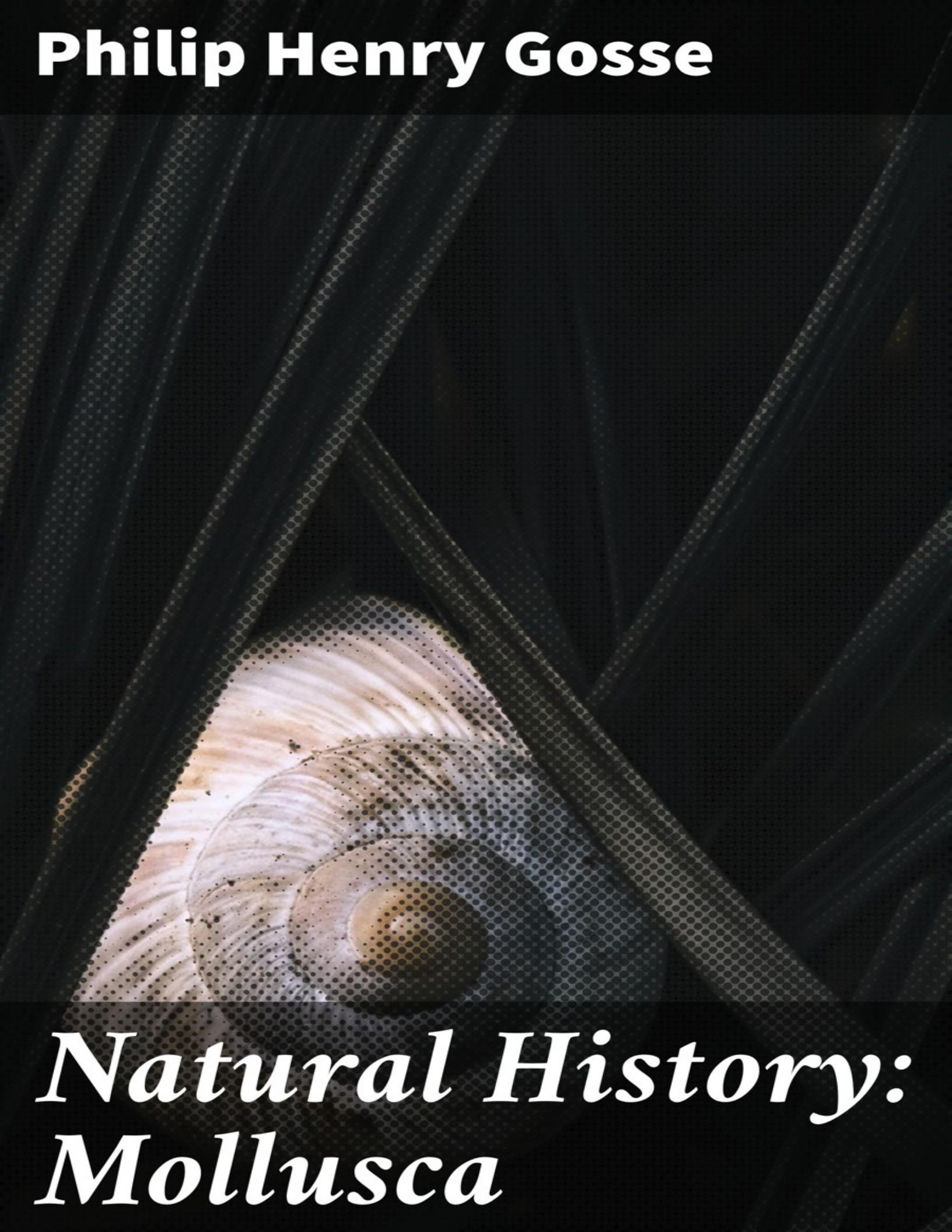
Philip Henry Gosse



Natural History: Mollusca

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THE four Classes of animals which have been considered in the preceding volumes of this series we have seen to have one character in common; viz. the possession of a bony framework within the body, of which a jointed spine is the most essential element. This character, which unites those four Classes into one great group, and gives to that group the name VERTEBRATA, by which it is distinguished among naturalists, we have seen, however, by slow degrees, *deteriorated*, if I may use such an expression, from bone to cartilage, and gradually diminished in its development, until, in the lowest of the Fishes, it can scarcely be recognised at all.

I come now to treat of animals in which the bony skeleton no longer exists. The conditions of their existence do not require such a scaffolding on which to build the constituent muscles: many are habitually immersed in water, a fluid the density of which supports their soft bodies; their motions generally lack the precision, energy and variety of those which belong to Vertebrate animals; and where this is not the case, as in the Articulate Classes, the skeleton which affords attachment to the muscles, is not internal, but invests the body, while its substance differs essentially from bone in its chemical composition and its structure.

An immense assemblage of living creatures are included in this category; creatures differing widely from each other in the most important characteristics, so that they cannot be grouped together. The term INVERTEBRATA, by which they are sometimes designated, indicates indeed only a negative character, and we shall be greatly mistaken if we suppose

(misled by such a term) that the animals which have a skeleton, and those which are destitute of one, constitute two primary divisions of living beings, of equal or co-ordinate importance.

Several divisions of INVERTEBRATE animals do, in fact, exist, each one of which is equal in rank to the VERTEBRATA. One of these will form the subject of the present volume, commonly known by the name of MOLLUSCA; a term invented by the illustrious Cuvier, from the word *mollis* (soft), and evidently suggested by the softness of their boneless bodies. The appellation can scarcely be considered happy, for the character so indicated is very trivial, and is shared by other animals of totally different structure:—objectionable, however, as it is, it has been generally adopted, and I shall not hesitate to make use of it.

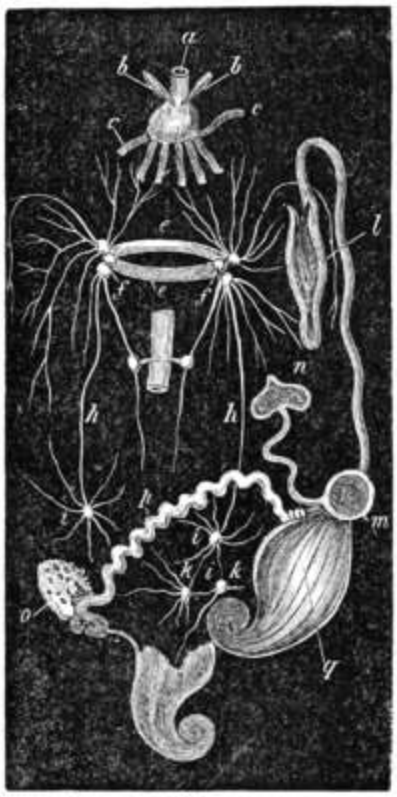
As the great Vertebrate Division includes the four distinct Classes of Beasts, Birds, Reptiles and Fishes, so does the great Division of MOLLUSCA contain six Classes, distinguished by characters which I shall presently enumerate. I must, however ever, first indicate those which they possess in common, and by which they are naturally grouped together.

The nervous system demands our first attention. Instead of a great mass of nervous substance accumulated in one place, and a lengthened spinal cord proceeding from it, giving out threads to all parts of the body, as in the VERTEBRATA, we find the nervous centres numerous, unsymmetrical and disposed in various parts of the system, no one having so decided a predominance over the others in bulk, as to merit the appellation of a brain. There is, however, one mass larger than the rest, which is always

placed either above the gullet (*œsophagus*), or encircling it, in the form of a thickened ring; and from this the nerves that supply the organs of sense invariably originate. This mass, or *ganglion*, must undoubtedly be regarded as the representative of the brain; for in the most highly organized animals of the Division, the Squids and Cuttles (*Cephalopoda*), this encirling mass is enclosed and defended by a case of cartilage, the lingering rudiment of a bony skull.

The accompanying engraving, which is copied from Professor Grant's "Outlines of Comparative Anatomy," will give the reader an idea of the system of nerves and ganglia, with some of the other organs, as they appear in *Bulla lignaria*, a large and handsome shelled Mollusk found on the British coasts.

In the above figure the chief ganglion forms a ring, (marked *ee,*); anterior to this there is a small ganglion, not seen, because situated below the bulb of the gullet (*a*), just before the insertions of its diverging muscular bands (*c*), and behind the salivary glands (*b*). The brain-ring (*e*) has on each side a large three-lobed ganglion (*f*), whence numerous nerves pass to the surrounding parts, and two long branches (*h*) extend backwards along the sides of the abdomen, to two ganglia (*i*,*i*), placed above the muscular



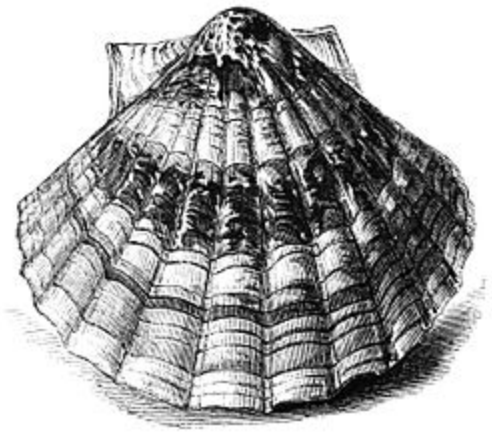
foot.

NERVES OF BULLA Behind these are two sympathetic ganglia, (*k*, *k*), which send threads to the digestive system, the ovary (*o*), the oviduct (*p*), the uterine sac (*q*) , the vulva (*m*), and the urinary organs (*n*). This may be considered as a fair average sample of the nervous system in the MOLLUSCA, being selected from a Class presenting neither the highest, nor the lowest forms of organization.

The nervous centres are, for the most part, grouped without regard to symmetry, those of one side not corresponding to those of the other; and this irregularity is characteristic of the whole Division, not only in the nerves, but in the other organs of the body. Some zoologists have derived from this peculiarity, a name for the Division, sufficiently expressive, though too uncouth for general adoption, that of HETEROGANGLIATA.[1]

All the senses common to the higher animals are found in the MOLLUSCA, though some are, doubtless, wanting in the humbler Classes of the Division. In the *Cephalopoda*, the organs of sight and hearing are distinct and well developed, and Professor Owen is of opinion that the Nautilus, an animal of this Class, possesses an organ of "passive smell." The *Gasteropoda* are almost invariably furnished with eyes; and, according to M. Siebold and other zoologists, with ears also, a pair of round capsules, placed near the bases of the tentacles, and enclosing one or more crystalline globules, called *otolites*. Some of the *Conchifera* are furnished with numerous eyes, placed among the tentacles, examples of which are found in the Clams and Scallops (*Pecten*) of our own shores. I scarcely know a more beautiful sight of the kind, than is presented by the edges of the mantle in one of our Scallops. If you ever have an opportunity of procuring a living specimen, which is not difficult to find at low water, on most of our rocky shores, place it in a glass of sea-water, and watch its movements. Soon the beautiful painted shells will begin to open, and the fleshy mantle will be seen to occupy the interval, like a narrow veil extending perpendicularly from each shell. The edge of each of these veils will now be seen, if you examine it with a pocket lens, to be fringed with long white threads, which are the tentacles, or organs of touch; and amongst them lie scattered a number of minute points, having the most brilliant lustre, and bearing a close resemblance to tiny gems. Indeed, the mantle has been aptly compared to one of those pincushions which are frequently made between pairs of these very shells, the eyes representing a double

row of diamond-headed pins, set round the middle. It is observable that the Bivalves, which are thus profusely furnished with eyes, are also



THE GREAT SCALLOP.

endowed with the faculty of precise and vigorous motion. It does not appear clear that any of this Class possesses a distinct sense of hearing.

The faculty of taste is plausibly *conjectured*, rather than *proved*, to belong to the MOLLUSCA. "It seems necessary," says Dr. Johnston, "to suppose the existence of this sense in all Mollusca, for they select particular articles of food in preference to others; and we know no other sense which is fitted to regulate the choice." The organs appropriated to this faculty are probably the margins and internal surface of the mouth, and the tentacles which in some species are placed close to this orifice.

Every one who has touched a crawling Slug or Snail, must have had a practical proof of the delicacy of its sense of touch. The whole surface of the body, invested with a soft, flexible, and mucous skin, contracts on the slightest contact with any unexpected substance, and is, doubtless,

an extended organ of feeling, probably much more sensitive than the naked skin of our bodies. But, besides this, most, if not all of these animals are furnished with organs of special touch called tentacles, which serve to collect and convey impressions of the proximity, the form, the hardness, and perhaps other qualities, of those bodies which the animals may desire to investigate. The mantle, also, in many of the *Gasteropoda*, is fringed with a number of filaments, often curiously branched, which are probably accessary organs of touch.

The sensitiveness manifested by some of the large *Gasteropoda*, the great Conchs of the West Indies, for example, to the presence of other bodies, even without contact, and which the Rev. Lansdown Guilding attributed to the sense of *hearing*, may, perhaps, rather be considered as a modification of *feeling*, capable of appreciating the pulsations of the atmosphere. The experiments of this naturalist, not to be vindicated from the charge of cruelty, are thus described. "I lately suspended," he says, "a number of large *Strombi* by the spire, that the animal, when dead, might fall from the shell. They had remained in this situation several days, till the body, weak and emaciated, hung down nearly a foot from the aperture, and the eyes had become dim. I found that even before my shadow could pass over them, they were aware of my presence, and endeavoured to withdraw into the shell. I then cut off the eyes, with the thick cartilaginous tentacula in which they were lodged, but the animals still continued to be sensible of my near approach, while hanging in this mutilated and painful condition."[2] Dr. Johnston records a manifestation of feeling,

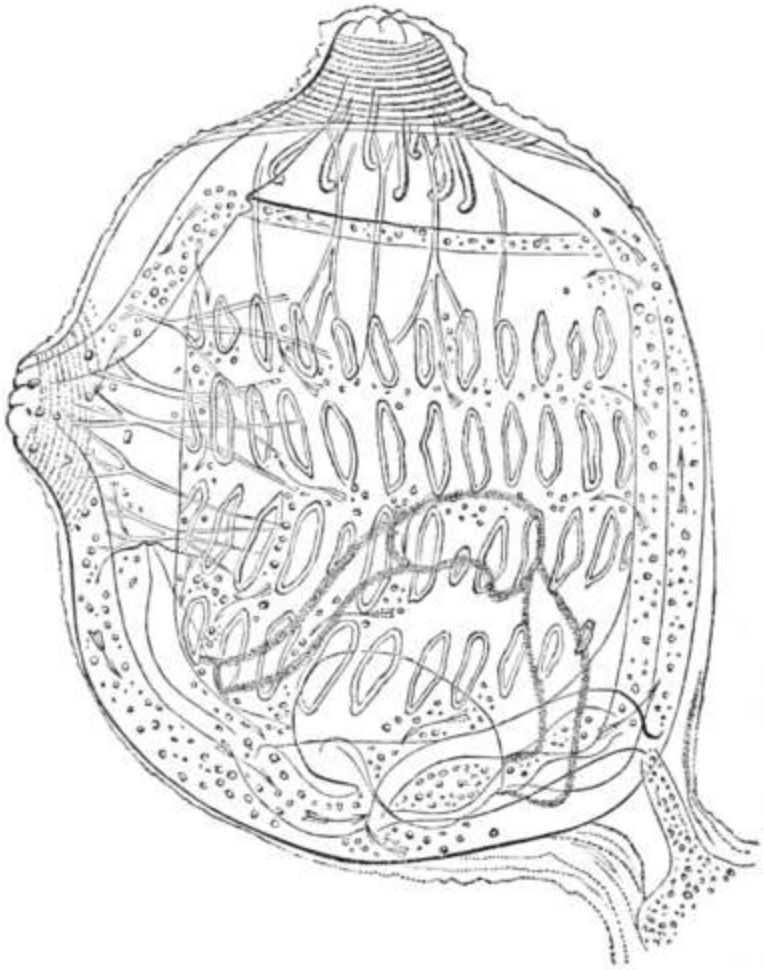
somewhat analogous to this, in one of the common shellfish of our sandy shores. "On a summer evening," he remarks, "I have observed the common Spout-fish (*Solen siliqua*), extended along the surface of the fine sand in which they burrow, enjoying, apparently, the calmness and mildness of the season, take alarm and instantaneously descend when I was yet distant several yards: and I can explain this and similar facts only on the supposition of the existence of a sense of touch feelingly alive to impressions impalpable to our grosser sense."[3]

The respiration is aquatic in most of the MOLLUSCA. The breathing organs, in most cases, resemble in essential points the gills of fishes, consisting of a great number of leaves, often minutely subdivided. They are chiefly formed of blood-vessels, covered with rows of vibrating *cilia*, by the constant motion of which, currents of water are perpetually hurled along the entire surface of the breathing organ, communicating oxygen, the vital principle, to the blood as they go, through the thin walls of the vessels. In many species, as the Bivalves, the gills form two large comb-like plates; in others they are arranged in the form of a feather; a beautiful tribe, known as naked-gilled, have these organs placed on the outside of the body, sometimes forming prominent warts or *papillœ*, disposed in rows, or in tufts, sometimes resembling little branching trees, and at others, arranged as a number of elegant plumes, set, like the petals of an exquisite flower, around a circle.

In the *Tunicata*, examples of which may be found on our rocky beaches, closely adhering to the under surface of stones at low water, and looking like shapeless masses of a

substance something between gristle and jelly,—the breathing organ is developed to a very great extent. It occupies a capacious chamber in the interior of the animal, the two sides of which are studded on their inner surfaces with little oval cells, arranged in a regular pattern of rows. Each of these cells is formed by an oval ring of *cilia*, which, when in full play, present a most beautiful and interesting spectacle. The accompanying figure, taken from the life, is a magnified representation of a tiny creature, not larger than a pin's head, but as transparent as the purest crystal. The oblong rings conspicuously seen are the ciliary cells of the breathing organ; but no figure can convey an adequate impression of the beauty of the sight, when the observer gazes upon forty or more of these ovals, all set round their interior with what look like the cogs on a watch-wheel, dark and distinct, running round and round with an even, moderately rapid, ceaseless motion.

One large tribe of the *Gasteropoda* comprises animals, however, which breathe air, and are terrestrial in their habits. Of these the Slugs and Snails of our fields and gardens afford familiar examples. The delicately-formed, and often brilliantly-painted shells, which throng the damp woods in tropical countries, likewise belong to this group, and furnish the most highly prized treasures of our conchological cabinets. In these the air is



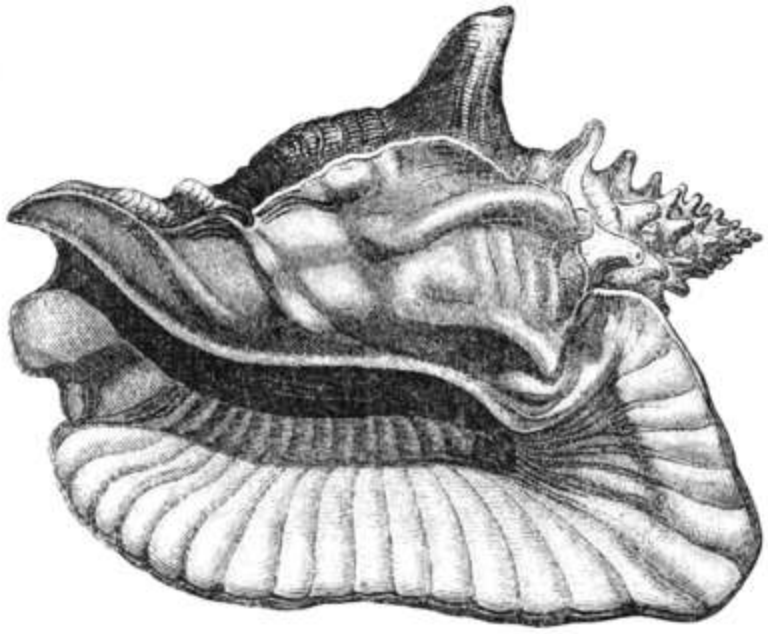
PEROPHORA.

inhaled into an ample chamber, the interior of which is lined with *cilia*. After parting with its oxygen, it is again expelled; the common orifice for both processes being situated on the side of the body. Any one may have ocular evidence of the existence of this organ, by watching our common Garden Snail. If you look at its right side, just behind the tentacle, or horn, that carries a black eye at its point, you will see a large hole suddenly open, where before there was no trace of it. After remaining open for a few moments, the margin will leisurely contract again, until it is perfectly closed, and as invisible as before. This is the

breathing orifice; and during the interval that you saw it open, the aerial contents of the chamber were expelled, and a copious draught of fresh air was inspired. The process is repeated with tolerable regularity about once every fifteen seconds.

The blood in the MOLLUSCA is thin, transparent, and colourless; or at most presents only a pale bluish-white hue. It is, however, contained in a system of distinct vessels, through which it circulates, having for the source of its motion a well-developed, complex, pulsating heart.

Besides the system of vessels which carry the blood, there is another system, most conspicuous in the aquatic tribes, which has been called the *system of aqueducts*. They communicate with the element in which the animal lives and moves, and are filled with it at will, as the galleries and canals of a sponge are filled with the liquid in which it is immersed. The chief use of these water-canals appears to be the distension and expansion of the foot, to render it better fitted for locomotion, yet so as not to interfere with the privilege, essential to most of these animals, of withdrawing the whole of the body within a shell. Some of the marine Mollusca, when in a state of activity, protrude a soft foot, far exceeding in dimensions the whole bulk of the shell; yet let the creature be disturbed, and the whole is suddenly withdrawn into the cavity, so completely that not a trace of it is visible. "When shrunk within its shell," observes Dr. Johnston, "you might well deem any animal that could hide itself there, all too small and weak to carry about a burden larger and heavier than itself,



THE GIANT STROMBUS.

and that safety might be here advantageously exchanged for relief from so much heaviness of armour, and from such an impediment to every journey. There is in my small cabinet a fine specimen of *Cassis tuberosa*, which measures fully ten inches in length, and upwards of eight in breadth, another of *Strombus gigas* is nearly one foot in length. The weight of the former is four pounds two ounces; that of the latter, four pounds nine ounces; yet the snail creeps under this load at apparent ease. Nor are you much surprised when you see it actually in motion, for the seeming disproportion between the contained animal and containing shell has disappeared. On issuing from its shell, like an Eastern Genii freed from his exorcism, the animal has grown visibly, — has assumed a portlier size and more pedestrious figure. The body has suddenly become tumid and elastic, the skin and exterior organs stretched and displayed, the foot has grown in length and in breadth, and,

with additional firmness, it has acquired at the same time the capability of being directed, bent, and modified in shape, to a considerable degree, as the surface of the road traversed may require. Thus it is with nearly all the cephalous mollusca; and by a similar disposition of aqueducts, the foot of the Bivalves is equally adapted to every act subservient to their locomotion and more especially to the act of burrowing; for had the foot not been so framed as to permit of an enlargement superior to the size of the shell, it seems obvious that the furrow could not have been made large enough to contain the latter. The same, too, with many Gasteropods which burrow in the sand when in search of prey. The *Buccina* and most carnivorous mollusca have this ability, dependent on the system of aqueducts we have been describing; and you must observe, that from the manner in which the shell is attached to the body by the large retractor muscle, it so happens that this is drawn into the furrow always with the notch in the aperture uppermost, so that, when completely buried, the animal is still enabled to communicate with the water by its respiratory siphon."[4]

Beyond the rudimentary strip of cartilage that in some of the *Cephalopoda* represents the vanishing spine of the VERTEBRATA, the MOLLUSCA have no internal skeleton. But in the great majority of cases, the soft parts are protected and supported by what we may call an external skeleton, of the substance familiar to us as *shell*. Lime is the essential element of this substance, as it is also of bone: but *shell* is a *carbonate* of lime, while the earthy part of bone is a *phosphate*.

When we consider the beauty and variety that are presented by shells, the important part they play in the economy and habits of the animals, and the use that is made of them in systematic arrangement, it becomes a question of high interest to inquire in what manner they are formed.

"The shells themselves are absolutely deprived of vitality, permeated by no vessels, and as incapable of expansion by any internal power as the rocks to which they are not uncommonly attached; so that the young naturalist is necessarily at a loss to conceive either the mode of their formation, or the origin of all the gaudy tints and external decorations that render them the ornaments of our cabinets.

"The simple apparatus by means of which shells are constructed, is the external membranous layer that invests the body of the mollusk,—the mantle, as it has been termed; and, whatever the form of the shell, it owes its origin entirely to this delicate organ. . . . .

"It is the circumference, or thickened margin of the mantle alone which provides for the increase of the shell in superficial extent. On examining this part, it is found to be of a glandular character, and moreover not unfrequently provided with a delicate and highly sensitive fringe of minute tentacula. Considered more attentively, it is seen to contain in its substance patches of different colours, corresponding both in tint and relative position with those that decorate the exterior of the shell.

"When the animal is engaged in increasing the dimensions of its abode, the margin of the mantle is

protruded, and firmly adherent all round to the circumference of the valve with which it corresponds. Thus circumstanced, it secretes calcareous matter, and deposits it in a soft state upon the extreme edge of the shell, where the secretion hardens and becomes converted into a layer of solid testaceous substance. At intervals this process is repeated, and every newly-formed layer enlarges the diameter of the valve. The concentric strata thus deposited remain distinguishable externally, and thus the lines of growth marking the progressive increase of size may easily be traced.

"It appears that at certain times the deposition of calcareous substance from the fringed circumference of the mantle is much more abundant than at others: in this case ridges are formed at distinct intervals; or, if the border of the mantle at such periods shoots out beyond its usual position, broad plates of shell, or spines of different lengths, are secreted, which, remaining permanent, indicate, by the interspaces separating successively deposited growths of this description, the periodical stimulus to increased action that caused their formation.

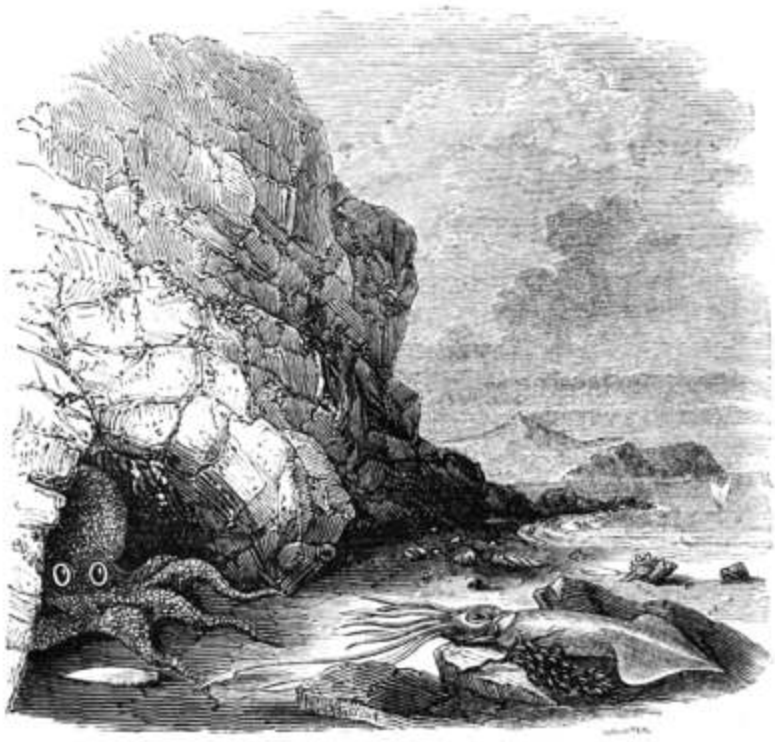
"Whatever thickness the shell may subsequently attain, the external surface is thus exclusively composed of layers deposited in succession by the margin of the mantle, and, seeing that this is the case, nothing is more easy than to understand how the colours seen upon the exterior of the shell are deposited, and assume that definite arrangement characteristic of the species. We have already said that the border of the mantle contains, in its substance, coloured spots: these, when minutely examined, are found to be of a

glandular character, and to owe their peculiar colours to a pigment secreted by themselves; the pigment so furnished being therefore mixed up with the calcareous matter at the time of its deposition, coloured lines are found upon the exterior of the shell wherever these glandular organs exist. If the deposition of colour from the glands be kept up without remission during the enlargement of the shell, the lines upon its surface are continuous and unbroken; but if the pigment be furnished only at intervals, spots or coloured patches of regular form, and gradually increasing in size with the growth of the mantle, recur in a longitudinal series wherever the paint secreting glands are met with. . . . .

"While the margin of the mantle is thus the sole agent in enlarging the *circumference* of the shell, its growth in *thickness* is accomplished by a secretion of a kind of calcareous varnish, derived from the external surface of the mantle generally; which, being deposited layer by layer over the whole interior of the previously existing shell, progressively adds to its weight and solidity. There is, moreover, a remarkable difference between the character of the material secreted by the marginal fringe, and that furnished by the general surface of the pallial membrane; the former we have found to be more or less covered by glands appointed for the purpose, situated in the circumference of the mantle, but as these glands do not exist elsewhere, no colouring matter is ever mixed with the layers that increase the thickness of the shell, so that the latter always remain of a delicate white hue, and form the well-known iridescent material usually distinguished by the name of *nacre*, or *mother of pearl.*"[5]

This lucid description of the process specifically applies to the *Conchifera*, or Bivalves; but the formation of the shell in the *Gasteropoda* is not marked by any important point of difference.

No species of this great Division of animals is furnished with *limbs*, properly so called: unless we may consider as such the long flexible tentacular arms of the Poulpes and Cuttles (*Cephalopoda*) which are used as instruments of an ungainly sort of crawling, as well as for seizing prey and dragging it to the mouth: yet various modes of locomotion are by turns practised among the MOLLUSCA. In one extensive Class, the *Gasteropoda*, of which the Limpet and the Snail are examples, an even gliding movement is that which is most characteristic; a broad expanded muscular disk, called the foot, being applied to the surface over which the animal crawls. Many of the aquatic members of the Class are able to float at the surface by the aid of the same organ. They crawl to the top of the water up the stem of a plant, or the side of a rock, and stretching out the bottom of the foot along the surface, *the back being downward*, it presently dries by contact with the air. While it remains dry, it will float the animal, which then glides along as if on a solid body, *crawling* in fact, *on the inferior surface of the air*: but if by any agitation of the water, or by the will of the animal, the foot become overflowed, the state of suspension is ended, and the creature falls to the



POULPE AND CALAMARY.

bottom. The Pond-snails (*Limneus*), with olive-coloured fragile shells, that inhabit every little pool and lakelet, may be seen in a summer's day, by scores, enjoying the air in this manner.

The wide ocean between the tropics is inhabited by a shell, resembling in appearance that of a Snail, but tinged with blue (*Ianthina*), which is furnished with an elaborate apparatus for swimming,—

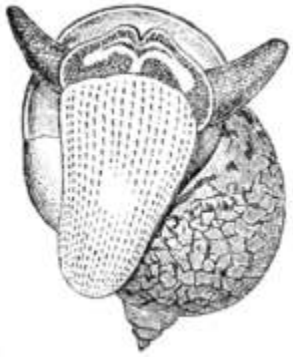
"Like little wanton boys that swim on bladders."

To the hinder part of the foot is attached a kind of float, consisting of many small bladders of thin membrane, united in a group, and looking somewhat like coarse froth. By means of these, the shell floats securely on the broad sea.

Another bladder-swimmer, and like the former, an ocean-species, is the *Litiopa*. "This is a small snail, born amid the

gulf-weed, where it is destined to pass the whole of its life. The foot, though rather narrow and short, is of the usual character, and, having no extra hold, the snail is apt to be swept off its weed; but the accident is provided against, for the creature, like a spider, spins a thread of the viscous fluid that exudes from the foot, to check its downward fall, and enable it to regain the pristine site. But suppose the shock has severed their connexion, or that the Litiopa finds it necessary to remove, from a deficiency of food, to a richer pasture, the thread is still made available to recovery or removal. In its fall, accidental or purposed, an air-bubble is emitted, probably from the branchial cavity, which rises slowly through the water, and as the snail has enveloped it with his slime, this is drawn out into threads as the bubble ascends; and now, having a buoy and bladder whereon to climb to the surface, it waits suspended until that bubble comes into contact with the weeds that everywhere float around."[6]

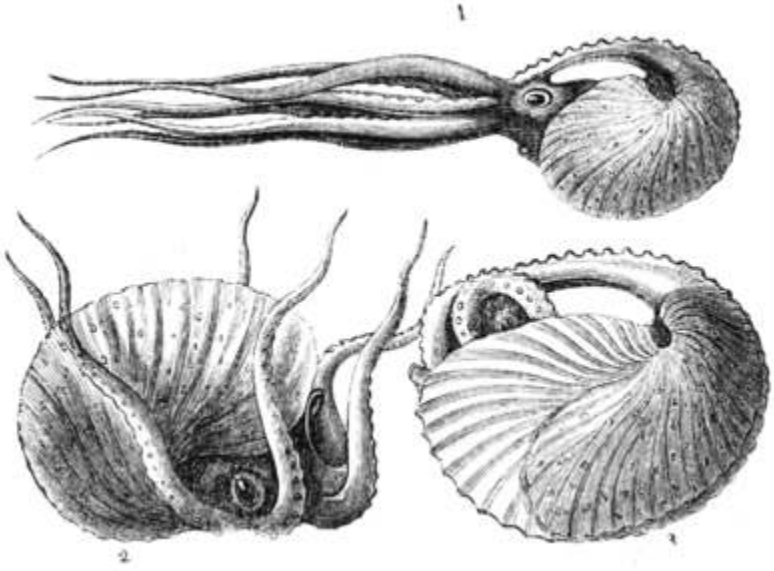
A species of *Cerithium*, found at the mouths of rivers in tropical countries, has the silkworm-like habit of spinning threads, by which it suspends itself from the mangrove-roots; and our own, freshwater Snails have the power of suspending themselves in the same manner. Mr. Warington, in an interesting paper on the habits of some aquatic animals kept in confinement, thus records the curious fact:—



LIMNEUS AURICULARIS."In watching the movements of the *Limnei*, I was for some time under the impression that they had a power of swimming or sustaining themselves in the water, as they would rise from the bottom of the pond, a portion of the rockwork, or a leaf of the plants, and float for a considerable period, nearly out of their shells, without any apparent attachment, and by the contortions and gyrations of their body and shell, move some little distance, in a horizontal direction, from the point which they had left. On more carefully watching this phenomenon, however, I found they were attached by a thread or web, which was so transparent as to be altogether invisible, and which they could elongate in a similar way to the spider: they also possessed the power of returning upon this thread by gathering it up, as it were, and thus drawing themselves back to the point which they had quitted. These facts were clearly proved in the following manner: A *Limneus stagnalis* had glided its way along a young and short leaf of the *Vallisneria*, which terminated below the surface of the water, and having reached the extremity, launched itself off from it; after moving about with a sort of swimming or rolling motion in a horizontal direction for some time it lowered itself gradually, and in effecting this, the long flexible leaf of the *Vallisneria* was bent with an undulating motion,

corresponding exactly with every movement of the snail, clearly showing that it had a firm attachment to the extremity of the leaf. On another occasion a *L. glutinosus* gradually rose from the surface of a piece of submerged rock, and when at the distance of about three or four inches from it, stayed its progress, floating about in a circumscribed horizontal direction for some time; at last it rose suddenly and rapidly to the surface, evidently from the rupture of its thread of attachment. The most convincing proof, however, of this fact, that I can, perhaps, adduce, and one that I have often repeated with all the before-mentioned *Limnei*, is that when the snail has been some inches distant from the supposed point of attachment, a rod or stick has been carefully introduced, and slowly drawn on one side between them in a horizontal direction, and by this means the snail can be made to undulate to and fro, obeying exactly the movement of the rod: this requires to be done very gently, as, if too much force is used, the web is broken, and the snail rises rapidly to the surface."[7]

The wide expanse of ocean from the equator to the poles is tenanted by a class of swimmers, small, indeed, in the number of its species, but countless in the hosts of individuals of which they are composed; the *Pteropoda*. Some of these inhabit shells, which for delicacy and transparency, exeel the thinnest glass. They possess a pair of large membranous fins, which closely resemble the wings of a butterfly, and by using these organs in a flapping manner, the little animals swim briskly about.



PAPER NAUTILUS.

Perhaps some of my readers will expect me to include the beautiful Paper Nautilus (*Argonauta*), among swimming Mollusks; seeing that the poets have claimed for it the honour of teaching navigation to man:—

"Learn of the little Nautilus to sail,
Spread the thin oar, and catch the rising gale."—POPE.

Montgomery, the poet of the ocean, thus beautifully expresses the popular notions concerning it:—

"Light as a flake of foam upon the wind,
Keel upward from the deep, emerged a shell.
Shaped like the moon ere half her horn is fill'd;
Fraught with young life, it righted as it rose,
And moved at will along the yielding water.
The native pilot of this little bark
Put out a tier of oars on either side,
Spread to the wafting breeze a twofold sail,
And mounted up, and glided down the billow,
In happy freedom, pleased to feel the air,
And wander in the luxury of light." — PELICAN ISLAND.

The accuracy of modern research, however, has proved this to be but a pleasant fable. The Argonaut is a Cuttle-fish, and crawls along the bottom, like its fellows, by means of its slender, flexible, tentacular arms, as represented in the preceding engraving, (fig. 2); while the pair that are furnished with a broad fleshy disk, have an office very different from that of sails, namely, that of forming, repairing, and protecting the thin and papery shell. (See fig. 3.) Its only swimming power appears to be that which it possesses in common with all *Cephalopoda*, of shooting along in a backward direction, by the force of a jet of water from the funnel, as shown at fig. 1, where it is represented as swimming towards the point *a*.

Among the TUNICATA there are some singular tribes which swim freely in the sea. "The *Salpœ*, translucent as their native waters, and often united in chains, after a pattern peculiar to each species, are driven along the surface with considerable quickness by alternate contractions and expansions, and by the propulsion they receive from a current of water, which is made continually to traverse the long diameter of the body, sucked in by the posterior aperture, and issuing in a stream through that on the side of the mouth. Hence the body is always pushed backwards—a circumstance that has misled some naturalists to describe the posterior aperture for the true mouth. The *Pyrosomata* are a still more singular family of the same order. Each seeming individual of this genus is, in fact, a numerous colony of little mollusca, every one in its own cell, distinct, yet inseparably connected with its fellows. Collected into the figure of a gelatinous cylinder, open at one extremity and

closed at the other, and roughened externally by a multitude of tubercles disposed sometimes in rings and sometimes irregularly, they float in the Australian seas like stars of this lower world, shedding around them a halo of light, brilliant indeed, but surpassed in beauty by those other colours of the creatures which it serves to disclose; colours which come and go at pleasure, glorying as it were, in their subtle changes, passing rapidly from a lively red to aurora, to orange, to green, and to azure blue; a magic scene, compelling more than the admiration of every beholder."[8]

Bivalve Mollusca in general have much less power of shifting their locality than Univalves. Many appear to be absolutely stationary, at least during their adult existence. But others, as the Cockle, have a most versatile organ, known as the foot, capable of being protruded from between the valves, which, among its various uses, serves the purpose of locomotion. It is in general applied in this manner. Being stretched out to its utmost extent, its point is made to hook downward into the sand or mud, and the body with the shell is then dragged down by the muscular contraction of the foot. In most cases, this mode of progression is sufficiently slow and awkward, but some of the sand-borers are able to conceal themselves thus with surprising rapidity.

Others of this Class are vigorous leapers; and of some the bounds are so vivacious, forcible and sudden, that they might almost be compared with the flight of a bird, or the shooting of a fish. The Clams or Scallops *(Pecten)* and their elegant relatives the *Limæ*, are eminent among our native