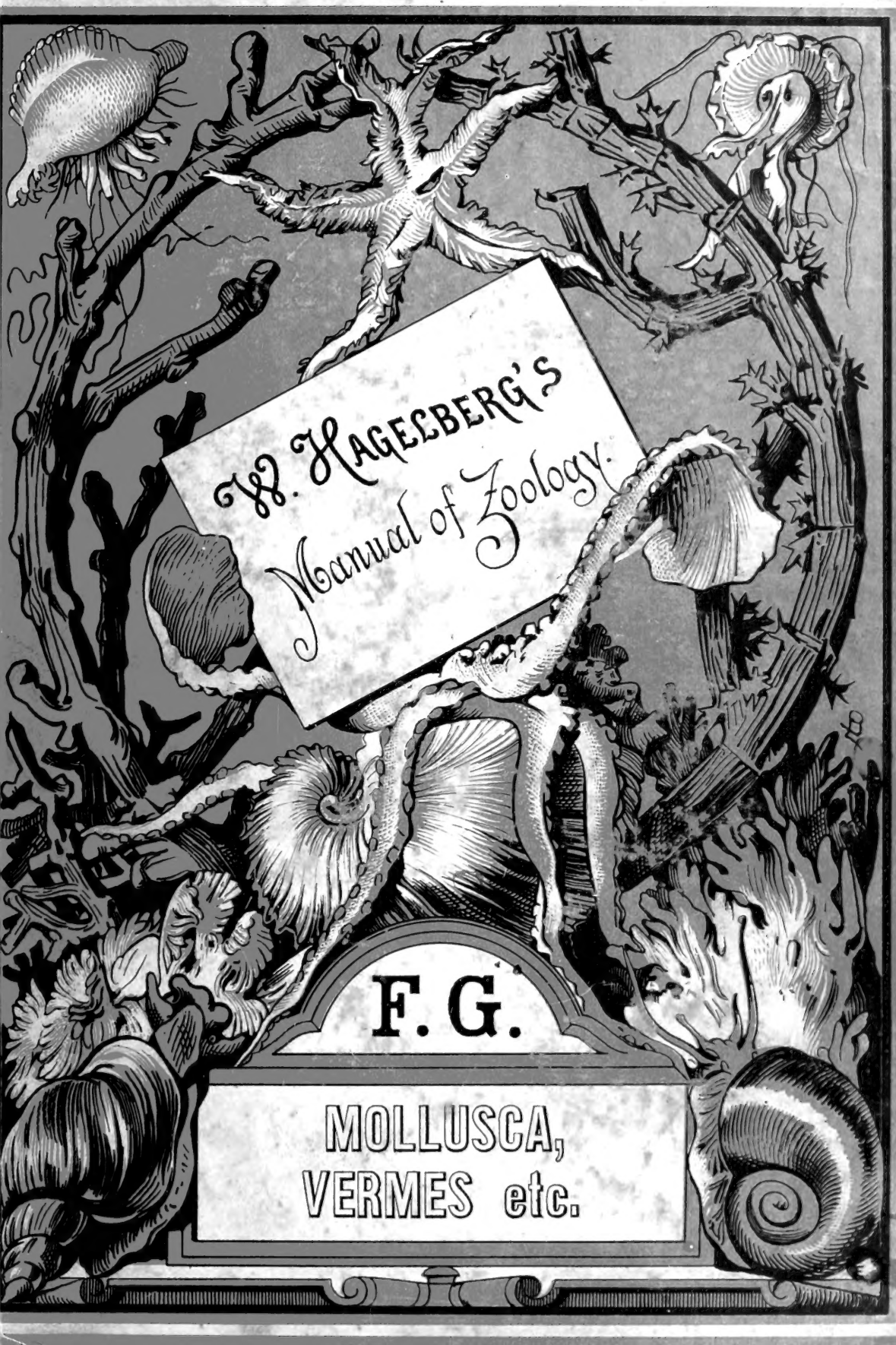
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MOLLUSCA,
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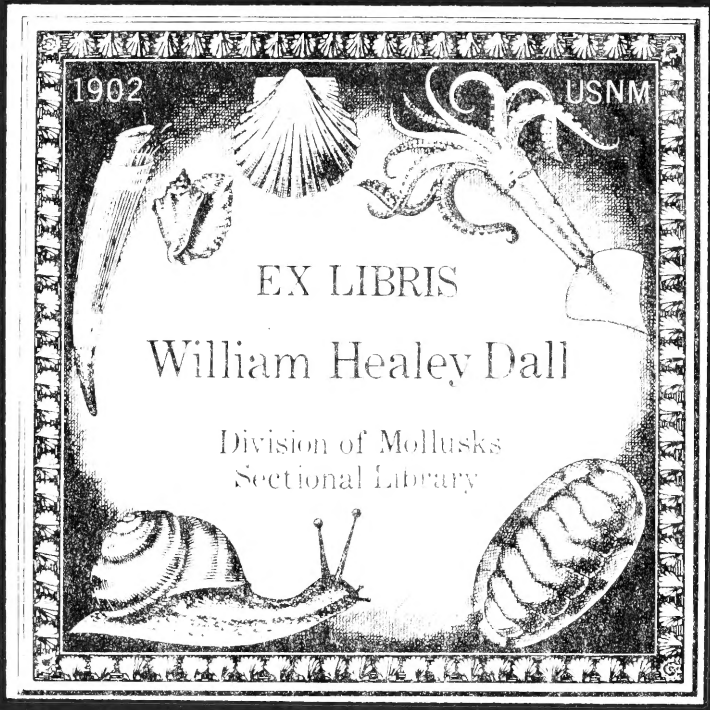
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W. HAGELBERG'S

MANUAL OF ZOOLOGY

EMBRACING FAITHFUL ILLUSTRATIONS OF
THE ANIMAL WORLD IN ITS MOST
PROMINENT TYPES

PART VI

MOLLUSCA

4 PLATES, CONTAINING 48 ILLUSTRATIONS

PART VII

VERMES, ECHINODERMATA, CŒLENTERATA, PROTOZOA

6 PLATES, CONTAINING 72 ILLUSTRATIONS

BERLIN

PUBLISHED BY THE PROPRIETOR

MOLLUSCA

MOLLUSCA.

In comparison with the great variety of form exhibited by the Vertebrata, the Mollusca appear but poorly represented. Their form, such as it is, is always more or less lumpy and sometimes even almost shapeless, there being in many cases no articulation of the body and no definitely formed limbs, a distinct head even being absent in some instances. Their most prominently conspicuous part, the shell, can scarcely be reckoned as a part of the body, inasmuch as it is only an appendage to it, and does not partake of its vitality.

Their very name, derived from the latin *Mollis*, Soft, indicates the character of their body — a soft mass, supported neither by an internal bony skeleton, as in the Vertebrata, nor by an external one, as seen in the shells of the Crustacea. The body on the contrary is enveloped in a soft and highly distensible skin, known as the 'Mantle', which, in those genera that are furnished with a shell, secretes the calcareous matter which goes to form the same. Nothing need be said therefore as to the build or outward appearance of the body, as these are continually fluctuating with every change of position assumed by the creature. In the more highly developed types, such as the cephalopods and snails, the body has to a certain extent a definite shape, the head also being more or less distinct. The cephalopods are furnished with two large glaring eyes, while in most of the snail tribe organs of sight are present, they being placed at the termination of the spindle-shaped feelers or horns. In the lower grades on the other hand every indication of a distinct head is wanting, while in most of them there are no organs of vision to be detected.

In the internal economy of the body, the most prominent feature consists of the organs of digestion. The liver and salivary glands and other organs forming part of the digestive apparatus are all highly developed, while those parts of the body which serve to seize and secure their prey are also formed in a manner adequate to fulfil those functions. In the snails the mouth is armed with a peculiar organ of mastication resembling a rasp in its action; the mussels on the contrary are not provided with anything of this nature, in lieu of which however the whole of the interior surface of the mantle is beset with a fine hair-like fringe which is kept in continual motion, and thus serves to convey food to the mouth. The circulation of the blood is effected by means of a heart, furnished with ventricle, auricle and pericardium. In the land-snails and most of the fresh-water snails respiration is carried on by means of lungs; the cephalopods are furnished with gills on the contrary, these being sometimes two and sometimes four in number, while the mussels are endowed with a double pair of gills.

Some of the Mollusca feed on animal, others on vegetable substances; all of them being excessively voracious, especially the cephalopods, which lay a vast number of fishes and other inhabitants of the deep under contribution to afford them sustenance. The terrestrial and fresh-water snails mostly live upon vegetable matter, which they grind up with their rasp-like tongues; the marine snails and other descriptions of Mollusca which inhabit the sea feed both on animal and vegetable substances, those which are confined to the former description of food being furnished with peculiar suctorial organs to enable them to extract nutriment therefrom. In conclusion, those mussels which are incapable of masticating their food are compelled to restrict themselves to the smallest atoms of organic matter to be found in the water, whether animal or vegetable, which they seize by means of their fringed mantle.

The propagation of the Mollusca is effected by means of eggs, a marvellous number of which are generated by some of the tribe; the oyster, for instance, will produce upwards of a million young in the course of a twelvemonth. In some cases the young emerge from the egg in a perfectly formed state, in others they have to pass through a larva stage. As regards development of size, the snails soon attain their maximum, while the cephalopods and mussels never seem to leave off growing. The duration of life in most species of the Mollusca is very prolonged, it having been ascertained that mussels, which had been marked and kept in some particular waters, have attained an age of from 70 to 80 years.

One of the most prominent peculiarities observable in many of the Mollusca is the faculty they possess of being able to construct a shell to live in. As mentioned above, the matter required for this purpose is secreted by the mantle, its chief ingredient being lime. The shell of the various descriptions of snails however, which is always more or less spiral in form, is built up on a core consisting of organic matter, around which the particles of lime are disposed, often exhibiting a beautifully variegated coloring. Both the shells of the true mussels consist of two layers, the outer one of which consists of calcareous matter, while the inner one, which lies next the body, exhibits a coating of mother of pearl. The two shells are connected by an elastic ligament, and can be opened or closed by the animal at pleasure by means of a pair of muscles.

The body of those Mollusks, which are not furnished with any shell, is covered with a firm skin, more or less granulated and slimy.

Water is an indispensable necessary of life with all the Mollusca, even those which live on dry land requiring a large amount of moisture for their existence, a prolonged drought being fatal to them. Rivers and inland waters are tenanted by a great variety of the snail and mussel tribe, the greatest abundance being however found in the Ocean, which contains Mollusks in its deepest waters, and there these creatures pass their lives, almost the sole occupation of which consists in feeding, seldom stirring, and then only slowly, from one spot.

With the exception of some of the more highly organised cephalopods and some of the natatory snails, which propel themselves with a jerking swimming motion by alternately contracting and extending their bodies, the locomotion of the Mollusca consists of a more or less slow creeping. The organ with which this is performed consists of the so-called foot; in the case of the snails, an oblong disc, which has the appearance of a dilatation of the abdomen. In the case of the bivalve mussels the foot assumes a cuneated shape, being in many cases bent round, and this is protruded from between the opened shells and enables the animal to propel itself slowly along the bottom.

Upwards of 20,000 varieties of Mollusca are known as being at present in existence, though without doubt the more profound depths of the ocean contain a number of other forms, at present unknown to us. The number of varieties in the antediluvian world was very much larger, a vast number of fossils of these creatures being met with in every geological formation. Of cephalopods, for instance, no less than 1800 fossil varieties have been found, while the whole number known to be in existence in the present age only amounts to 218.

The usefulness of the Mollusca is not to be undervalued. It largely overbalances the damage and destruction wrought by some genera, which is indeed limited to the eating away of plants and fruit by the snails and the devouring of fishes by the cephalopods. Many of the Mollusca afford a nutritious and palatable article of food, others yield pearl and mother of pearl, while others again are valuable as constituting the food of other useful animals. —

The Mollusca are divided into six main groups: I. Cephalopods, II. Snails, III. Mussels, IV. Brachiopods, V. Ascidians, VI. Bryozoa. These however, especially the snails and mussels, are again divided into several sub-families. The Ascidians and Bryozoa, which are mostly found attached as polypi to some fixed spot, have only recently been included among the Mollusca by modern Naturalists, owing to their affinity in development and internal construction.

CONTENTS.

MOLLUSCA. CEPHALOPODA. HELICINA.

The *Mollusks* are inarticulated animals, mostly with a shapeless body, the head and body only being distinct in the more highly organised genera; they have no skeleton or callous covering whatever. The body is enclosed in a loose, wrinkled skin, which can be distended at will in any direction. In many of the genera the eyes are wanting; the alimentary apparatus on the other hand being especially well developed. Some of the mollusks are naked, such as the cephalopods and some of the gasteropods, while others form a shell for themselves with the calcareous matter exuded from the skin, which however only adheres loosely to the body. Most of the mollusks are marine animals, though some genera are found in fresh water and others on dry land.

In the *Cephalopods* the head is quite distinct from the body. The large mouth is surrounded by a circle of muscular arms, from four to ten in number, provided with suckers, which serve for locomotive purposes or to enable the animal to grasp its prey or to attach itself to foreign bodies. A large staring eye is situated at each side of the head. Most of the cephalopods are provided with a gland, the so-called inkbag, which furnishes the brown-black pigment know to painters by the name of sepia. This liquid can be ejected at pleasure and serves as a protection to the animal by clouding the water and thus obscuring its retreat when pursued.

1. The *Octopus Vulgaris*, or common Octopod has 8 feet or arms, as its name implies, and is found in all the European seas. Its color varies ftom a white-grey to a dark brown, according as it is in a quiescent or an irritable condition. It lies in wait for its prey concealed among the rocks under water.

2. The *Eledone Moschata* has the faculty of varying the shape of its body at will, at times appearing like a loose bag or assuming a pointed or egg-shaped form; it is also capable of changing its color. This species is only found in the Mediterranean on a muddy bottom, where it is very common, and, in spite of its pronounced musky flavor, is much used as an article of food by the poorer classes.

3. The Paper Nautilus, *Argonauta Argo*, is a most beautiful and delicately colored animal, inhabiting an elastic shell, as thin as paper, but which is not in any way adherent to or connected with its body. It is remarkable for its peculiar method of sailing over the sea, using six of its tentacles as oars and the other two membranous ones for sails. On the approach of danger or rough weather it draws in all its arms and sinks to the bottom. It is found in the Mediterranean, especially on the coast ot Sicily.

4. The common Cuttle-fish, *Sepia Officinalis*, belongs to the family of the Decapods, or ten-footed mollusks, and is very common in the Mediterranean near the shore. The soft parts of the animal are supported by a firm calcareous bone, the well-known cuttle-bone, which is found on our coasts.

5. The Flying Squid, *Loligo Sagitta*, has a long, narrow body, enclosed in a sort of sheath, which spreads out at the tail into a broad fin-like appendage. It has a delicate, transparent backbone, in shape like a pen, whence it is commonly known as the 'penfish'. It is most exquisitely colored. —

The Snail family, *Helicina*, is distinguished by a more or less well-developed head and by the eyes being placed at the tips of the long horns or feelers. The mouth is also most peculiar in its arrangement, there being a pair of sharp, dentated lips while the tongue is also covered with a number of small teeth. They move themselves slowly along by means of the large foot or disc which extends over the greater part of the under side of the body. Most of the snail tribe are marine animals, furnished with gills; while the land snails, though furnished with lungs and breathing air, also require a certain amount of moisture.

6. The Road-Slug, *Limax Rufus*, has no shell and belongs therefore to the subfamily of the *nudilimaces* or naked snails. It is a very well-known genus.

7. The Great Water-Snail, *Limnœus Stagnalis*, is found in stagnant water. Its shell, which is always coated with mud, attains the length of 2½ inches.

8. The Marsh-Snail, *Paludina Vivipara*, is found in ditches and ponds. The young are brought forth furnished with shells.

9. The *Helix Carocolla* is one of the most beautiful types of tropical snails. It is found in the Antilles.

10. The *Oliva Elegans* is found in the southern seas. Its shell, which is closely rolled together, has a number of short whorls at the end. It has a very broad foot, which extends beyond the head.

11. and 12. represent two beautiful specimens of the *Conus: C. Cedonulli* and *C. Achatina*. The species are very numerous, some 400 varieties being known. They are found in the southern and tropical seas and are much sought after by collectors on account of their beauty, very high prices being sometimes paid fer them. The animal has a long, narrow foot and a small head.

MOLLUSCA. CEPHALOPODA. HELICINA.

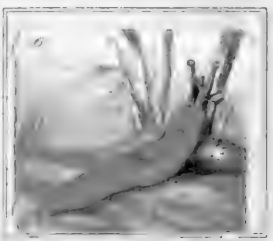
The *Octopus Vulgaris.*

The *Eledone Moschata.*

The Paper Nautilus.
Argonauta Argo.

The common Cuttle-fish.
Sepia Officinalis.

The Flying Squid.
Loligo Sagitta.

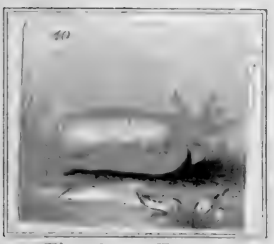


The Road-Slug.
Limax Rufus.

The Great Water-Snail.
Limnæus Stagnalis.

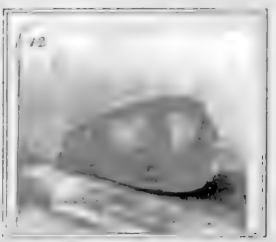
The Marsh-Snail.
Paludina Vivipara.

The *Helix Carocolla.*



The *Oliva Elegans.*

Conus Cedonulli.



Conus Achatina.

MOLLUSCA.

The family of the *Cypræa* embraces a very large variety of form and coloring in their beautiful, marbled shells. The shell, which at first closely resembles that of the snail and has a large aperture, becomes more and more elongated, the prominent spiral corrugations or whorls becoming more indistinct and sometimes disappearing almost entirely, while the aperture is transformed to a mere slit with serrated edges. The animal has a large head with long tentacles, while the portion of its body known as the Mantle is so large as to be able to cover the entire shell. The Cypræa burrow in the sand on the sea shore. They are very timid creatures and shun the light, and are found in all seas.

1. The *Cypræa Geographica* is found in the southern seas. Its shell will be recognised as a favorite plaything of many of our juvenile readers.

2. The *Mitra Papalis* is found in the Indian seas. The animal has a broad foot while its head terminates in a disproportionately long proboscis.

3. The *Voluta Undulata* has a very broad foot and a large distinctly defined head with long tentacles. Both the shell and its occupant are of a yellow color with irregular streaks of a darker tint. It is only found on the shores of the southern seas.

4. The *Harpa Ventricosa* is a beautiful variety with an eggshaped shell, voluted longitudinally. The animal has a small head and a very large foot, the length of which is more than twice that of the shell. The Harpa inhabits the Indian seas.

5. The *Nassa Coronata* is found in every sea. The animal has a large flat head with two tentacles. Its foot is narrow and longer than the shell, and terminates in two tentacular appendages.

6. The *Strombus Pugilis* is a very curiously fashioned creature. In addition to a long proboscis, the head bears two stout cylindrical tentacles, at the end of which the large and beautifully colored eyes are placed. The foot is as it were twisted round, the posterior part being prolonged and bearing a horny, crescent-shaped operculum. This formation of the foot does not allow of the animal's creeping, its mode of progression being rather a jerk or jump. The outer edge of the shell is prolonged like a wing. The Strombi are indigenous to the tropical seas.

7. The *Phasianella Bulimoides* has a very beautifully marked, conical shell. The animal has two long tentacles projecting from its head, and several other tentacular appendages besides, while its foot bears a calcareous operculum. This genus is found in the Indian Ocean

8. The *Trochus Pagodus* is met with in almost every sea, among the weed-grown rocks lining the coast. The animal has long tentacles, and a short fringed foot, with which it propels itself forwards by jerky steps. The beautifully fashioned, top-like shell is lined with mother of pearl.

9. The *Murex Palmatus* is a beautiful specimen met with in the Southern seas. The excrescences on the shell assume every variety of shape, sometimes spinous, sometimes wart-like or corrugated. The animal has two tentacles placed close together, and a short foot with horny operculum. The genus to which this specimen belongs is remarkable for its yielding a peculiar coloring matter, from which the ancients used to prepare a purple dye. This matter is secreted by two glands situated near the gills, and is at first yellow in appearance. On being exposed to the light however it soon changes to a violet, rather than a purple tint, of varying intensity. In the present day this dye is no longer employed, but in former ages it constituted an important and valuable article of commerce.

10. The *Pyrula Purpuracea* contains a very curiously formed animal with a square foot and conical head, which is so completely covered by the mantle, as only to be seen on turning the creature over. The shell is thin and delicate, and very varied in form. This beautiful genus is found on the coasts of Central America.

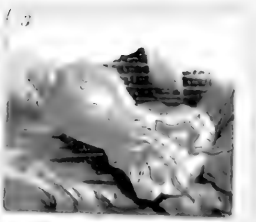
11. The *Scalaria Preciosa* has the whorls of its shell corrugated longitudinally. The animal has a small foot and a snout-like head with long tentacles. It is carnivorous in its habits, and secretes a purple coloring matter.

12. The *Chiton Priscus* somewhat resembles the woodlouse in appearance, its shell, which consists of 8 plates overlapping one another like tiles, allowing the creature to roll itself together like a ball The edge of the mantle projects under the shell. The Chiton is a sluggish creature and is found in every sea. It adheres so tightly to the rocks, that it will allow itself to be pulled to pieces rather than be pulled off, and though generally found under water, it can remain out of water for a length of time without being any the worse for it.

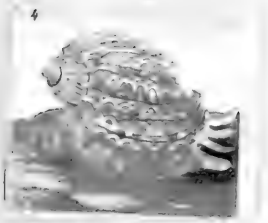
MOLLUSCA.

The *Cypræa Geographica*

The *Mitra Papalis.*

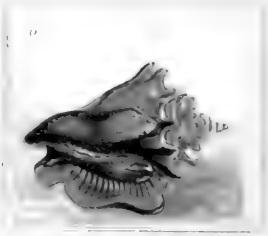


The *Voluta Undulata.*



The *Harpa Ventricosa.*

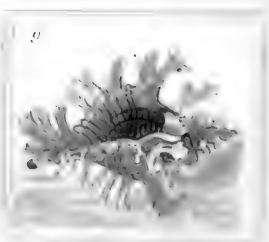
The *Nassa Coronata.*



The *Strombus Pugilis.*

The *Phasianella Bulimoides.*

The *Trochus Pagodus.*



The *Murex Palmatus*

The *Pyrula Purpuracea.*

The *Scalaria Preciosa.*

The *Chiton Priscus.*

MOLLUSCA. OPISTHOBRANCHIA. PTEROPODA. ACEPHALA.

The *Opisthobranchia* are a species of marine slug of an elon gated form and furnished with a variety of appendages, which serve as gills They are found among the seaweed under water in the vicinity of the coast, and are mostly very gorgeously colored. The animals are all hermaphrodites, and their numerous eggs are clustered together in a gelatinous mass, the young emerging from the same in a larva form, which is distinguished by the presence of a spiral shell. After a time the larva casts aside its shell and begins to use its foot, which becomes broader by degrees and thus imparts to the animal its perfected form.

1. The *Aplysia Depilans* is a marine slug with a head bearing four feelers, the posterior pair of which resemble the ears of a hare. The creature cannot swim, but is only able to creep about, and if touched it emits a fluid of a dark violet tint which, owing to its poisonous properties, serves as a means of defence. The *Aplysia* is very plentifully found on the coasts of the South of Europe, and attains a length of six inches.

2. The *Pleurobranchus Peronii* is indigenous to the south sea. Its egg-shaped body, viewed from above, resembles a flattened disc with an arched back, and it is so soft that its form is easily changed, which is very often the case. The animal is found under the rocks at small depths, and on being touched it rolls itself together and lets itself sink.

3. The *Doris Pilosa* bears two conical warts or excrescences on its back, of varying size, and two large feelers, the surface of which is disposed in diagonal folds. It varies in color from brown to yellow, and is found among the wrack and seaweed, more especially in the Bay of Kiel in Holstein.

4. The *Dendronotus Arborescens* is one of the most beautiful of marine animals. Its delicate flesh-colored body is set all over with warty excrescences, resembling the inequalities of the bark of a tree, which contain the organs of respiration. This genus is very plentifully found in the Northern seas, especially in the Bay of Kiel, where it creeps about among the seaweed.

5. The *Æolis Papillosa* is distinguished by the numerous nippleshaped excrescences with which its body is fringed on either side, and which contain a sting, serving as a weapon of defence. The animal attains the length of two inches and creeps along very slowly. It is able to roll itself together like a hedge-hog. —

The *Pteropoda* have nothing in common with the Opisthobranchia. In shape they differ very much, according to the varying form of the wing-like appendages, which they are able to move to and fro, like the wings of the butterfly. The Pteropoda are found in the open sea.

6. The *Hyalea Marginata* is found in the Mediterranean. Its body is enclosed in a thin horn-like shell, into which the wingshaped fins can be withdrawn. Its lays its eggs enclosed in transparent shells, which float about in large clusters.

7. The *Clio Borealis* has a body somewhat resembling a carrot in shape, with a plainly defined head and a pair of wings attached to the neck. It is very commonly found in the arctic seas. –

8. The *Carinaria Cymbium* belongs to the family of the *Heteropoda*, and has an elongated, semi-transparent body, the back of which bears a small, thin shell, resembling glass in appearance, while its under side is furnished with a fin or keel, which serves as an organ of propulsion. It is a very helpless creature and is found in the Mediterranean, where it is exposed to the attacks of a multitude of enemies among the fishes and crustacea. —

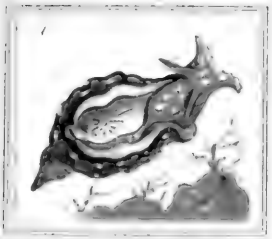
The Mussels are soft, headless creatures, whose body is enclosed between two calcareous shells, which when closed fit tightly together. The body consists of a mantle, i. e. the portion lying next to the shells and enclosing the organs, two pairs of branchiæ, and the wedge-shaped foot, which the animal can protrude from the shell and use as an organ of locomotion.

9. The fresh-water Mussel, *Anadonta Cygnea*, is found in stagnant, muddy water, and is distributed all over Europe, its size varying very much, being sometimes as much as 7 inches in length.

10. The *Unio Pictorum* is a very common fresh-water species, its form varying according to the depth of the water and the nature of the bottom. A kindred species, the *Unio Margaritifer*, which is found in clear, smoothly flowing brooks, yields pearls, and is on this account cultivated and preserved in Bavaria, Saxony and some other parts of Germany, although the number and quality of the pearls thus obtained are but trifling.

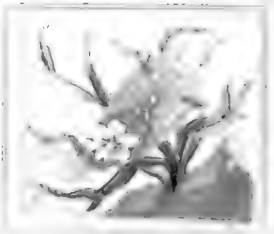
11. and 12. The Edible Mussel, *Mytilus Edulis*, fig. 11, showing the animal in its shell, fig. 12, the empty shells, is a wellknown shell-fish, found in large quantities in the Baltic and North Sea, and constitutes an important article of food among the lower classes. With the byssus, or beard, the animal is able to attach itself so firmly to the rocks or other fixed objects as to defy the force of the strongest corrent to dislodge it.

MOLLUSCA. OPISTHOBRANCHIA. PTEROPODA. ACEPHALA.

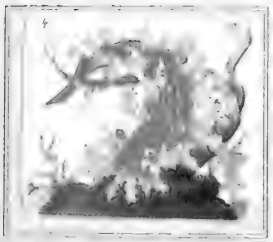


The *Aplysia Depilans.*

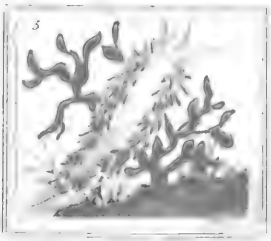
The *Pleurobranchus Peronii.*



The *Doris Pilosa.*



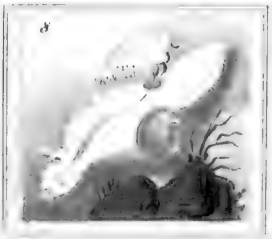
The *Dendronotus Arborescens.*



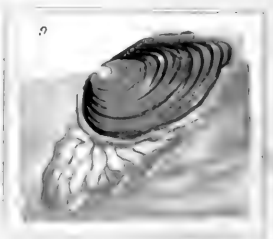
The *Æolis Papillosa.*

The *Hyalea Marginata.*

The *Clio Borealis.*



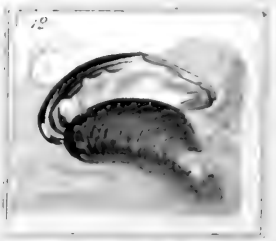
The *Carinaria Cymbium.*



The fresh-water Mussel.
Anadonta Cygnea.

The *Unio Pictorum.*

The Edible Mussel.
Mytilus Edulis.



The empty shells of the edible Mussel.

MOLLUSCA. ACEPHALA. ASCIDIÆ.

1. The Pearl-Oyster, *Avicula Margaritifera*, is found at a considerable depth in the waters of the Indian Ocean, Persian Gulf and off the coast of California, the best pearl-fishery being in the Persian Gulf, where some 30,000 persons are engaged in it. The best pearls are formed in the muscular part of the shell or in the body of the fish itself; the number present in a single individual varying considerably, as many as 150 having sometimes been found.

2. The Common Oyster, *Ostrea Edulis*, has a thick, irregular shell, which it has the power of attaching to rocks and other objects in the water by means of an adhesive substance, which it exudes. Its powers of reproduction are incredible; one single oyster being able to bring forth upwards of a million young ones in the course of a year. The oyster is diffused over the Adriatic, the western part of the Mediterranean, the Atlantic seaboard northwards to the Norwegian coast, being artificially cultivated wherever practicable. This is done by dredging for the 'spat' or spawn and transferring it from the open sea to artificial beds, expressly constructed for the purpose, where the fish are properly fed and fattened for market. They are a most nutritious delicacy, and in Europe alone several hundred millions are consumed annually.

3. The Scallop, *Pecten Jacobæus*, has a beautifully ribbed shell, which is much used as an ornament. In the olden time it was used as a badge by the pilgrims returning from the Holy Land. The thickened borders of the lobes of the mantle are furnished with several rows of fleshy cilia, between which are regularly disposed a series of bright, smooth oculiform tubercles.

4. The *Spondylus Americanus* is distinguished by the long spines covering the outside of the shell. This genus seldom moves away from the spot where it has once attached itself, so that in course of time the accumulations of ooze render both the form and color of the shell almost undistinguishable.

5. The *Venus Papilionacea* is a beautiful specimen of the extensive family of the *Veneridæ*. The shell is symmetrical and beautifully colored in many of the varieties. The animal burrows into the sand or ooze, projecting its breathing tubes up into the clear water.

6. The *Cytherea Gibbia*, also nearly allied to the family of the *Veneridæ* by the form of its shell, is a beautiful specimen of this genus and is found in every sea.

7. The Cockle, *Cardium Echinatum*, is very common on the coasts of Great Britain and is much esteemed as an article of food. It has a very long foot, bent like a knee in the middle, which serves both for the purpose of progression and for excavating holes in the mud and sand in which it lives.

8. The Razor-shell, *Solen Vagina*, has a long, narrow, sheath-like shell and a long, conical foot, with which it burrows in the sand like a mole. This it will do very rapidly when pursued. This genus is very common in the Mediterranean.

9. The *Arca Laurata* has a rather irregular and deeply furrowed shell. It is very commonly found on the sand and beach, and is used as an article of food in many parts.

10. The Hammer-Oyster, *Malleus Vulgaris* has a most peculiarly shaped, foliated shell, like a T or hammer, the interior of which is covered with mother of pearl. It is found in the seas of the East and West Indies attached to the rocks by its byssus or beard, which grows from the hinge of its shells. —

The *Salpacea* are delicate, transparent animals, enclosed in a shell, through the posterior aperture of which it sucks in the water, ejecting it by the anterior one, thereby propelling itself through the water tail foremost. The strangest peculiarity of the Salpacca is however that the young ones do not resemble their parents, the original form only reappearing in the next generation. For instance, one generation will appear aggregated together in long chains; these however produce only isolated individuals differing in form, which in their turn reproduce the chain-form.

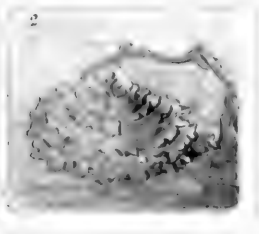
11. The *Salpa Maxima* — an isolated individual. This species is endowed with phosphorescence. —

The Ascidians, *Ascidiæ*, only exist as locomotive animals for a short time; moving about like a tadpole by means of a vibrating tail. After a while they attach themselves to a submarine plant or rock, the tail disappears and they remain fixed, like fungi, their bodies being covered with irregular excrescences. The leathery external mantle encloses a second mantle, which contains the various organs and only adheres to the former near the orifices. The Ascidians are found in all seas and are divided into two classes — compound and solitary.

12. The *Cynthia Papillosa* — a solitary individual.

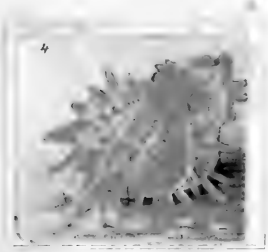
MOLLUSCA. ACEPHALA. ASCIDIE.

The Pearl-Oyster.
Avicula Margaritifera.

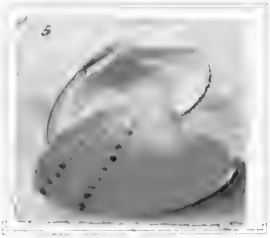


The Common Oyster.
Ostrea Edulis.

The Scallop.
Pecten Jacobæus.

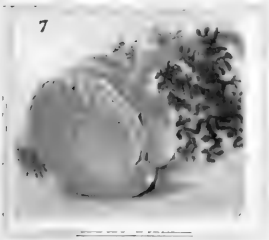


The *Spondylus Americanus.*



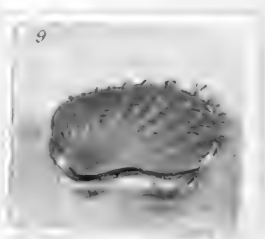
The *Venus Papilionacea.*

The *Cytherea Gibbia.*



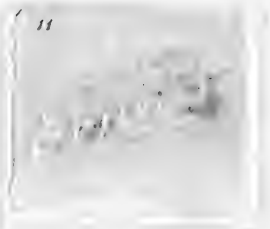
The Cockle.
Cardium Echinatum.

The Razor-shell.
Solen Vagina.



The *Arca Laurata.*

The Hammer-Oyster.
Malleus Vulgaris



The *Salpa Maxima.*

The *Cynthia Papillosa.*

INDEX.

The large numbers refer to the plates, the small ones indicating the number of the illustrations.

VERMES, ECHINODERMATA, CŒLENTERATA, PROTOZOA

VERMES, ECHINODERMATA, CŒLENTERATA, PROTOZOA.

In the case of the higher animals, and even in that of the Articulata and Mollusca, it was possible to regard them from a definite point of view, affording certain general data, on which to classify them according to their structure and mode of life. When we descend however to the contemplation of the lower forms of animal life this possibility vanishes altogether. So numerous are the varieties and so heterogenous the forms met with, that each genus must be taken on its own merits in order to obtain an idea of its organisation. We will now attempt to describe the most important groups in a few words.

The Worms, *Vermes*, may be subdivided into three orders, viz: Annelida, Nematodes and Platyhelminthes. As a general characteristic of all the worm tribe we may instance the soft skin and the hairs or bristles with which it is beset. In other respects however the different genera show the utmost possible variety.

In the general system of Natural History the *Annelida*, or Articulated worms, stand immediately below the Articulata proper. They are distinguished by their blood being of a red color, and are subdivided into two groups according to the presence or absence of hairs at each of the numerous segments into which the body is divided. In some genera there is only a single hair at each segment, in others there are two hairs, or even a tuft, and these varieties are known as 'simple or double oar'. In these worms the mouth aperture is situated on the under side, immediately behind the first ring, and constitutes the entrance to the intestine, which in several of the genera can be protruded like a trunk and used for burrowing or for capturing their prey. The worms with bristles mostly live in the sea, respiration being carried on by means of gills. Some genera move about freely in the water, others take up their abode in calcareous tubes at the bottom, their food consisting sometimes of animal, sometimes of vegetable substances. Organs of vision are not present in all cases. The smooth-skinned worms live in fresh water, or appear as parasites in the bodies of fishes, crustacea or mussels. The leeches — which belong to this class — have several pairs of eyes, and are armed with a very sharp mouth. They feed exclusively on the blood of vertebrate animals. The Annelida are propagated by means of eggs, the bristled worms having to pass through a larva stage before arriving at their perfect form. —

The *Nematodes*, or round-bodied worms, are destitute of all articulation, although the head is in most cases plainly marked. They mostly live as parasites on plants or in the bodies of animals. In the latter case propagation is not effected in the intestine of the animal, but the eggs are usually voided, and attain their development in the water or in the earth, as the case may by. The rate of increase of these worms is astounding, some genera having been ascertained to lay as many as 60 Millions of eggs in the course of one year. The young are thus disseminated in every direction, and pass into the body of the animal with its food or water, to batten there at its expense. —

The *Platyhelminthes*, or flat-bodied worms, have a soft, fragile body, which is easily torn asunder. The *Turbellarii* which constitute the first order, live mostly in

the water and somewhat resemble the snail in appearance. The body is thickly set with fine hairs, which are kept in continual motion, and thus enable the creature to shift its position. The second order, the *Trematodes*, are furnished with suckers, and live as parasites, mostly on fishes, but also in the intestines of other animals. The third order, the *Cestodes*, or tape-worms, are very long and flat, and in their perfect state consist of a large number of segments, the head being furnished with hooks and suckers. Almost all of them live as parasites in the intestines of animals. Their propagation is effected in a twofold manner: by the separation of the posterior segments, which speedily develop into a perfect individual, and by eggs. These eggs however do not produce the perfect worm, but an intermediate larva form, or hydatid, which lives in the flesh or in the organs of the animal, and only developes into the perfect tape-worm on reaching the intestine. —

The *Echinodermata* are exclusively marine animals, and present great varieties of form, the skin being however in all cases beset with spines, warts or other excrescences. They have a plainly discernible mouth, which is generally situated on the lower side, and are also furnished with a number of suckers, by using which they are enabled slowly to shift their position. Their food consists of mussels and other marine animals. The *Holothuriæ*, which constitute the first group, have an oblong, coriaceous body, open at both ends, the mouth being situated at the anterior extremity and surrounded by very complicated branched tentacula. There are double rows of suckers along the whole length of the body. The next group, the *Echinoidea*, or sea-urchins, contains a number of genera, which do not however show any very great variety of form. The body is round in shape and consists of from four to six plates covered with spines of different lengths, between which the suctorial feet are protruded. The mouth, which is furnished with a powerful masticatory apparatus, is situated on the lower side, which is somewhat flattened.

The *Asteriæ*, or Star-fishes, are found in two varieties — the scutellated, and the radiated, some descriptions of the latter appearing to consist of arms and nothing else. These arms, which vary from five to twelve in number, are grooved with a longitudinal furrow on their lower side, the furrow being pierced laterally with small holes through which pass the feet or tentacula, each of which terminates in a little suctorial disc. By alternately lengthening and shortening these numerous little organs, and fixing them by means of the terminal disc, a slow sort of locomotion is attained. The upper side of the star-fish is generally gorgeously colored, and is covered with short spines and calcareous warts and excrescences. The *Crinoidea*, although of but rare occurrence in our modern seas, were one of the most widely diffused forms of animal life in the earlier ages of the world, as is evidenced by the countless myriads of their remains, which fill so many limestone beds and compose vast strata of marble extending over large tracts of country in the Northern hemisphere. They grow attached to the bottom of the sea, and consist of a long, slender stem bearing a body of varying shape, furnished with a number of delicate arms, the whole forming a beautiful flower-like animal. —

No general distinctive marks can be quoted for the group of the *Cœlenterata*, which embraces the Sea-blubbers and the Polypi. The only feature of their internal structure that need be mentioned is that the intestine does not consist of a separate canal, but is connected with every part of the body by means of a diffused tubular system. The *Medusæ*, or Sea-blubbers are soft, gelatinous creatures, with a hemispherical body resembling a mushroom or umbrella in shape, and from the under side of which a number of tentacular cirrhi depend. These cirrhi are endowed with the property of stinging or numbing any creatures with which they are brought into contact, and are used for the purpose of securing their prey. They float about in the sea near the surface, and are seen in vast numbers in the warmer season of the year, many varieties being endowed with the faculty of producing a phosphorescent glow. Most of the Sea-blubbers have to pass through a larva stage after emerging from the egg.

The *Polypi* differ from the Medusæ in living for the most part fixed to one spot. Some of them, like the Sea-anemones, or Actinia, pass a solitary existence, attached to some rock in the sea, while others, such as the coral, live united in vast colonies. The aperture which serves both for mouth and vent is situated at the top,

and is surrounded with one or more rows of tentacula, which can be folded down into the aperture and concealed under the outer envelope. The interior of the body is subdivided into a number of cells, which receive and distribute the food, and contain the organs of propagation. The young are produced in a twofold manner, from eggs and by budding. As most of the Polypi, with the exception of the soft, leathery-skinned Actinia, secrete calcareous particles they gradually produce reefs of rock or even islands. They are mostly very beautifully colored. —

Under the title of *Protozoa* are grouped together a multitude of organisations, mostly of microscopical minuteness and many of them of no definite shape, which represent the lowest form of animal life. In their case but little can be said about any distinct organs; their body consists rather of merely living matter, known as protoplasma, and which with but little change goes to form the substance of plants. Indeed the animal and vegetable world approach here so nearly together, that it is sometimes difficult to decide to which of the two to ascribe some of these forms of existence. Under the generic title of Protozoa are classed the Infusoria, Sponges and Rhizopoda.

The *Infusoria* are for the most part exceedingly minute animalcules and are confined exclusively to the water, their bodies being in some cases furnished with cilia, and in others with flexible stems. Some species move about swiftly in the water, while others remain attached by the stem, and by moving to and fro create a motion in the water and thus obtain their nourishment. Their propagation is effected either by eggs or by spontaneous division, either longitudinal or transverse. —

The Sponges, *Spongiæ*, are entirely vegetable formations, as far as appearance is concerned. Their bodies, which are either lumpy, or bushy or resembling a cup in shape, grow and live under water, firmly attached to stones or to the bottom. Their skeleton is either simple, consisting of horny fibres, or compound, being strengthened by calcareous or siliceous spicula. The surface is perforated with a number of pores, into which the water enters and from which it is ejected after the nutriment has been extracted from it. Propagation is effected by means of eggs, which at first float freely in the water. —

Under the title of *Rhizopoda* are classed the very lowest forms of animal life. Their body consists of a gelatinous mass, sometimes enclosed in a shell, from the aperture of which a number of minute filaments are protruded, which are used for the purposes of locomotion. They live in the sea, in the ooze, and are found at the greatest depths, sometimes in amazing numbers. Their shells are found among the sand of the seashore in every part of the world, while whole mountains are formed of their fossil remains, and thus the humblest and most insignificant of living creatures perform their assigned part in the economy of nature and in fashioning or modifying the surface of the earth.

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Plate 90.

POLYPI.

1. *Lucernaria Auricula.*
2. *Pennatula Phosphorea.*
3. *Tubularia Indivisa.*
4. *Madrepora Abrotanoides.*
5. *Millepora Alcicornis.*
6. *Tubipora Rubeola.*
7. *Sertularia Tamarisca.*
8. *Corallium Rubrum.*
9. *Gorgonia Verrucosa.*
10. *Hydra Viridis.*
11. *Hydra Fusca.*
12. *Cristatella Mucedo.*

Plate 91.

PROTOZOA. INFUSORIA. SPONGIÆ. RHIZOPODA.

1. *Stentor Roeselii.*
2. *Vorticella Convalaria.*
3. *Bursaria Vorticella.*
4. *Ophryoglena Acuminata.*
5. *Stylonychia Lanceolata.*
6. *Trachelius Ovum.*
7. *Leucophrys Sanguinea.*
8. *Rotifer Vulgaris.*
9. *Axinella Polypoides.*
10. *Spongia Manus.*
11. *Nonionina Germanica.*
12. *Noctiluca Miliaris.*

VERMES. ANNELIDA.

The Worms, *Vermes*, include a very large number and variety of forms, at the head of which we must place the *Annelida*, whose name is derived from the latin word, *Annulus*, a ring, because the animals arranged under this division always have their bodies formed of an indefinite number of rings, as in the earthworm. Their skin is soft and pliable, and their bodies, having no bony skeleton are soft and mostly cylindrical in shape. The *Annelida* are for the most part oviparous, but the leeches and earthworms deposit a sort of capsule or cocoon, containing many embryo young. Somespecies live in fresh and others in salt water, while others again are amphibious. Some perforate holes in stones, others construct calcareous cases around themselves, generally of sand. Some are sedentary, other locomotive, and these latter are frequently very nimble.

The *Annelida* are subdivided into animals with bristles and those with a naked skin. The former genus, or *Chætopoda*, is distinguished by the presence of one or more bristles, generally at each ring, the form and disposition of which vary exceedingly, these bristles serving as an aid to locomotion. Most of the varieties are marine animals, of a predatory nature and sometimes of considerable size. They are furnished with a variety of cirri, and have eyes and sharp, hooked jaws, and often glitter with metallic hues.

1. The *Euphrosyne Foliosa* is a sort of marine caterpillar with a hairy body, the hairs being barbed at the end and glittering with the most beautiful metallic colors.

2. The *Nereis Nuntia* is a genus found in the Red Sea. It is very predatory, and has its turned-up proboscis armed with a pair of nippers, in addition to the cirri, or feelers.

3. The *Cirrhatulus Lamarckii* is a very beautiful species found in the Atlantic, its body bearing a number of very long, red cirri, which are continually in motion.

4. The Sand-worm, *Arenicola Piscatorum*, is found in large numbers on the sandy coasts of Western Europe, and is a very favorite bait for fishing. It varies very much in color, and sometimes attains the length of 9 inches. Thirteen of the central rings of its body are decorated with bunches of beautiful red bristles.

5. The *Terebella Conchilega* constructs a case for itself out of fragments of mussels, which it keeps continually moving in serpentine undulations, and from which it projects its head which bears a number of antennæ. It is found on the coasts of the Atlantic and the Mediterranean.

6. The *Serpula Contortuplicata* is very common in the North Sea. It gives off a certain secretion which becomes solidified, and forms a calcareous tube within which the animal takes up its abode, seldom protruding more than its head, which is adorned with a number of delicate, feathery cirri, beautifully colored, and which are kept constantly in motion.

7. The *Sabella Protula* is found off the coast of Nice, and constructs a flexible tube for its habitation.

8. The *Syllis Maculosa* is indigenous to the same waters, and bears two long bristles at each of the numerous segments of its body.

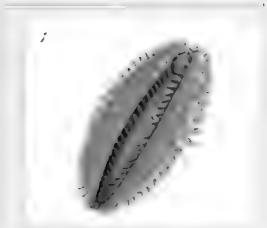
9. The Earth-worm, *Lumbricus Vulgaris*, is furnished with a number of very short hooked bristles. Its favorite habitat is in rich mould, especially such as contains any decaying animal or vegetable matter, on which it battens. Although blind, the worm is very sensitive to the light, and is therefore rarely seen above ground in the daytime.

10. The Leech, *Hirudo Medicinalis*, represents the second division of the Annelida, its body being quite destitute of bristles or other appendages. Its triangular mouth is armed with jaws, containing some 60 or 70 fine teeth, which act like a saw, and thus produce a peculiar triangular wound. The stomach consists of 11 sacs, all of which can be filled with blood, and when the creature has thus gorged itself, its body increases to 3 or 4 times its normal size. The leech feeds on blood alone, by preference on that of the vertebrata. It can however go without food for a great length of time, and only attacks living animals. —

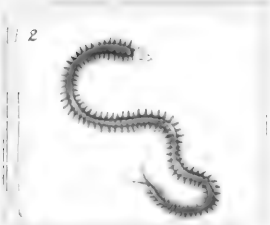
11. The *Priapulus Caudatus* is a peculiar species, belonging to the genus of the *Gephyrea*. The annulated body terminates in a bushy caudal appendage, its anterior part consisting of a retractile trunk, armed with sharp spines. It is found in the Northern Seas, especially on the coasts of Greenland, Iceland and Norway, and lives on vegetable substances.

12. The *Sipunculus Edulis* is found on the coast of Java and is used as an article of food by the natives. It has an annulated body and a retractile trunk.

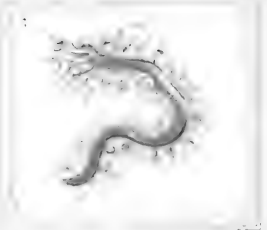
VERMES. ANNELIDA.



The *Euphrosyne Foliosa.*

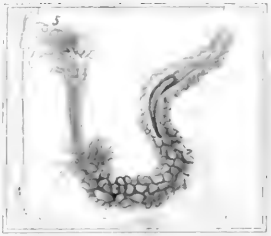


The *Nereis Nuntia.*



The *Cirrhatulus Larmarckii.*

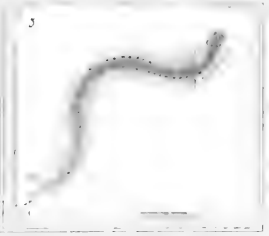
The Sand-worm.
Arenicola Piscatorum.



The *Terebella Conchilega.*

The *Serpula Contortuplicata.*

The *Sabella Protula*



The *Syllis Maculosa.*

The Earth-worm.
Lumbricus Vulgaris.

The Leech.
Hirudo Medicinalis.

The *Priapulus Caudatus.*

The *Sipunculus Edulis.*

VERMES. ENTOZOA. ECHINODERMATA.

The *Intestina*, or worms, which pass their existence as parasites in the bodies of human beings and other vertebrate animals, constitute a large and somewhat varied class which may be divided into two categories, namely: those with a round body, and those with a flat one.

The *Nematodes*, or round-bodied worms, are destitute of feet and are not articulated, their skin being perfectly smooth and naked. They frequently change their habitat, passing from the flesh of one animal into the intestines of another, or from the earth or the water, in which they were generated, into the body of some animal where they attain their full development.

1. The *Ascaris Lumbricoides* infests the smaller intestines of human beings, sometimes by hundreds at a time, and is also frequently found in the horse and in pigs and cattle, its development taking place before it finds its way into the human body. Authorities are not agreed as to the mode in which it passes into the body.

2. The *Strongylus Gigas* is found in the intestines of several of the mammalia, especially the dog. The eggs are developed in moist earth, whence the diminutive worms pass into their future habitat.

3. The *Trichina Spiralis* is a very small, thread-like worm, which seems originally to have been peculiar to the rat. It is found in large numbers in pigs, and passes into the human body on the flesh of those animals being partaken of. The trichinæ which have thus found their way into the intestines, do not quit their abode again, but increase and multiply, the young brood perforating the coats of the intestine and eating their way into the muscular tissue, where they increase considerably in size, rolling themselves together in a spiral coil and gradually enveloping themselves in a hard calcareous shell, in which form they are innocuous, their presence being apparently quite compatible with the enjoyment of robust health.

4. The *Trichocephalus Dispar* grows to a very great length and selects its habitat in the human cœcum.

5. The *Echinorhynchus Gigas* infests the intestines of pigs andis distinguished by its hooked proboscis. —

The *Platyhelminthes*, or flat-bodied worms, embrace a large number of very varied forms, extremely divergent in their mode of life and place of abode. The *Turbellarii* are an aquatic genus, and have the body thickly covered with fine hairs, which they keep constantly in motion. The *Planaria* are found both on land and in the water, while the *Cestodes* in habit the intestines of human beings and other mammalia.

6. The *Planaria Aurantica* is a beautiful species of marine Planaria, found in the Mediterranean.

7. The Common Tape-worm, *Tœnia Solium*, attains a surprising length, being sometimes found as long as 20 feet or more. Its has from 700 to 800 articulations, and its head is furnished with a series of hook-like appendages, with which it attaches itself to the human intestine in which it lives. Its original habitat is in the pig, and it is only on its passing into the human body that it assumes the tape-worm shape.

8. The Broad Tape-worm, *Tœnia Lata*, only differs from the foregoing in being broader and stronger, and without the hooked termination at the head. —

The *Echinodermata* constitute a class of radiate marine animals, with a hard, calcareous skin, in most case beset with prickles, and a suctorial foot, which serves the double purpose of an organ of locomotion and adhesion.

The *Holothuriæ*, or Sea-cucumbers, have several rows of these suctorial feet. Our illustrations present two species, viz:

9. The *Holothuria Tubulosa*, which attains a length of 12 inches, and is common in the Mediterranean, and

10. The *Holothuria Edulis*, a native of the Indian Ocean.

The Sea-eggs, or Sea-urchins, *Echinoidea*, have a calcareous shell composed of polygonal plates, set with prickles. They are very widely distributed and extremely sluggish, seldom quitting the depths of the Ocean.

11. The *Echinus Esculentus* is very common in the Mediterranean. In our illustration one half of the body is denuded of its spines, in order to show the disposition of the plates of its shell.

12. The *Echinus Mammillatus* is a very beautiful and peculiar variety, with extremely long spines.

VERMES. ENTOZOA. ECHINODERMATA.

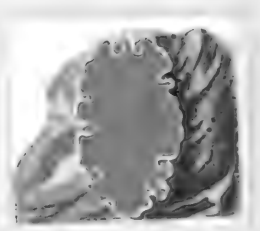
The *Ascaris Lumbricoides.*

The *Strongylus Gigas.*

The *Trichina Spiralis.*

The *Trichocephalus Dispar*

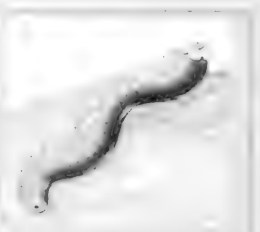
The *Echinorhynchus Gigas.*



The *Planaria Aurantica.*

The Common Tape-worm.
Tænia Solium.

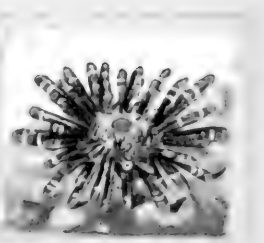
The Broad Tape-worm.
Tænia Lata.



The *Holothuria Tubulosa.*

The *Holothuria Edulis.*

The *Echinus Esculentus.*



The *Echinus Mammillatus.*

ZOOPHYTES: VERMES.
ECHINODERMATA. SEA-BLUBBERS, MEDUSÆ.

The Starfishes, *Asteriæ*, may be divided into two sections — the radiated and the scutellated. In the former the rays, in number from 5 to 12, extend far beyond the central disc, while in the latter they are not so much developed, lying within the disc, which assumes the form of a pentagon. The rays are hollow and furnished on the under side with numerous suckers, which serve the double purpose of locomotion and enabling the animal to catch and suck its prey, which mostly consists of mollusks. In some species the rays are very long and serpentine. The orifice of the mouth, which also serves for the anus, is in the centre of the disc on the under side. The Starfishes are found abundantly in every sea.

The *Ophiuræ*, or serpentine starfishes, are distinguished by the extreme flexibility of their long rays, which are attached to the lower side of the rounded disc. Their movements are very rapid and dexterous.

1. The *Ophiura Fragilis*, with five long rays, is found in the Atlantic and German Oceans. It is very fragile, but when it loses any of its rays they are quickly replaced by new ones.

The Order of Encrinites, *Crinoidea*, is only represented by a few varieties now, although they were extremely abundant in former ages.

2. The Medusa's Head, *Pentacrinus Caput Medusæ*, is found at great depths in the seas of the West Indies, growing on stony bottoms. It has a long, flexible stem, at the upper end of which the actual body grows. This is in the shape of a cup surrounded by branching, twining arms.

3. The *Comatula Mediterranea*, resembles the foregoing, except that it has no stem. It is found in the Mediterranean on a muddy bottom, and creeps along with the aid of its ten twining arms. —

The Starfishes, properly so called, of which some 400 different varieties are known, are distinguished by their rays forming an immediate continuation of the substance of the central disc.

4. The *Asterias Papposa*, one of the largest species, has 12 rays and is found on the coast of Normandy. The whole of the body is covered with a number of fasciculated excrescences.

5. The *Asterias Aurantiaca* is a regular five-rayed star, about 4 inches in diameter and of a pomegranate color.

6. The *Asteriscus Verruculatus* is an almost equilateral pentagon, with rudimentary rays, that do not extend beyond the disc. It is found in the Mediterranean.

The Sea-blubbers form the first order of the very extensive family of radiated animals or *Actinozoaria*. Of great variety of form, their bodies are gelatinous and generally radiated, some of them being melon-shaped, others a simple disc or umbrella with long depending tentacles, which possess the power of stinging or numbing those smaller animals on which they feed, whence they have also received the title of sea-nettles, *Acalephæ*. Their transparent bodies, which are either colorless or of a delicate pink or blue tint, vary in size in the different species from a microscopical minuteness to that of a foot in diameter. They inhabit the open sea and are generally found in shoals.

7. The *Cydippe Pileus* is a ribbed species of sea-blubber, *Ctenophora*, the body resembling an apple or melon in shape and being striated from pole to pole with ribs formed of delicate ciliated laminæ, which serve for locomotive purposes. On each side there is a long, twining tentacle, which is endowed with the faculty of numbing.

The very numerous family of tho *Medusæ*, or umbrella-shaped blubbers, is spread over all the seas. The mouth is situated on the lower side and is surrounded with several thick tentacles with folded edges, besides which there are in many of the species a number of long, fine, hair-like tentacles, all of which possess the faculty of numbing and thus catching the animals, which form their food.

8. The *Pelagia Noctiluca* is abundantly found in the Atlantic and Mediterranean, rendering the water phosphorescent by night.

9. The *Rhizostoma Aldrovandi* is one of the best known forms of sea-blubber, being extensively met with in the Mediterranean. In our illustration it is shown somewhat turned up, so as to show the form of the thick tentacles. It attains a diameter of upwards of a foot.

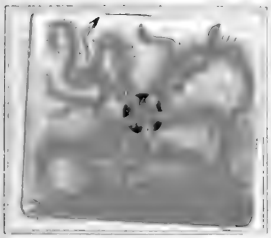
10. The *Berenix Carisochroma*, a native of the South Sea, is almost a perfect disc, the edges of which are somewhat thickened. It has a great number of hair-like tentacles.

11. Venus' Girdle, *Cestum Veneris*, diverges very considerably from the preceding examples, appearing like a broad band, about a foot long, and delicately fringed at its edges. It is found in the Mediterranean.

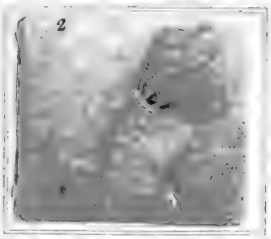
12. The *Physalia Atlantica* is perhaps the most beautiful of all, having a sort of crest surmounting its body, which it spreads like a sail to assist its progress. It is most delicately tinted and about a foot in length, and is found in the Atlantic.

ZOOPHYTES: VERMES.

ECHINODERMATA. SEA-BLUBBERS, MEDUSÆ.

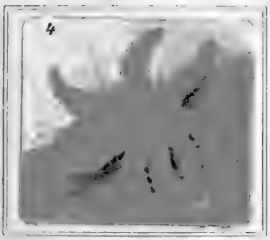


The *Ophiura Fragilis.*

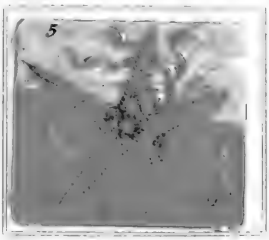


The Medusa's Head.
Pentacrinus Caput Medusæ.

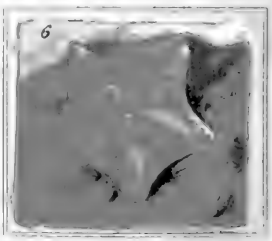
The *Comatula Mediterranea.*



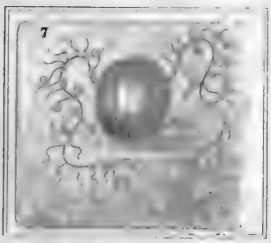
The *Asterias Papposa.*



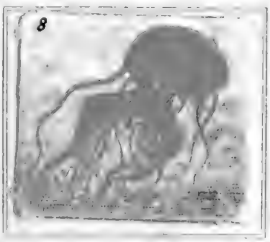
The *Asterias Aurantiaca.*



The *Asteriscus Verruculatus.*

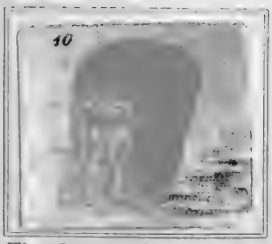


The *Cydippe Pileus.*

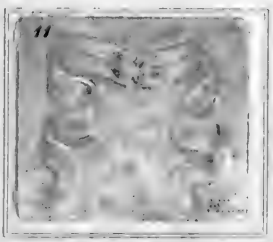


The *Pelagia Noctiluca.*

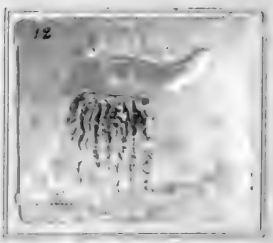
The *Rhizostoma Aldrovandi.*



The *Berenix Carisochroma.*



Venus' Girdle.
Cestum Veneris.



The *Physalia Atlantica.*

VERMES. SIPHONOPHORA. POLYPI.

The *Siphonophora*, are animal forms of very peculiar construction. The central point of the organism is formed of a long tube commencing in a vesicle, which is inflated with air and serves to keep the animal in an upright or slanting position. On this tube there are rows of cirrhiform productions, which serve to propel the animal through the water. Below these there are situated a number of movable feelers, intermixed with long filamentous tentacles, which enclose two suckers or gastric pouches. These receive the food and diffuse it over the whole of the organism.

1. The *Physophora Disticha*, is one of the simplest forms, about 4 inches in length and with two rows of vesicles. It is found in the southern seas.

2. The *Hippopodius Luteus*, does not exhibit the tubular formation so distinctly. The natatory vesicles are crowded closely together. This animal inhabits the Mediterranean. —

The *Polypi* are zoophytes, mostly of cylindrical form and generally attached to the rocks. The mouth-aperture, situated at the top, is surrounded with several rows of extremely elastic, movable feelers. The stomach, which is situated immediately below it, is divided into cells and encloses both the circulatory system and the organs of reproduction. In most of the Polypi reproduction is effected by germination, buds showing themselves in various places on the mother and growing, more or less firmly attached to her. In this manner whole colonies come into being, frequently of enormous extent, and, as the external covering of their bodies generally becomes petrified, they form banks and ridges of rock.

The Sea-Anemones or Animal flowers, *Actinia*, are able to shift their quarters slowly and attach themselves in some fresh locality by means of the fleshy disc, which forms the base or foot of the body. They live singly and are found in every sea. The species is propagated by means of eggs, which frequently develop themselves before quitting the mother's body.

3. The Coral Sea-Anemone, *Actinia corallina*, is found in the Mediterranean. Its color is a splendid red, with numberless tentacles streaked with blue.

4. The *Actinoloba Dianthus*, or Sea-pink, has a columniform body, 5 inches high, but which can at pleasure be completely contracted, so as to make the creature appear quite flat. The tentacles are delicately feathered. This beautiful species is found on every coast in Europe.

5. The *Sagartia Venusta* is a small species, scarcely one inch in height, of a beautiful orange color with white tentacles. It is found on the South and West coasts of Great Britain and Ireland, generally in the cavities of overhanging rocks.

6. The *Sagartia Parasitica* prefers to attach itself to crabs and mussels and let itself be carried about by them. It is a very common species and is found in the British Channel and in the Mediterranean and Red seas. When fully grown it is 4 inches high and has some 500 tentacles.

7. The *Tealia Crassicornis*, the thick-horned Sea-Anemone, is so called from the form of its tentacles, which are transparent. The body is very broad for its height, measuring sometimes as much as 3 inches in diameter. It is found on the atlantic seaboard of Europe in the cavities of the rocks.

8. The *Stomphia Churchiæ* resembles a short, thick column, over which the deflected tentacles project. This species, which is richly colored, grows to the height of $2^1/_2$ inches, and is found in deep water on the coast of Scotland.

9. The *Peachia Hastata* does not fasten itself to the rocks, like most of the Actinia, but works its way into the sand. In form it is something like a cucumber. It is generally about 4 inches long, but can stretch itself to twice that length; its color is very varied. It is found on the English coast.

10. The *Aiptasia Couchii* is long and slender in shape, the upper part expanding like a trumpet and crowned with four rows of tentacles. It is 4 inches in length and is found in the British Channel, in deep water attached to the rocks. —

The *Alcyoneæ* are closely allied to the sponges. The body branches into several lobes, the leathery skin of which is pierced with numerous star-shaped pores, which are in fact the terminal openings of the tube-like rays that distribute themselves through the glutinous mass of the body, and from which the small polypi stretch forth their tentacles. There are but few varieties of the genus, which is chiefly met with in the southern seas, attached to rocks and mussels.

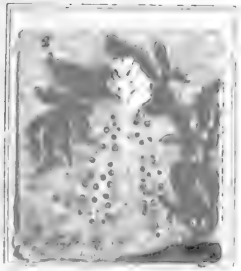
11. The *Alcyonium Aurantiacum*, a beautiful coral red in color with white polypi, is found on the coast of New Zealand.

The *Caryophyllea* resemble the Actinia in organisation. They are however smaller and adhere to the rocks in clusters of 20 or more by the calcareous tubes enclosing their bodies.

12. The *Caryophyllea Fasciculata* resembles a bouquet of flowers and is found off the island of Vanikoro in the South Sea.

VERMES. SIPHONOPHORA. POLYPI.

The *Physophora Disticha.*

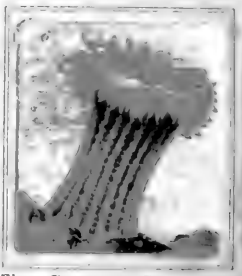


The *Hippopodius Luteus.*

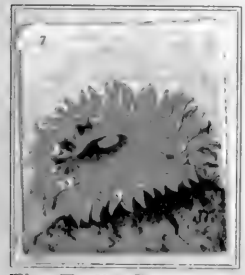
The Coral Sea-Anemone.
Actinia corallina.

The *Actinoloba Dianthus.*

The *Sagartia Venusta.*



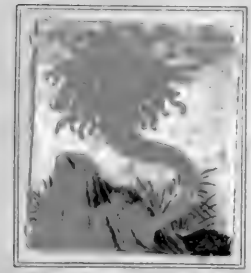
The *Sagartia Parasitica.*



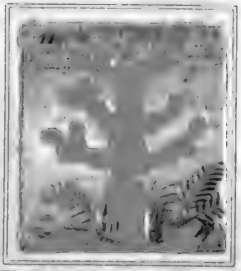
The *Tealia Crassicornis.*

The *Stomphia Churchiæ.*

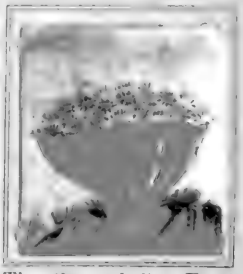
The *Peachia Hastata.*



The *Aiptasia Couchii.*



The *Alcyonium Aurantiacum.*



The *Caryophyllea Fasciculata.*

POLYPI.

In outward appearance the *Polypi* approach very closely to the *Actinia*. The lower part of the body is in most cases firmly attached to some object, while the upper end spreads itself out like a bell, and bears some 8 or 9 short arms disposed around the wide mouth and furnished with an ample number of tentacles.

1. The *Lucernaria Auricula* is found in the Northern Seas attached to seaweed by a narrow disk, from which it expands into a broad octagonal figure with a bundle of tentacles at each angle and a quadrangular mouth in the centre. This pretty little creature is only one inch in height.

The family of the *Pennatulidæ*, or Sea-feathers, includes only a few varieties, most of which are found in European waters. Whatever be the general form, one of the extremities is always devoid of polypi, while the polypiferous portion resembles expanded barbs and exhibits more bilateral symmetry than is seen in the other *Polypiaria*. Most of these animals are unattached, and float in the water or stick themselves into the sand or mud.

2. The *Pennatula Phosphorea* is from 2 to 4 inches in length, and is met with on the Scottish coast. It is nocturnal in its habits, and when touched emits a transitory phosphorescent gleam.

The *Tubularia* have fine straw-like stems of a horny consistence, which are firmly attached to stones or mussels, the upper ends bearing small polypi, which are free and non-retractile, and adorned with a bunch of tentacles. They are only found in deep water.

3. The *Tubularia Indivisa* is found on the coasts of the North Sea, generally in groups of 30 or 40 stems about 5 or 6 inches in height. The bright red polypi bear a double row of tentacles which are constantly in motion. —

Among those genera of the Polypi, which distinguish themselves by the formation of their calcareous stems, the *Madrepora* occupy an important place. These formations sometimes resemble a widely branching tree, while in some genera the growth is ragged and irregular, the extent however being so great as often to form a regular reef of rock.

4. The *Madrepora Abrotanoides* is found in the Pacific, and often grows so profusely as to form islands.

5. The *Millepora Alcicornis* of the Antilles more resembles sea-weed in its irregular shape. The polypi cells distributed over the whole of its surface do not project, but form little cavities in its substance.

6. The *Tubipora Rubeola*, or Organ-Coral, is distinguished for the beautiful grouping of its brilliantly tinted stems, which do not grow together laterally, but stand independently, like the pipes of an Organ, and are merely connected by lateral ribs at intervals. This beautiful species is found among the islands of the Atlantic.

The *Sertularia* attach themselves to seaweed, mussels or other objects, the upper end extending itself in many branches with cells, arranged alternately or in pairs obliquely on the stem, which cells open upwards and contain the polypi.

7. The *Sertularia Tamarisca*, a very pretty species, is commonly found on the English and Irish coasts.

8. The *Corallium Rubrum*, the Common Red Coral of the Mediterranean, grows like a little tree firmly attached to the rugged rocky bottom at a depth of from 40 to 100 fathoms, and is very abundant on the coast of Algiers, where it is fished for with long drag-nets and exported to be worked up into necklaces and other ornaments. The delicate white polypi, decorated with a cluster of tentacles, are irregularly distributed over the red stems.

The genus *Gorgonia* is of a horny substance and slightly flexible notwithstanding the calcareous corpuscules with which it is studded. It sometimes assumes the form of a tree, and at others appears as network.

9. The *Gorgonia Verrucosa*, a delicate species, is found in the Mediterranean. —

The *Hydra* is the only genus of fresh-water polypi. They are found all over Europe attached to aquatic plants, though they can easily shift their quarters if so disposed. They are very diminutive creatures and have 6 or 8 feelers surrounding the mouth, which they use to numb and thus overcome their prey with. Reproduction is effected by means of external germs, which are developed at the lower end of the mother-plant, detaching themselves when fully developed.

10. The *Hydra Viridis*, and 11. The *Hydra Fusca* are commonly found growing on plants in ponds and ditches. —

The very varied genus of the *Bryozoa*, owing to the similarity manifested in many respects to the Ascidians, has been classed by modern zoologists with the *Molluscoidea*. It is divided into two subfamilies, — the marine, with horny cells, and the fresh-water, with soft cells, — both of which are found in very extensive colonies.

12. Represents the *Cristatella Mucedo*, a fresh-water species.

POLYPI.

The *Lucernaria Auricula.*

The *Pennatula Phosphorea.*

The *Tubularia Indivisa.*

The *Madrepora Abrotanoides.*

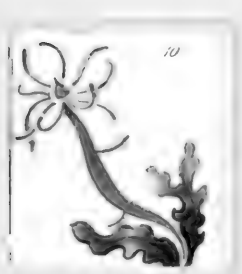
The *Millepora Alcicornis.*

The *Tubipora Rubeola.*

The *Sertularia Tamarisca.*

The *Corallium Rubrum*

The *Gorgonia Verrucosa.*



The *Hydra Viridis.*

The *Hydra Fusca*

The *Cristatella Mucedo.*

PROTOZOA. INFUSORIA. SPONGIÆ. RHIZOPODA.

A drop of water, when viewed through the microscope, reveals to the eye of the observer a whole world of animated beings. This fact was discovered some 200 years ago by the celebrated Dutch naturalist, Leeuwenhoeck, who in order to investigate the stinging properties of pepper placed some ground peppercorns in water and after letting the mixture stand a while viewed the same through his microscope, when to his astonishment he found the water swarming with minute living creatures, wriggling, fighting and devouring one another. He had in fact discovered one of the lowest stages of animal life, the *Infusoria*, the nature of which are to this day problems which have not yet received any thoroughly satisfactory solution. The celebrated Naturalist, Ehrenberg of Berlin, was the first to throw light upon this branch of Natural History, and his investigations went to show the enormous diffusion and the vastness of the numbers, in which the manifold forms of Infusoria are met with in all waters, and to prove that reproduction is effected, as in the case of others among the lowest forms of animal life, partly by means of eggs and partly by spontaneous division.

Our illustrations represent some of the most interesting forms, which are met with in water all over Europe.

1. The *Stentor Roeselii* is shown in its two varieties of shape: compressed, which form it takes when swimming, and spread out like a trumpet. It may be observed with the naked eye.

2. The *Vorticella Convalaria* is one of the prettiest of the Infusoria. Attaching itself, generally in large groups, by its delicate flexible stem to some fixed object, it stretches out its bell-shaped body, the open end of which is surrounded by tentacles, in all directions to catch its prey.

3. The *Bursaria Vorticella* has the edges of its body fringed with fine hairs, which it uses to propel itself with.

4. The *Ophryoglena Acuminata*, has a red eye and a brown body covered with fine hairs and terminating in a tail

5. The *Stylonychia Lanceolata* is furnished with spines on the upper and lower portion of the body and about the mouth, which enable this very voracious animalcule to climb about among plants.

6. The *Trachelius Ovum* has a broad egg-shaped body with a large mouth and a plainly visible digestive canal. It is found in bog-water.

7. The *Leucophrys Sanguinea* is covered with fine moveable hairs all over its body. Our illustration shows an individual in the act of reproduction by spontaneous division.

The *Rotatoria* were formerly included among the Infusoria. The more critical researches of modern investigators have however led to their being classed with the Articulata. They are most minute beings, the largest specimens being scarcely $^1/_3$ of a line in length, and owe their name to the wonderful organs, with which they propel themselves. These are situated around the mouth and consists of two semicircular arms, covered with numerous fine cilia, which on being set in motion produce the impression of a wheel in rotation. They are found all over the world, both in fresh and salt water.

8. The *Rotifer Vulgaris* can compress and distend its body at pleasure. —

The Sponges, *Spongiæ*, are only found in the sea. For a long time it has been a disputed point whether to class them among the animals or the vegetables. Their external appearance, which allows of the utmost possible variety of shape would justify the latter theory, while their internal organisation is decidedly that of an animal. The body which grows slowly, firmly attached to the bottom, is perforated in every direction by innumerable pores, which imbibe the water and extract aliment from it. The genus is divided into two sections, the *Calcispongiæ* and *Halispongiæ*, which are distinguished by their fibres being strengthened by calcareous and silicious spicula respectively.

9. The *Axinella Polypoides* belongs to the Halispongiæ, and is found in the Adriatic. It grows to the length of 18 inches.

10. The *Spongia Manus*, so called from its resemblance to the human hand, is also found in the Mediterranean. —

The *Rhizopoda* constitute the lowest form of animal life. A delicate, and often beautifully articulated shell encloses the gelatinous mass of the body, light moveable filaments extending from the openings of the shell, and serving to propel the animalcule and enable it to catch its food. They appear in myriads, the sand and mud at the bottom of the sea swarming with them.

11. The *Nonionina Germanica*, a very beautiful species, is very common in European waters, and noted for its voracity.

12. Tho *Noctiluca Miliaris* appears in countless myriads on the surface of the ocean, producing the exquisite phosphorescent gleam so often seen at night.

PROTOZOA. INFUSORIA. SPONGIÆ. RHIZOPODA.

The *Stentor Roeselii.*

The *Vorticella Convalaria.*

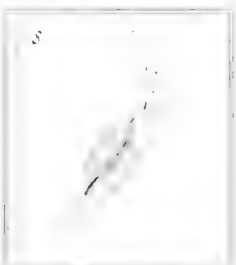
The *Bursaria Vorticella.*

The *Ophryoglena Acuminata.*

The *Stylonychia Lanceolata.*

The *Trachelius Ovum.*

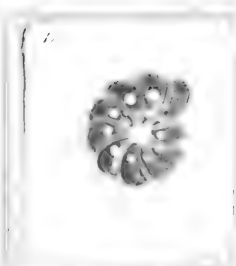
The *Leucophrys Sanguinea.*



The *Rotifer Vulgaris.*

The *Axinella Polypoides.*

The *Spongia Manus.*



The *Nonionina Germanica.*

The *Noctiluca Miliaris.*

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The large numbers refer to the plates, the small ones indicating the number of the illustrations.

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