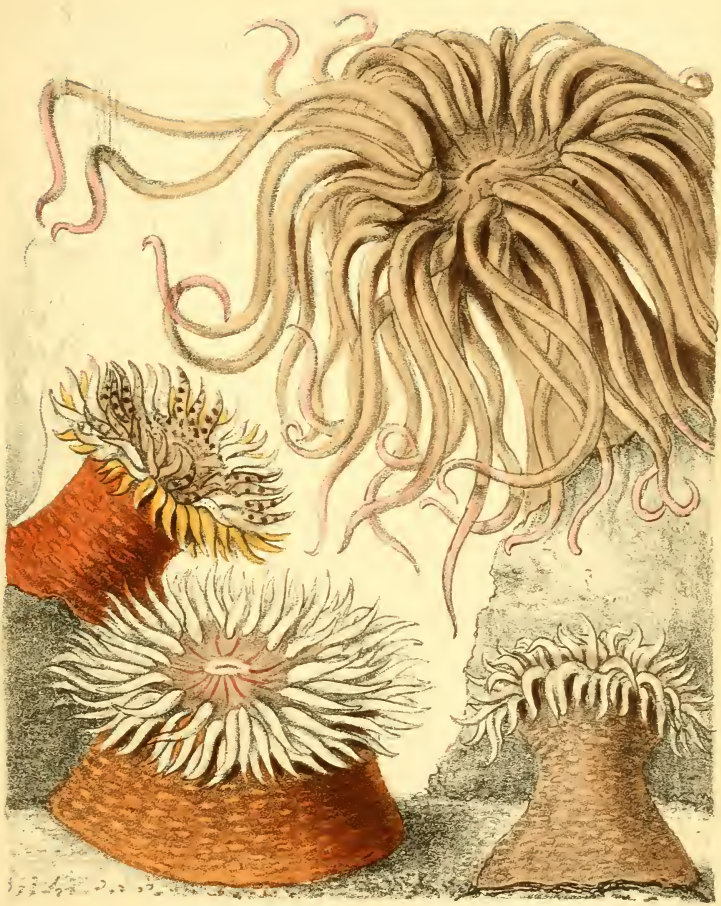
a central tank in the Zoological Gardens, at about the same time that Mr. W. A. Lloyd procured the Zoophyte in some numbers from the coast of North Wales. Specimens of the latter may now be seen at the Zoological Society's fish-house, and at the establishment of Mr. Lloyd, in the Portland-road. My figure is taken from one of that gentleman's finest specimens, which had made its covering under his own observation. The worm had been removed, and, after a few days, was found secreting its slime, which gradually became opaque and thick. It is of a dull greyish-purple colour, and looks like very ragged leather hanging in shreds in many places. It is open at both ends, and it appears to be the habit of this Zoophyte to leave the hinder extremity uncovered: I noticed this in all the specimens. Mr. Forbes remarks that the creature is very voracious, crawling about, when divested of its covering, and attacking everything it came in contact with. I do not know whether it was an instance of this that we witnessed at Lloyd's. There were a number of specimens in a shallow pan, some in and some out of their *blankets;* one fellow in the latter state had been crawling slowly about round the pan, when presently we noticed that he had come in contact with an *Actinia:* their tentacles were all engaged,

but which was the aggressor, it was difficult to say. However this might be, the *Edwardsia* was evidently getting the worst of it, and appeared evidently in danger of being swallowed by his more sedentary antagonist. They were parted, when the *Edwardsia* lay on the bottom of the vessel apparently very much exhausted, with his tentacles shrivelled up. Unfortunately the final result was not known: whether it died or recovered, I am unable to say.

Peachia hastata, *Gosse*.

This is another abnormal form of Actinoid Zoophyte, approaching, in form and appearance, the character of the Sea Cucumber, and differing from all other Actinias in having a posterior opening. It is unattached, and lives buried with its body upright in the sand, the tentacular disc being aboveground. It was found by the Rev. Charles Kingsley in the neighbourhood of Torquay, and described by Mr. Gosse in the 'Transactions of the Linnæan Society.' The body is pear-shaped, transparent, very pale red, with white longitudinal lines running from one end to the other, at equal distances. It is protected partly by a very thin epidermis, which is apt to burst and hang in shreds when the animal distends itself. The upper disc is oval, surrounded

with twelve tentacula, which are ornamented with arrow-headed brown markings on a white ground; they are bent outwards and backwards. From the mouth protrudes a fleshy proboscis, the top of which spreads into a clubbed head, divided into papillæ. Mr. Kingsley gives the following observation on the habits of this Zoophyte:—"They lie (or rather stand) in wet, ribbed, clean sand, at low-water mark, the disc just out of ground. On digging carefully (for the animal retracts on the least shaking of the sand) you find that he is buried bolt-upright to the depth of nine inches, where his extremity stops; the whole animal tapering gradually from stem to stern. On being taken out (no easy matter, since its power of retraction, if irritated, is far more springy and rapid than in any of the class, as far as I have tried them), and put into a vase of salt-water, he swells himself out with water like a *Holothurian*, disclosing longitudinal septa. All his motions are rapid and spasmodic; betokening, as does his whole make, a higher muscular organization than that of the *Actiniæ*."



Sowerby del. et lith. Vincent Brooks Imp

1. Anthea cereus, with two tentacles suspended by confervæ and air-bubbles
2. Bunodes miniata. 3 and 4. Sagarua nivea.

CHAPTER VI.

SEA-BELLS AND CORALS.

LUCERNARIA.—ZOANTHUS.—MADREPORES.—COMPARED WITH ANEMONES.—THEIR BEAUTY.—FEEDING.—BALÆNOPHYLLEA.—TURBINARIA.—OCULINA.—CORALS AND CORAL ISLANDS.—MUSHROOM CORAL.

The *Lucernaria* is very closely allied to the *Sea-Anemones*, and may be termed a *Sea-Bell*. It differs greatly in form from the family of *Actiniadæ*, and presents a set of characters which place it sufficiently apart from all other forms. The genus *Lucernaria* is thus described:—"Body bell- or goblet-shaped, adherent or free at pleasure: mouth quadrangular, in the centre of a membranous expanded disc; tentacles knobbed, clustered in groups on the projecting angles of the disc."

Lucernaria auricula.

This little bell, hanging on the stems and branches of

seaweeds, and expanding its web-like disc in the transparent water, presents one of the most beautiful objects that can be conceived. It has been found on *Fuci*, on the coast of Devonshire, by Montagu and Fleming; and at Weymouth, by Gosse. From its elegant form it suggests a variety of comparisons, such as the flower of convolvulus, the expanded mouth of a trumpet, a hanging bell, and a small *Medusa*.

It has a short knotted stalk, which is capable of adhering to the stems on which it hangs, or of gliding along it and shifting its position. The narrow end of the bell is attached to this stalk, and is divided by eight beaded or knotted ribs. The bell expands rather suddenly towards the outer extremity, where it attains the form of an octagonal disc. The disc is thin and filmy, and at each angle of the octagon is a little cluster of thread-like tentacles, which are, like those of *Caryophyllea*, globular at the ends. Mr. Gosse thus describes his examination of some young specimens:—"Collecting a basketfull of tufts at random, I brought them home; one by one I waved them to and fro, in the tank of water, between my eye and the light, whereby the animals became distinctly discernible, and were easily detached. Sometimes four or five were scattered over

one tuft of the parasitic plant, and it was rare to find a *Rhodomela* of any size without one at least."

"The specimens were evidently the young of the season: but many were no larger than I have named; but some were as much as one-third of an inch in diameter. They were very beautiful, closely resembling a bell or trumpet-mouthed monopetalous flower, with a short flexible foot-stalk, and a small, expanded, sucking disc at the base. The substance was clear, transparent, gelatinous; the flower-like expansion thin and filmy, with the margin projecting into eight equidistant points. From each of these points radiated about twenty slender tentacular threads, bearing at their extremities orange or yellow globules. The ovaries radiated in eight irregular bands from the centre of the flower to the marginal points, and from the centre itself projected a little, protrusile, four-cleft mouth, closely like the peduncle of a *Thaumantias*. Indeed I was strongly struck with the resemblance which the entire creature bore to a small *Medusa*, and I consider it as a link that connects the normal *Actiniæ* with the *Acalephæ*."

Lucernariæ are found at low water on the under sides of floating leaves of *Zostera*, mouth downwards, seeking for prey. Here, in their natural situation, they are believed to

be very active, throwing out their threads in various directions, moving from one spot to another, and easily holding and devouring any small shrimps or other marine animals that its long-reaching tentacula bring near enough to its mouth. In confinement they are very difficult to keep alive, and even while still surviving they seem to lose much of their strength and activity; in short, not taking kindly to their confinement, they soon become weak in all their functions and die.

Zoanthus Couchii

Resembles a cluster of small *Actiniæ* united together by a creeping, root-like, fleshy band. Each *Actinoid* body is capable of contracting into a half-globe, like the true *Actiniæ*, or of extending its trunk and expanding its tentacular disc like them; while its connection with others of its race by means of a fleshy band which unites many individuals, takes it out of simple, and places it with compound Zoophytes. Thus it presents one of those anomalous forms with which every part of Nature's great series is studded, and which shows that the God of Nature will not be restricted in the fashion of his works by wise rules of uniformity invented by man. Man would have had all Hydræ

or all *Actiniæ*. God varies his productions by giving us a Zoophyte partaking some of the characters of each.

Corals.

(Plate III. and Plate XVII. fig. 4.)

On seeing one of the beautiful specimens of white branching Madrepore, or of hemispherical Brain-stone, which are brought from the South Seas, we are told that this elaborate structure is the work of minute animals existing in those seas in countless myriads, and that whole islands are composed of similar structures in large masses. We are astonished at the intelligence, if we have not heard it before, but find it difficult to form a clear conception of the fact, or of the manner of its production. The English coasts afford no examples of coral reefs or rocks, excepting in a fossil state; and we can scarcely hope to see the aforesaid animals engaged in the process of building a coral island in one of our tanks, however large its dimensions. The few species of Coral-forming Zoophytes which can at present be brought within actual observation in a living state, are so simple in construction, and so small in size, that they appear almost unworthy of being considered by the side of the magnificent and varied specimens brought

from foreign seas, which yet dwindle to insignificance compared to the immense masses from which they have been torn. Yet if we examine our own British species, it will not be difficult to trace the line that leads from them to the more complicated forms of their wonder-working brethren in distant oceans.

Caryophyllea Smithii.—(Plate III. fig. 2 to 7.)

Some of the *Actiniæ* are very fond of crawling upon the glass sides of a tank, so as to present their basal disc to the observer. It is of an irregular circular form, and a transparent whitish substance; but from the centre may be seen numerous opaque white threads radiating to the circumference. These threads must be the edges of folds or plates running through the body of the animal lengthwise. In the *Actinia* the plates, although more opaque, and consequently more dense, are yet soft, and essentially composed of the same substance with the other parts of the body. If we cut the body across in any other part, so as to form another disc, the same radiating white lines would appear, indicating a continuation of the vertical plates. But if, instead of being soft or gristly, these plates were hard and bony, we should be presented with exactly what occurs in

the case of our little Coral: *Caryophyllea Smithii* might, in fact, be described as a Sea-Anemone with a bony skeleton; and the description would be almost correct.

In the Aquarium, with their scalloped scarlet fringes, their delicate salmon-tinted filaments and membranes, their purple-bodied and white-headed tentacles, and their symmetrical skeletons, they present very pleasing and flower-like objects when viewed in themselves; but they become far more interesting when we see in them the simple and humble representatives of those wonderful structures to which we have alluded. Mr. Gosse, in detailing the circumstances under which his first living specimens were obtained, observes that they were all fixed either on upright or overhanging surfaces, and in no case with their faces upwards. This might have afforded a lesson to the keepers of Aquaria, who should have fixed their specimens in a similar manner. The specimens might have been brought attached to their pieces of stone, and the pieces fixed in the required position. Perhaps, if the habits indicated by Nature were followed more faithfully in Aquarian arrangements, we might see the characters of these and many other water-animals more fully developed. The following is Mr. Gosse's account of his Coral-gathering.

"I searched some time without success for the Coral, and had begun to despair of finding it; for the tide was almost at its lowest; when suddenly I caught sight of one projecting from under the surface of one of the slanting ridges of rock. The water would not allow me to reach it with any hope of detaching it uninjured, but presently I peeped into a small cavern formed by large masses of rock piled one against another, in which there were nearly a score of them. By a little manœuvring, I managed to squeeze my body between the stones, so as to work with the chisel, disregardful of the water which covered my feet below, and the coating of mud, the slimy Zoophytes, and Sponges, that adhered to the overhanging rock above me. The Corals varied in size, from that of a pea to three-quarters of an inch in diameter. They were not at all clustered, but scattered at irregular distances. I observed them to be fixed to perpendicular and overhanging surfaces, but in no case on a diagonal or a horizontal one with an upward aspect; not even in the remotest part of the cavern. All that I saw were left exposed by the receding tide, though in any but spring tide they would all have been constantly covered. I afterwards found a few more on the sides of pools in the rocky ridges several feet above low-water mark."

The fleshy part of the animal is seldom evenly spread over the circular surface of the disc; for it will sometimes leave the plates apparently bare at one end while it hangs out in a mass from the other end. Sometimes it will retreat altogether, so as to be scarcely seen between the plates, and the red centre contracted into the small star at the bottom of the hollow, only showing a thread-like slit indicating the mouth; like the *Serpulæ* and other Annelides, it retreats into its shelly cave almost instantaneously when touched or startled.

I have not been fortunate enough to see the fleshy part of the *Caryophyllea* extended, as is sometimes described, very considerably above the edges of the plates; and, in fact, on looking at a specimen living in its usual quiet condition, you would hardly suppose it natural for it to assume so distended a state. As the Anemone, when placed in unnatural circumstances, will sometimes turn its stomach, as it were, inside-out, may it not be that the Coral, when so observed, is dissatisfied with its position, as when in captivity, or unexpectedly left by the spring tides without moisture?

The soft parts of this Madrepore, viewed externally, consist of, first, a thin film investing the plates on their edges

and sides some distance down; secondly, of tentacula resembling those of an *Actinia*, which seem to be irregularly placed on various parts of the film, and to make the interstices their home when withdrawn between them; thirdly, the scalloped fringe surrounding the mouth; fourthly, the mouth itself, represented by a central slit. The most beautiful specimen in the Aquarium of the Zoological Society is one in which the enveloping skin is of a delicate salmon-tint, the tentacula tinged with purple, the frill in the centre bright crimson, and the mouth, or rather lips, white. The tentacula have swellings or knobs on the tips; but these are not, in the Zoological specimens, nearly so distinct nor so remarkable as represented in the 'Devonshire Rambles.'

"The feeding of the Madrepores," remarks the Author of the last-mentioned Work, "affords much amusement; they are very greedy, and the presence of food stimulates them to more active efforts, and the display of greater intelligence, than we should give them credit for. I put a minute spider, as large as a pin's head, into the water, pushing it down with a bit of grass to a Coral, which was lying with partially exposed tentacles. The instant the insect touched the tip of a tentacle, it adhered, and was drawn in with the surrounding tentacles between the plates, near

their inward margin. Watching the animal now with a lens, I saw the small mouth slowly open, and move over to that side, the lips gaping unsymmetrically; while, at the same time, by a movement as imperceptible as that of the hour-hand of a watch, the tiny prey was carried along between the plates towards the corner of the mouth; the latter, however, moved most, and at length reached the edges of the plates, and gradually took in and closed upon the insect; after which it slowly returned to its usual place in the centre of the disc."

The Madrepores, however, are not undiscriminating in their greediness; for, after swallowing a morsel and tasting it, they will frequently reject it, if it does not meet their approval.

They exhibit under certain circumstances a remarkable power of reproducing parts. Thus new plates will replace those accidentally broken, and a specimen, the base of which had been partly detached from the rock on which it grew, formed a new mouth at the exposed part of the base with tentacula and all complete; so that the creature could receive food at both ends, and double all the functions of life; the new mouth stretching and gaping, and enclosing its prey, with as much regularity as the old one! It has also been observed that, when a specimen was divided

perpendicularly, each half of the mouth, etc., would act an independent part without much apparent inconvenience.

BALANOPHYLLEA REGIA.—(Plate XVII. fig. 4.)

This pretty little species was discovered and described by Mr. Gosse, who ascertained that it differed in many important particulars from the *Caryophyllea*. It is difficult to say which is the most beautiful of the two; each has beauties of its own. The *regia* has a much more bright and sparkling appearance than the *Smithii*. The body is of a brilliant scarlet, and the tentacles are of a yellow tint. They are not terminated by a little globe, but are conical, and more or less bluntly pointed. Numerous warts, by which they are studded, give them at once a granulated appearance and a golden hue. However contracted the animal may be, it is always sufficiently thick over the plates to hide them completely; and the mouth, instead of receding into the central hollow, protrudes in the form of a high conical proboscis. Mr. Gosse observes, that, "if any additional evidence were wanting to show that this species approaches much nearer the *Actinia* than *C. Smithii* does, it would be found in the stony skeleton. This is very different in appearance from that of the kindred species, and is mani-

festly rudimentary. When the soft parts have been carefully removed by several days' maceration in fresh-water, and the gelatinous matter all cleared away from the stony plate by a slender stream of water allowed to run upon it from a height, a vertical view shows the following arrangements. First, at the very margin there is a narrow circle of white calcareous plates, small and very irregularly anastomosing, so as to resemble in miniature the honeycombed limestone-rock that we find in Torquay and elsewhere. In the centre of the cavity, there is another loose spongy mass of similar irregular plates. Eighteen perpendicular radiating plates extend between the marginal circle and the central mass, arranged in six threes, so as to make a six-rayed star. The plates are all very rough, with irregular projections and erosions. They do not rise in an arched outline above the level of the margin, but the whole surface is concave." I had noticed in the British collection of the British Museum a few specimens, marked "Ilfracombe," which struck me as extremely different from the skeleton of *C. Smithii*, before being aware of Mr. Gosse having thus completely described this species. It has since been taken in considerable numbers, and living specimens can be easily obtained.

MARINE BIOLOGICAL LABORATORY
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Turbinalia milletiana.

This is a very small Madrepore, shaped like a top, with ribs or plaits lengthways, but flattened at the sides. It seems to present no point of attachment, and must therefore have a free set of plates within a moving animal, thereby taking another step towards the *Actinia*.

Oculina prolifera.—(Plate III. fig. 7.)

Here we have a branched Coral, presenting a series of radiating circles of plates united into one stem. Our figure is from a small specimen in the British Museum; but specimens of considerable size are procured occasionally, the largest specimen weighing six pounds. It was first found on the coasts of Norway. On British coasts it is rare, and has not yet been taken in a living state.

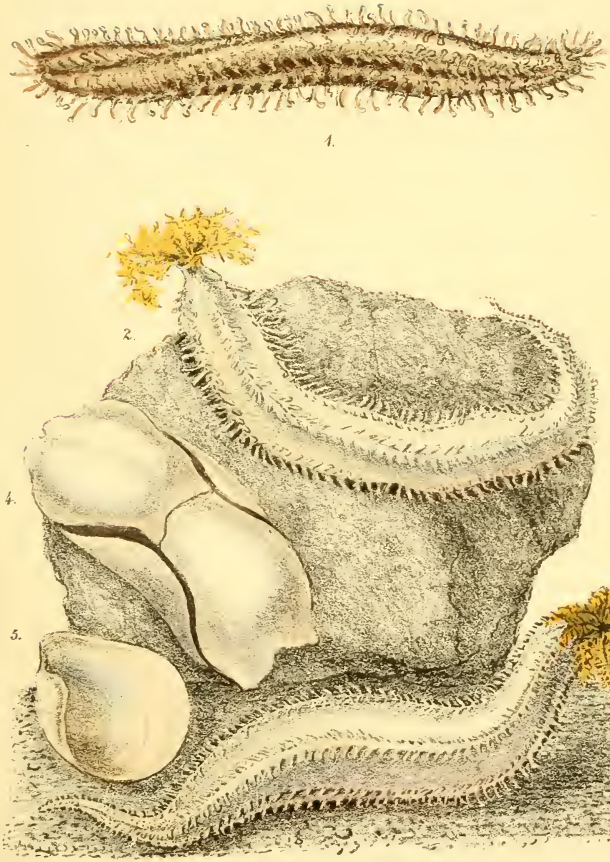
These are the British Corals. We find that they are bony skeletons of Actinia-like Zoophytes; not made by pincers and mandibles like wax honeycombs, but secreted within the body of the animal in the same manner as our bones are secreted within our own. It is the habit of the *Caryophylleæ* to live singly, not attached to each other, but to independent bodies. The young generally separate en-

tirely from the parent, and the result is in each case a simple single-rayed Coral. But it does sometimes happen that the young *Caryophyllea* lingers about the parent until it has formed its skeleton, and then becomes permanently attached, and grows as a branch on the parent stock; or it may be that in some instances it is reproduced by budding at the sides. In this abnormal condition we have a transition from the single-rayed Coral to the branched or many-rayed Coral, which is presented, although in a humble form, in our *Oculina*. Then again, these branches may be formed on differently shaped stars on differently shaped stems aggregated together by very different rules, and at different angles, so as to form very differently shaped masses: but the same principle may be traced throughout. Branch being added to branch, and mass to mass, it is not difficult to imagine the formation, steady and certain, but gradual, of rocks, which in time may become tracts of land. It is impossible to treat of this wonderful subject without introducing the oft-repeated lines of Montgomery, although my readers must have seen them over and over again.

> "Millions of millions thus, from age to age,
> With simplest skill and toil unwearable,
> No moment and no movement unimproved,

Laid line on line, on terrace terrace spread,
To swell the heightening, brightening, gradual mound
By marvellous structure climbing towards the day.
Each wrought alone, yet all together wrought;
Unconscious, not unworthy instruments,
By which a hand Invisible was rearing
A new creation in the secret deep.
Omnipotence wrought in them, with them, by them;
Thus what Omnipotence alone could do,
Worms did. . . .

" Atom by atom, thus the burden grew;
Even like an infant in the womb; till Time
Delivered ocean of that monstrous birth,
A Coral Island, stretching east and west,
In God's own language, to its parent saying,—
'Thus far, no farther, shalt thou go; and here
Shall thy proud waves be stayed.' A point at first,
It peer'd above those waves; a point so small,
I first perceived it, fix'd where all was floating;
And when a bubble cross'd it, the blue film
Expanded like a sky above the speck;
That speck became a hand-breadth; day and night
It spread, accumulated, and ere long
Presented to my view a dazzling plain,
White as the moon amid the sapphire sea;
Bare at low-water, and as still as death;
But when the tide came gurgling o'er the surface,
'T was like a resurrection from the dead;
From graves innumerable, punctures fine,
In the close Coral, capillary swarms



Sowerby del. et lith. Vincent Brooks Imp.

1. Sea Cucumber, Pentacta pentactes, headless specimen. 2 & 3. Healthy specimens. 4. Phyllline (Bullæa) aperta. 5. Shell of the same.

Of reptiles, horrent as Medusa's snakes,
Covered the bald-pate reef; then all was life,
And indefatigable industry;
The artisans were twisting to and fro,
In idle-seeming convolutions; yet
They never vanished with the ebbing surge,
Till pellicle on pellicle, and layer
On layer, was added to the growing mass.
Ere long the reef o'ertopped the spring-flood's height,
And mocked the billows when they leap'd upon it,
Unable to maintain their slippery hold,
And falling down in foam-wreaths round its verge.
Steep were the flanks, with precipices sharp,
Descending to their base in ocean gloom,
Chasms few and narrow and irregular,
Form'd harbours, safe at once and perilous,—
Safe for defence, but perilous to enter.
A sea-lake shore amid the fossil isle,
Reflecting in a ring its cliffs and caverns,
With Heaven itself seen like a lake below."

Yet it is incorrect to suppose that the Coral Islands, as they are called, are composed entirely of Corals from their very foundations. It has been well advanced, and almost proved, that the islands were originally volcanic mountains rising to a great height above the sea. Round the base of the mountain these Zoophytes commenced their operations, and fringed the edge at low-water mark. By degrees, the island began to sink, and the fringe of Corals would sink

with it, but that it is the instinct of these animals to work upwards, so as to keep near the surface, for they do not live in deep water. They also increase more vigorously at the outward or seaward edge; so that when the mountain has sunk a little, and the Corals nearest to it have not risen in proportion, there is formed a channel or lake between the island and the outer edge of Corals; and this outer edge forms what is called a Coral-reef. As the island sinks lower and lower, the lake or lagoon becomes wider and wider, and in some cases, the island has sunk below the surface of the sea, while the surrounding reef, keeping up to the surface, and becoming in process of time covered with soil and vegetation, forms that circular kind of island which is called an *Atoll*.

Fungia.—(Plate III. fig. 1.)

While, on one hand, the simply formed *Caryophyllea* leads us to the branched masses of many-starred Madrepores, on the other hand, their rayed laminated surface presents a striking resemblance to the flat, mushroom-shaped Coral, which seems to have so little attachment to surrounding objects. Our Plate contains the representation of a very small specimen of the Mushroom-Coral, which, al-

though being a single-rayed Madrepore, plays no important part in the construction of Coral-reefs, yet forms a pleasing object in the shallow lagoons. Another very beautiful form allied to this is constructed on the same principle, but elongated; the inner edges of the plates meeting in a longitudinal line. This species has the outside or back hollow, so that with the mouth downwards it resembles a boat. We have seen very fine specimens of this, with numbers of young individuals of the same or other species adhering to the outer surface.

Mr. Samuel Stutchbury, who went out as collector of Natural History in a voyage undertaken by a Company formed in the year 1825 for the purpose of fishing for Pearls in the Pacific Ocean, gives some lucid details respecting the growth and propagation of specimens of the genus *Fungia*. They generally lie at the hollows of reefs, where they are in some degree protected from the more violent agitation of the sea by the surrounding portions of branching Coral, which enclose the hollows, and, at the same time, allow sea-water free access through their interstices.

It appears then, although the older and larger individuals are quite unattached and present no mark of former

attachment, yet that in the young state they are fixed sometimes to rocks, and frequently to the dead remains of one of their own species. In this state, they grow upon a footstalk, and generally remain attached till they acquire the size of nearly an inch in diameter, when they separate at the top of the peduncle. At this time, the Coral, when divested of the fleshy part, shows a circular opening underneath, through which the radiating plates of the upper surface are visible. In a short time, a deposit of Coral-matter takes place, which cicatrizes at the opening; the marks of which, however, can be traced for a considerable time: at length, the increase of this deposit, which continues with the growth of the animal, entirely obliterates all appearance of it. It will not appear surprising that this circumstance should have remained hitherto unnoticed, when it is recollected that it has very rarely occurred to Naturalists to visit the places of their growth; and that to general collectors, the smaller specimens would appear hardly worth the trouble of preserving and bringing home.

"The sheltered situations in which the *Fungiæ* are found are peculiarly well adapted to their nature, as they would be liable to injury if they were exposed to the full force of a stormy sea; and the circumstance of their being attached

in the young state is a beautiful provision of Nature for their preservation at that period, as from their light weight when first developed, they would, if unattached, be exposed to great injury even by a slight agitation of the water.

"I have also to remark upon this fact, that the *Caryophylleæ*, more especially in their early state, when the radiating plates are first developed,—at this time their upper discs are scarcely larger than the stem, but they soon begin to spread, and show indications of their characteristic form. There are not unfrequently instances of smaller individuals remaining fixed to large ones in a living state; and such specimens are not unfrequent in a collection of Corals; but in all such cases that I have seen, the younger ones are attached to the under side of the old one, and I believe them to be cases of accidental attachment."

Rumphius says, "The more elevated folds, or plaits, have borders like the denticulated edges of needlework lace; these are covered with innumerable oblong vesicles, formed of a gelatinous substance, which appear alive under water, and may be observed to move like an insect."

"I observed," says Stutchbury, "these radiating folds of the animal which secrete the lamellæ, and which sink between them when the animal contracts itself on being

disturbed. They are constantly moving in tremulous undulations; but the vesicles above described appear to me to be air-vessels placed along the edges of the folds; and it is some confirmation of this opinion, that the vesicles disappeared when the animal was touched.

"This arrangement of air-vessels would very materially assist in keeping uppermost the convex disc of the Coral, and be of vital importance to the young polype at the time of separation, and, subsequently, in keeping it upon the surface of its sandy bed; or if they were moved by a sudden roll of the sea, which would lift even the most ponderous, and possibly convey them a considerable distance, they would be again deposited in their natural position. That they have no power of turning themselves, I proved during a sojourn of six weeks at Tahiti, by placing a healthy specimen with its upper surface downwards, during which time it remained in the position placed, and the vitality of the points in contact with the rocks was destroyed.

"In *Fungia limacina*, I have seen instances where the Coral, having been accidentally placed, and permanently fixed in such unusual positions, has adapted itself to its new situation by increasing upon its edges and forming a new convex surface. They seem, when young, to be

conical, and attached to some marine body (often their parent) by the base, which is contracted into a kind of stem. When in this state, the animal only occupies the upper surface, but when it is full-grown and free, it completely encloses the Coral.

"As long as the young *Fungia* retains the form of a *Caryophyllea*, it is entirely enveloped by the soft parts of the animal; but as the upper disc of the Coral spreads and it assumes its characteristic form, the pedicle is left naked, and the soft part extends only to the line where the separation takes place. I consider the cases where the young *Fungiæ* are found fixed to the under side of others of the same species, to arise from the accidental attachment of the young polype when detached from the ovarium of the parent, and by the motion of the water floated underneath a larger one of its own species, the edges of which were not so even as to touch the rock or Coral on which it rested, at every part of its circumference. In such cases, the soft parts of the older specimen would continue to cover the short stem of the younger individual, and hence its separation from its pedicle would be prevented."

In Plate III. is figured the skeleton of a young *Fungia* (fig. 1), and *Oculina prolifera* (fig. 7), between which, the

British *Caryophyllea* occupies a middle station. It is represented in the intermediate figures 2 to 6; fig. 2, is the empty skeleton divided perpendicularly; 3, the living Zoophyte, with its tentacles out; 4, tentacles magnified; 5, specimen with adherent young, forming branches; 6, living specimen with tentacles withdrawn.

Plate XVII. contains a *Balænophyllea* in company with Star-fishes.

CHAPTER VII.

MEDUSÆ, OR JELLY-FISH.—NOT GOOD AQUARIANS.—THEIR HISTORY.—MULTIPLICATION.—METAMORPHOSES.—CHRYSOARIA CYCLONOTA.—BEROE OVATA.—SEA-CUCUMBERS.—MODE OF PROGRESSION.—HABITS IN AN AQUARIUM.—SELF-MUTILATIONS.—PSOLINUS BREVIS.—CUCUMARIA GRANDIS.—THYONE PAPILLOSA.

Sea-blubbers, or Jelly-fish, are among the most familiar objects of the shore. Those pellucid bladders of jelly are often seen floating on the breakers, or thrown up by their violence, on the beach, where they spangle and crowd the sand and shingle, mingling with dead *Laminariæ* wrecked by the same mighty power.

They are not creatures fitted for the Aquarium, even when taken living; their part is to roam freely through the wide ocean, and, themselves almost invisible, seek for living prey. For a few days they may be kept, or even weeks, but seldom and with difficulty. In most cases they die

almost as soon as they are taken, and dissolve their substance into the watery element of which it is so largely composed. I remember being much astonished and disappointed, when a child, at the strange result. Taking up from the shore a large Jelly-fish, weighing a pound or two, most beautifully formed, and still showing some slight signs of life, I put him into a large pan of water, and, after taking a good look at my prisoner, left him. On returning, after a time, to examine him more minutely, what was my astonishment to find no Jelly-fish in the pan, but an increase of water, and an empty skin! Pining at the cruelty of his situation, he had, Niobe-like, melted away his substance in tears.

Yet there are very interesting facts in the history of these evanescent animals, some of which may be observed in an Aquarium. The prevailing form of a Jelly-fish is that of an umbrella, with an upper and under disc, the space between the two being filled up with a liquid, which is in fact little more than water. From the under disc, hangs a mass called the peduncle, forming a handle to the umbrella. This generally ends in four lobes or lips, much fringed and scalloped at their edges. The mouth is in the middle of these lips, and leads, of course, to the stomach. From the rim of

the umbrella hang thread-like tentacles, which are active and sensitive, and provided with minute darting threads, giving them an adhesive, and somewhat stinging power.

"*Naked-eyed*" *Medusæ* are those which have swelling coloured bulbs at the bases of the tentacula, supposed to be eyes. While "*Covered-eyed*" are those in which the organs, more complicated, are protected by membranous folds hanging over them.

Few objects can exceed the elegance of these creatures, when floating in the briny fluid. Their graceful forms, their crystalline transparence, their airy and evanescent tints, and wavy motions, combine to make them exquisite in loveliness; while many of them are luminous, giving out flashes of light in the midst of darkness.

> "Within the shadow of the ship
> I watched their rich attire;
> Blue, glossy-green, and velvet black,
> They coil'd and swam; and every track
> Was a flash of golden fire!"

The most attractive part of the history of *Medusæ* is the wonderful manner in which they multiply their species. In the course of this operation metamorphoses take place from the state of fixed Zoophytes to that of free *Acephala*.

The *Medusa* first gives birth to numbers of minute balls, or eggs of jelly covered by a thin skin studded with vibratile hairs. The action of the hairs enables this germ or spherule to swim through the water. They are nearly oval bodies but rather wider at one end than at the other, and they are propelled with the larger end foremost. After swimming about for some time, the larger end turns downwards towards the ground, and attaches itself to some submarine object convenient for the purpose. Presently the body lengthens, and at the same time becomes wider at what was before the narrowest end, and then there is formed in the centre of that end a mouth, at first a mere opening of small dimensions, but soon enlarging and becoming surrounded by four prominent lobes or lips. These, increasing in length, are changed to long thin tentacula, or feelers, between which new tentacula make their appearance, till the whole thing assumes the appearance of a kind of cup-flower with long petals, and is, in fact, a Hydra-like polype, fixed on a stalk. This is the *Medusa-bud*, from whose sides new buds of the same character and appearance grow out, each one beginning like a small tubercle, stretching out till it reaches something to which it can attach its apex, and then, detaching itself from the other bud, grows

on the chosen spot, when it gets a mouth and tentacles like those of its parent. From this, new germs sprout out and establish themselves in the same manner, until a large colony is formed. The next process is more surprising; it is that by which the *Medusæ* rise from the buds. The bud begins to lengthen and become cylindrical and narrow; it is wrinkled at intervals and divides into segments. The tentacles at the apex waste away, and in place, the edge of the top segment is scalloped into eight lobes. The top edge of each segment in succession becomes lobed in like manner, and exfoliates from the next; so that a column of cups is formed one within the other. By-and-by the top cup turns over and leaves the column; then another, and another; each swimming about, a young *Medusa*. The column still grows from beneath, forming fresh cups when the top ones fall off. At last, the rising process ceases; the last young *Medusa* is thrown off, and a stump only is left of the original bud. All is not over yet; the remaining stem forms a new head of tentacula, and becomes a flower-polype again.

I have seen the beautiful little *Medusa*-cups, propelling themselves in playful activity, upwards and downwards, forwards and backwards, and slant, by means of contracting

and expanding the frill of furbelows which borders their edge. They undergo several changes after this, before they assume the perfect form to which they are destined. But what a wonderful history is theirs!

"The very Jelly-fish," says Harvey, "as it swims the wave, expanding and contracting its umbrella, and thus propelling itself through the water, has its beauty; but few are aware of the singularity of its history; how its eggs are of the nature of seeds, which, sown on their rocky bed, sprout and grow, throwing out buds and suckers, each of which forms an animal stem, quite unlike the parent Jelly-fish; till at a certain time young Jelly-fish begin to be formed, and to be thrown off by the several branches, just as flowers are formed and expand on the several branches that originate from a vegetable seed. And if the abject Jelly-fish, whose body consists of little more than organized water, have a history so wonderful, shall we not expect to find, in tracing the history of other tribes of animals, matter of equal interest?"

Chrysoaria cyclonota,

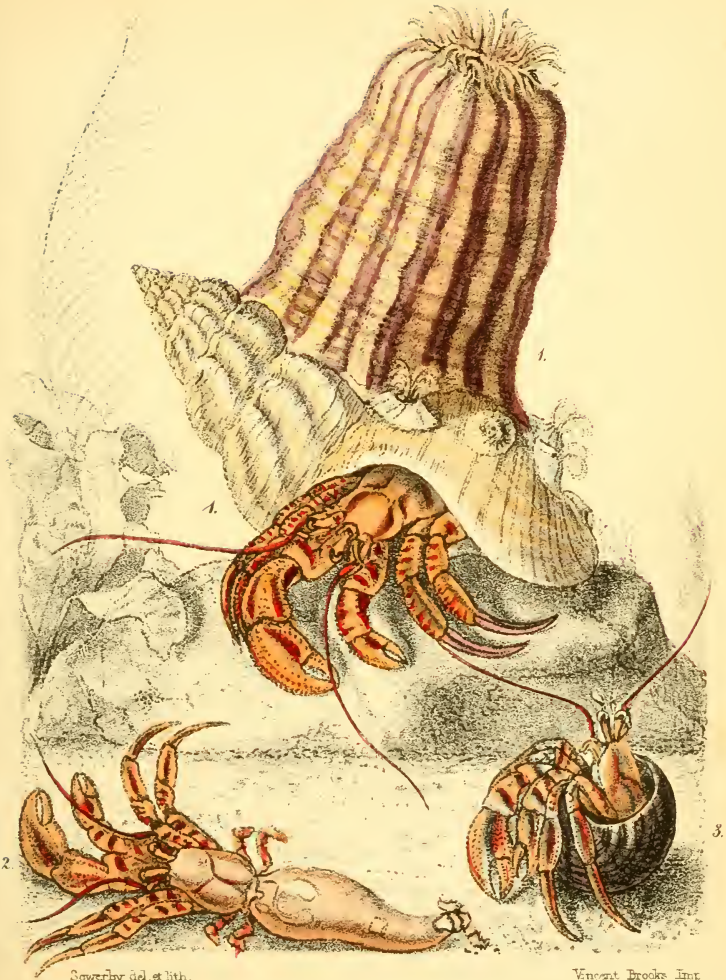
A magnificent species discovered by Mr. Gosse, a pet specimen of which was kept living for three weeks in a

glass vase by that gentleman. The umbrella part is three inches wide, not quite lenticular, but slightly depressed in the middle circle, very transparent, and tinged with a rosy blush, with radiating lines of pink. Long thread-tentacles hang and wave from the rim, and between them are the brown-coloured bulbs, called eyes. The peduncle is bulbous, and the mouth is surrounded by four membranous arms of great length, which are frilled and twisted in a very elegant manner. In captivity the *Chrysoaria* moved gracefully, twirling, furling, and unfurling his flounces in ever-varying undulations. His possessor, having casually touched the animal with a stick, found that the furbelows, as well as the tentacles, clung to it and wrapped themselves round it, and were drawing it towards the peduncle; and it was liberated with difficulty. This suggested an attempt to feed it. A whitebait being introduced was presently surrounded, and drawn up under the umbrella, but being perhaps too heavy, was allowed to fall. Its head had actually been for some time in the oral cavity of the *Medusa;* but when examined it was found that the process of digestion had not begun. After awhile the captive Jelly-fish changed its habits, turned over its umbrella-body, and died in the act of propagating fresh buds.

Beroe ovata.

This pretty little *Medusa* is of a different order from the umbrella-shaped Sea-jelly. Its body is shaped like a melon, from half an inch to three-quarters long, quite crystalline, and divided into gores by eight ribs. On the ribs are little plates or scales, capable of moving up and down, and acting as paddles, by which the *Beroe* can move itself freely in every direction. It has two very long pendent tentacles, to which are attached, at regular intervals, still more slender threads, which coil like the tendrils of a vine. These have all the adhesive qualities of the tentacula and filaments of *Actiniæ*, and constitute the fishing-tackle of the *Beroe*. The whole apparatus, when not in use, is drawn up into the body and lodged in sheaths.

"Though at first," says Landsborough, "we observed only one solitary *Beroe*, we had not gone far till we found them in abundance. In one little creek there was a flotilla of fifty. What life! What beauty! What happiness in that little fleet! Fifty thousand paddles, of exquisite workmanship, were in rapid, noiseless motion, twinkling with all the iridescent beauty of the morning dew. I had not before observed this lovely iridescence; and I ascribed it in part



Sowerby del. et lith. Vincent Brooks Imp.

1 Hermit Crab, Pagurus Bernhardus, in a shell of the whelk, surmounted by an Anemone, Sagartia parasitica, and studded by Balani. 2. The same withdrawn. 3 The same in a shell of the Periwinkle.