the egg is entirely unknown, that of Chiton only partially. Impregnation is effected when the eggs have been discharged and are lying beneath the mantle-skirt. A trochosphere larva is developed from the Diblastula of Chiton (Loven).

The Chitons are found in the littoral zone in all parts of the world, and are exclusively marine. Neomenia, Proneomenia, and Chætoderma have hitherto been dredged from considerable depths (100 fathoms and upwards) in the North Sea, Proneomenia also in the Mediterranean (Marion).

Sub-class 2.—GASTROPODA ANISOPLEURA.

Characters.—Gastropoda in which, whilst the head and foot retain the bilateral symmetry of the archi-Mollusca, the visceral dome, including the mantle-flap dependent from it, and the region on which are placed the ctenidia, anus, generative and nephridial apertures, have been subjected to a ROTATION tending to bring the anus from its posterior median position, by a movement along the right side, forwards to a position above the right side of the animal's neck, or even to the middle line above the neck. This torsion is connected mechanically with the excessive vertical growth of the visceral hump and the development upon its surface of a heavy shell. The SHELL is not a plate enclosed in a shell-sac, but the primitive shell-sac appears and disappears in the course of embryonic development, and a relatively large nautiloid shell (with rare exceptions) develops over the whole surface of the visceral hump and mantle-skirt. Whilst such a shell might retain its median position in a swimming animal, it and the visceral hump necessarily fall to one side in a creeping animal which carries them uppermost.

The shell and visceral hump in the Anisopleura incline

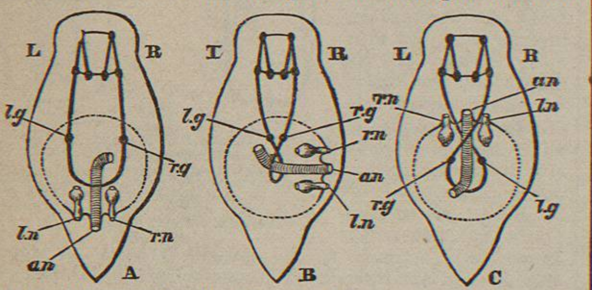


FIG. 19.—Diagram to show the effect of torsion or rotation of the visceral hump in Gastropoda, when the visceral nerve commissure passes above the intestine; *A*, unrotated ancestral condition; *B*, quarter-rotation; *C*, complete semi-rotation (the limit); *L*, left, *R*, right side of the animal; *an*, anus; *ln*, *rn*, primarily left nephridium and primarily right nephridium; *lg*, primarily left (subsequently the sub-intestinal) visceral ganglion; *rg*, primarily right (subsequently the sub-intestinal) visceral ganglion. The dotted circle indicates the basal area of the visceral hump which undergoes rotation.

normally to the right side of the animal. As mechanical results, there arise a one-sided pressure and a one-sided strain, together with a one-sided development of the muscular masses which are related to the shell and foot. Both the TORSION THROUGH A SEMICIRCLE of the base of the visceral dome and the continued leiotropic spiral growth of the visceral dome itself, which is very usual in the Anisopleura, appear to be traceable to these mechanical conditions. ATROPHY of the representatives on one side of the body of paired organs is very usual. Those placed primitively on the left side of the rectum, which in virtue of the torsion becomes the right side, are the set which suffer (see fig. 19). Some Anisopleura, after having thus acquired a strongly-marked inequilateral character in regard to such organs as the ctenidia, nephridia, genital ducts, heart, and rectum, appear by further change of conditions of growth to have acquired a superficial bilateral symmetry, the secondary nature of which is revealed by anatomical examination (Opisthobranchia, Natantia).

In all groups of Anisopleura examples are numerous in which the shell is greatly developed, forming a "house" into which the whole animal can be withdrawn, the entrance being often closed by a second shelly piece carried upon the foot (the operculum). The power of rapidly extending and of again contracting large regions of the body to an enormous degree is usual, as in the Lipocephalous Mollusca. In spite of the theories which have been held on this matter, it appears highly probable that no fluid from without is introduced into the blood, nor is any expelled during these changes of form. A large mucous gland with a median pore is usually developed on the ventral surface of the foot, comparable to the similar gland and pore in Lipocephala, and in some cases (*e.g.*, Pyrula, fig. 37, B) this has been mistaken for a water-pore.

FIG. 20.—Nervous system of Aplysia, as a type of the long-looped Euthyneurous condition. The untwisted visceral loop is lightly shaded. *ce*, cerebral ganglion; *pl*, pleural ganglion; *pe*, pedal ganglion; *ab. sp*, abdominal ganglion, which represents also the supra-intestinal ganglion of Streptoneura and gives off the nerve to the osphradium (olfactory organ) *o*, and another to an unlettered so-called "genital" ganglion. The buccal nerves and ganglia are omitted. (After Spengel.)

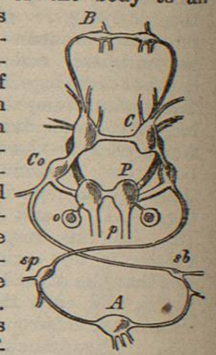


FIG. 21.—Nervous system of Paludina as a type of the Streptoneurous condition. *B*, buccal (sub-œsophageal) ganglion; *C*, cerebral ganglion; *Co*, pleural ganglion; *P*, pedal ganglion with otocyst attached; *p*, pedal nerve; *A*, abdominal ganglion at the extremity of the twisted visceral "loop"; *sp*, supra-intestinal visceral ganglion on the course of the right visceral cord; *sb*, sub-intestinal ganglion on the course of the left visceral cord. (From Gegenbaur, after Jhering.)

The leiotropic torsion of the visceral dome has had less deep-seated effect in one series of Anisopleura than in another. Accordingly, as the loop formed by the two VISCERAL NERVES (fig. 19) is or is not caught, as it were, in the twist, we are able to distinguish one branch or line of descent with straight visceral nerves—the EUTHYNEURA

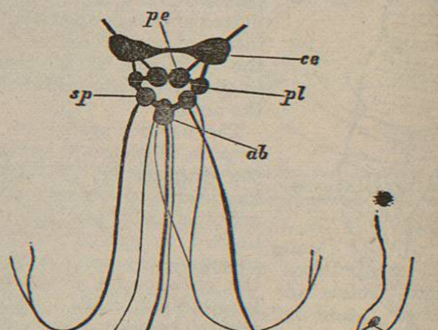


FIG. 22.—Nervous system of the Pond-Snail, *Limnæus stagnalis*, as a type of the short-looped Euthyneurous condition. The short visceral "loop" with its three ganglia is lightly-shaded. *ce*, cerebral ganglion; *pe*, pedal ganglion; *pl*, pleural ganglion; *ab*, abdominal ganglion; *sp*, visceral ganglion of the left side; opposite to it is the visceral ganglion of the right side, which gives off the long nerve to the olfactory ganglion and osphradium *o*. In Planorbis and in Auricula (Pulmonata, allied to Limnæus) the olfactory organ is on the *left* side and receives its nerve from the *left* visceral ganglion. (After Spengel.)

(fig. 20)—from a second branch with the visceral nerves

twisted into a figure-of-eight—the STREPTONEURA (fig. 21). Probably the Euthyneura and the Streptoneura have developed independently from the ancestral bilaterally symmetrical Gastropods. The escape of the visceral nerve-loop from the torsion depends on its having acquired a somewhat deeper position and shorter extent, previously to the commencement of the phenomenon of torsion, in the ancestors of the Euthyneura than in those of the Streptoneura. The junction of the two halves of the visceral loop in the Euthyneura is below the anus, and the loop is therefore not caught by the intestine. In the Streptoneura the junction is (as in the Isopleura) above the anus.

Branch *a*.—*STREPTONEURA* (Spengel, 1881).

Characters.—Gastropoda Anisopleura in which the visceral "loop" (the conterminous visceral nerves) embraces the intestine and therefore shares in the torsion of the visceral hump, the right cord crossing above the left so as to form a figure-of-eight (see fig. 19).

The Streptoneura comprise two orders — the Zygobranchia and the Azygobranchia.

Order 1.—Zygobranchia.

Characters.—Streptoneura in which, whilst the visceral torsion is very complete so as to bring the anus into the middle line anteriorly or nearly so, the atrophy of the primitively left-side organs is not carried out. The right and left ctenidia, which have now become left and right respectively, are of equal size, and are placed symmetrically on either side of the neck in the pallial space. Related to them is a simple pair of osphradial patches. Both right

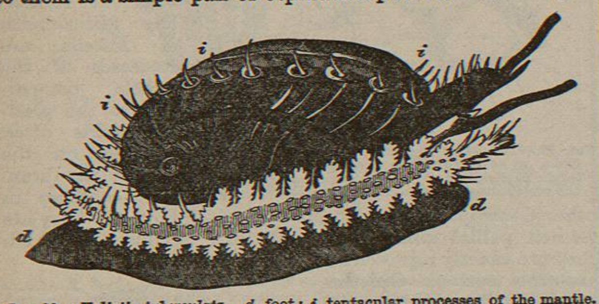


FIG. 23.—*Haliotis tuberculata.* *d*, foot; *i*, tentacular processes of the mantle. (From Owen, after Cuvier.)

and left nephridia are present, the actual right one being much larger than the left. Two auricles may be present right and left of a median ventricle (Haliotis), or only one (Patella). The Zygobranchia are further very definitely characterized by the archaic character of absence of special genital ducts. The generative products escape by the larger nephridium. The sexes are distinct, and there is no copulatory or other accessory generative apparatus. The teeth of the lingual ribbon are highly differentiated (Rhipidoglossate). The visceral dome lies close upon the oval sucker-like foot, and is coextensive with its prolongation in the aboral direction.

The Zygobranchia comprise three families, arranged in two sub-orders.

Sub-order 1. *Ctenidiobranchia.*

Character.—Large paired ctenidia acting as gills.

Family 1.—*Haliotidæ.*
Genera: *Haliotis* (Ear-Shell, Ormer in Guernsey); mostly tropical; *Teinotis.*

Family 2.—*Fissurellidæ.*
Genera: *Fissurella* (Key-hole Limpet) (figs. 24, 36), *Emarginula*, *Parmophorus* (fig. 25); mostly tropical.

Sub-order 2. *Phyllidiobranchia.*

Characters.—Ctenidia reduced to wart-like papillæ; special sub-pallial lamellæ, similar to those of the Opisthobranch Pleurophyllidia, perform the function of gills.

Family 3.—*Patellidæ.*
Genera: *Patella* (Limpet, figs. 26, &c.), *Nacella* (Bonnet-Limpet), *Lottia.*

Further Remarks on Zygobranchia.—The Common Limpet is a specially interesting and abundant example of the remarkable order Zygobranchia. A complete and accurate account of its anatomy has yet to be written. Here we have only space for a brief outline. The foot of the Limpet is a nearly circular disc of muscular tissue; in front, projecting from and raised above it, are the head and neck (figs. 26, 30). The visceral hump forms a low conical dome above the sub-circular foot, and standing out all round the base of this dome so as to completely overlap the head and foot, is the circular mantle-skirt. The depth of free mantle-skirt is greatest in front, where the head and neck are covered in by it. Upon the surface of the visceral dome, and extending to the edge of the free mantle-skirt, is the conical shell. When the shell is taken away (best effected by immersion in hot water) the surface of the visceral dome is found to be covered by a black-coloured epithelium, which may be removed, enabling the observer to note the position of some organs lying below the transparent integument (fig. 27). The muscular columns (*c*) attaching the foot to the shell form a ring incomplete in front, external to which is the free mantle-skirt. The limits of the large area formed by the flap over the head and neck (*ecr*) can be traced, and we note the anal papilla showing through and opening on the right shoulder, so to speak, of the animal into the large anterior region of the sub-pallial space. Close to this the small renal organ (*i*, mediad) and the larger renal organ (*k*, to the right and posteriorly) are seen, also the pericardium (*l*) and a coil of the intestine (*int*) embedded in the compact liver.

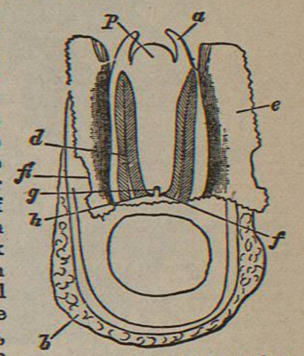


FIG. 24.—Dorsal aspect of a specimen of Fissurella from which the shell has been removed, whilst the anterior area of the mantle-skirt has been longitudinally slit and its sides reflected. *a*, cephalic tentacle; *b*, foot; *d*, left (archaic right) gill-plume; *e*, reflected mantle-flap; *fi*, the fissure or hole in the mantle-flap traversed by the longitudinal incision; *f*, right (archaic left) nephridium's aperture; *g*, anus; *h*, left (archaic right) aperture of nephridium; *p*, snout. (Original.)

On cutting away the anterior part of the mantle-skirt so as to expose the sub-pallial chamber in the region of the neck, we find the right and left renal papillæ (discovered by Lankester (27) in 1867) on either side the anal papilla (fig. 28), but no gills. If a similar examination be made of the allied genus Fissurella (fig. 24, *d*), we find right and left of the two renal apertures a right and left gill-plume or ctenidium, which by their presence here and in Haliotis furnish the distinctive character to which the name Zygobranchia refers. In Patella no such plumes exist, but right and left of the neck are seen a pair of minute oblong yellow bodies (fig. 28, *d*), which were originally described by Lankester as orifices possibly connected with the evacuation of the generative

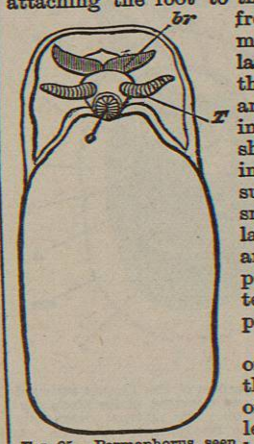


FIG. 25.—Parmophorus, seen from the pedal surface. *o*, mouth; *T*, cephalic tentacle; *br*, one of the two symmetrical gills placed on the neck. (Original.)

products. On account of their position they were termed by him the "capito-pedal orifices," being placed near the junction of head and foot. Spengel (24) has, however, in a most ingenious way shown that these bodies are the representatives of the typical pair of ctenidia, here reduced to a mere rudiment. Near to each rudimentary ctenidium Spengel

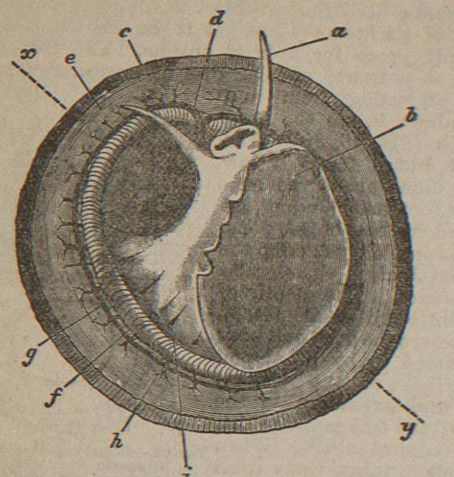


FIG. 26.—The Common Limpet (*Patella vulgata*) in its shell, seen from the pedal surface. *x*, *y*, the median antero-posterior axis; *a*, cephalic tentacle; *b*, plantar surface of the foot; *c*, free edge of the shell; *d*, the branchial efferent vessel carrying aerated blood to the auricle, and here interrupting the circlet of gill lamellæ; *e*, margin of the mantle-skirt; *f*, gill lamellæ (*not* ctenidia, but special pallial growths, comparable to those of Pleurophyllidia); *g*, the branchial efferent vessel; *h*, factor of the branchial advehent vessel; *i*, interspaces between the muscular bundles of the root of the foot, causing the separate areæ seen in fig. 27, *c*. (Original.)

has discovered an olfactory patch or osphradium (consisting of modified epithelium) and an olfactory nerve-ganglion (fig. 32). It will be remembered that, according to Spengel, the osphradium of Mollusca is definitely and intimately related to the gill-plume or ctenidium, being always placed near the base of that organ; further, Spengel has shown that the nerve-supply of this olfactory organ is always derived from the visceral loop. Accordingly, the nerve-supply affords a means of testing the conclusion that we have in Lankester's capito-pedal bodies the rudimentary ctenidia. The accompanying diagrams (figs. 34, 35) of the nervous systems of Patella and of Haliotis, as determined by Spengel, show the identity in the origin of the nerves passing from the visceral loop to Spengel's olfactory ganglion of the Limpet, and that of the nerves which pass from the visceral loop of Haliotis to the olfactory patch or osphradium, which lies in immediate relation on the right and on the left side to the right and the left gill-plumes (ctenidia) respectively. The same diagrams serve to demonstrate the Streptoneurous condition of the visceral loop in Zygobranchia.

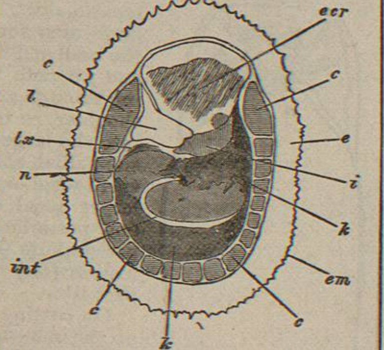


FIG. 27.—Dorsal surface of the Limpet removed from its shell and deprived of its black pigmented epithelium; the internal organs are seen through the transparent body-wall. *c*, muscular bundles forming the root of the foot, and adherent to the shell; *e*, free mantle-skirt; *em*, tentaculiferous margin of the same; *i*, smaller (left) nephridium; *k*, larger (right) nephridium; *l*, pericardium; *lx*, fibrous septum, behind the pericardium; *n*, liver; *int*, intestine; *ecr*, anterior area of the mantle-skirt overhanging the head (cephalic hood). (Original.)

Thus, then, we find that the Limpet possesses a symmetrically-disposed pair of ctenidia in a rudimentary condition, and justifies its position among Zygobranchia. At the same time it possesses a totally distinct series of *functional* gills, which are not derived from the modification of the typical Molluscan ctenidium. These gills are in the form of delicate lamellæ (fig. 26, *f*), which form a series extending completely round the inner face of the depending mantle-skirt. This circlet of gill-lamellæ led Cuvier to class the Limpets as Cyclobranchiata, and by erroneous identification of them with the series of metamerically repeated ctenidia of Chiton, to associate the latter Mollusc with the former. The gill-lamellæ of Patella are processes of the mantle comparable to the plait-like folds often observed on the roof of the branchial chamber in other Gastropoda (*e.g.*, Buccinum and Haliotis). They are termed pallial gills. The only other Molluscs in which they are exactly represented are the curious Opisthobranchs Phyllidia and Pleurophyllidia (fig. 57). In these, as in Patella, the typical ctenidia are aborted, and the branchial function is assumed by close-set lamelliform processes arranged in a series beneath the mantle-skirt on either side of the foot. In fig. 26, *d* the large branchial vein of Patella bringing blood from the gill-series to the heart is seen; where it crosses the series of lamellæ there is a short interval devoid of lamellæ.

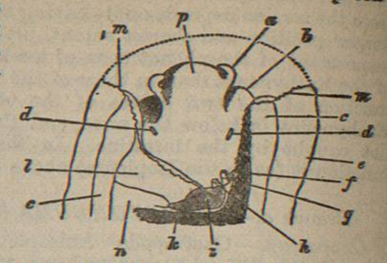


FIG. 28.—Anterior portion of the same Limpet, with the overhanging cephalic hood removed. *a*, cephalic tentacle; *b*, foot; *c*, muscular substance forming the root of the foot; *d*, the capito-pedal organs of Lankester (=rudimentary ctenidia); *e*, mantle-skirt; *f*, papilla of the larger nephridium; *g*, anus; *h*, papilla of the smaller nephridium; *i*, smaller nephridium; *k*, larger nephridium; *l*, pericardium; *m*, cut edge of the mantle-skirt; *n*, liver; *p*, snout. (Original.)

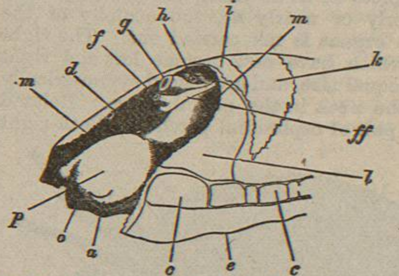


FIG. 29.—The same specimen viewed from the left front, so as to show the sub-anal tract (*ff*) of the larger nephridium, by which it communicates with the pericardium. *o*, mouth; other letters as in fig. 28.

The heart in Patella consists of a single auricle (not two as in Haliotis and Fissurella) and a ventricle; the former receives the blood from the branchial vein, the latter distributes it through a large aorta which soon leads into irregular blood-lacunæ.

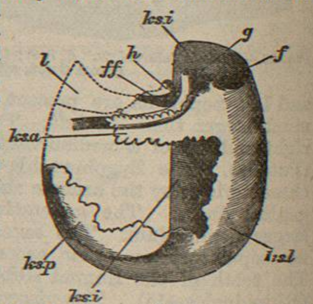


FIG. 30.—Diagram of the two renal organs (nephridia), to show their relation to the rectum and to the pericardium. *f*, papilla of the larger nephridium; *g*, anal papilla with rectum leading from it; *h*, papilla of the smaller nephridium, which is only represented by dotted outlines; *l*, pericardium indicated by a dotted outline,—at its right side are seen the two reno-pericardial pores; *ff*, the sub-anal tract of the large nephridium given off near its papilla and seen through the unshaded smaller nephridium; *ks.a*, anterior superior lobe of the large nephridium; *ks.l*, left lobe of same; *ks.p*, posterior lobe of same; *ks.i*, inferior sub-visceral lobe of same. (Original.)

The existence of two renal organs in Patella, and their relation to the pericardium (a portion of the cœlom), is important. Each renal organ is a sac lined with glandular epithelium (ciliated cells with concretions) communicating with the exterior by its papilla, and by a narrow passage with the pericardium. The connexion with the pericardium of the smaller of the two renal organs was demonstrated by Lankester in 1867, at a time when the fact that the renal organ of the Mollusca, as a rule, opens into the pericardium, and is therefore a typical nephridium, was not known. Subsequent investigations (27) carried on under the direction of the same naturalist have shown that the larger as well as the smaller renal sac is in communication with the pericardium. The walls of the renal sacs are deeply plaited and thrown into ridges. Below the surface these walls are excavated with blood-vessels, so that the sac is practically a series of blood-vessels covered with renal epithelium, and forming a mesh-work within a space communicating with the exterior. The larger renal sac (remarkably enough, that which is aborted in other Anisopleura) extends between the liver and the integument of the visceral dome very widely. It also bends round the liver as shown in fig. 30, and forms a large sac on half of the upper surface of the muscular mass of the foot. Here it lies close upon the genital body (ovary or testis), and in such intimate relationship with it that, when ripe, the gonad bursts into the renal sac, and its products are carried to the exterior by the papilla on the right side of the anus (Robin, Dall). This fact led Cuvier erroneously to the belief that a duct existed leading from the gonad to this papilla. The position of the gonad, best seen in the diagrammatic section (fig. 31), is, as in other Zygobranchia, devoid of a special duct communicating with the exterior. This condition, probably an archaic one, distinguishes the Zygobranchia among all Glossophorous Mollusca.

The digestive tract of Patella offers some interesting features. The odontophore is powerfully developed; the radular sac is extraordinarily long, lying coiled in a space

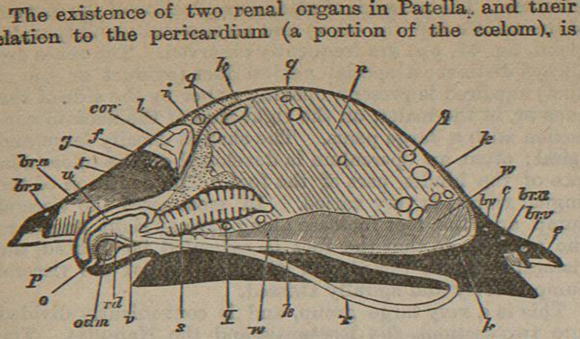


FIG. 31.—Diagram of a vertical antero-postero median section of a Limpet. Letters as in figs. 28, 29, with following additions: *q*, intestine in transverse section; *r*, lingual sac (radular sac); *rd*, radula; *s*, lamellated stomach; *t*, salivary gland; *u*, duct of same; *v*, buccal cavity; *w*, gonad; *br.a*, branchial advehent vessel (artery); *br.v*, branchial efferent vessel (vein); *bv*, blood-vessel; *odm*, muscles and cartilage of the odontophore; *cor*, heart within the pericardium. (Original.)

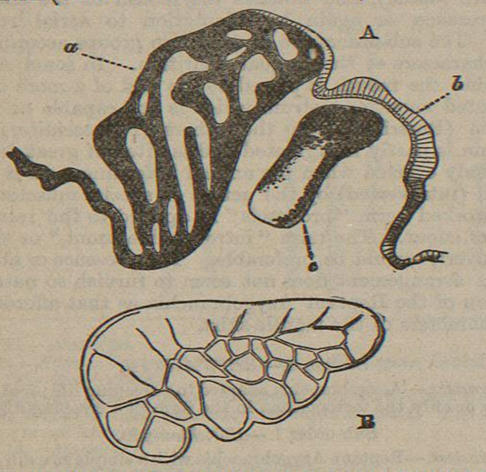


FIG. 32.—A. Section in a plane vertical to the surface of the neck of Patella through *a*, the rudimentary ctenidium (Lankester's organ), and *b*, the olfactory epithelium (osphradium); *c*, the olfactory (osphradial) ganglion. (After Spengel.) B. Surface view of a rudimentary ctenidium of Patella, excised and viewed as a transparent object. (Original.)

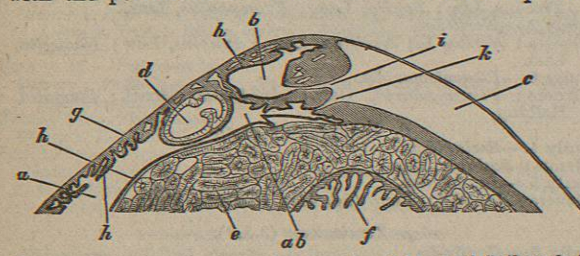


FIG. 33.—Vertical section in a plane running right and left through the anterior part of the visceral hump of Patella, to show the two renal organs and their openings into the pericardium. *a*, large or external or right renal organ; *ab*, narrow process of the same running *below* the intestine and leading by *k* into the pericardium; *b*, small or median renal organ; *c*, pericardium; *d*, rectum; *e*, liver; *f*, manyplies; *g*, epithelium of the dorsal surface; *h*, renal epithelium lining the renal sacs; *i*, aperture connecting the small sac with the pericardium; *k*, aperture connecting the large sac with the pericardium. (From an original drawing by Mr J. T. Cunningham, Fellow of University College, Oxford.)

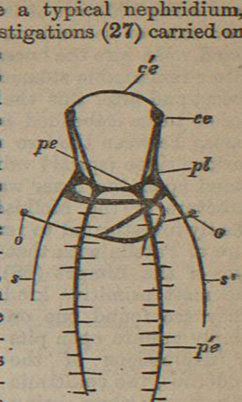


FIG. 34.—Nervous system of Patella; the visceral loop is lightly shaded; the buccal ganglia are omitted. *ce*, cerebral ganglia; *c'e*, cerebral commissure; *pl*, pleural ganglion; *pe*, pedal ganglion; *p'e*, pedal nerve; *s*, *s'*, nerves (right and left) to the mantle; *o*, olfactory ganglion, connected by nerve to the Streptoneurous visceral loop. (After Spengel.)

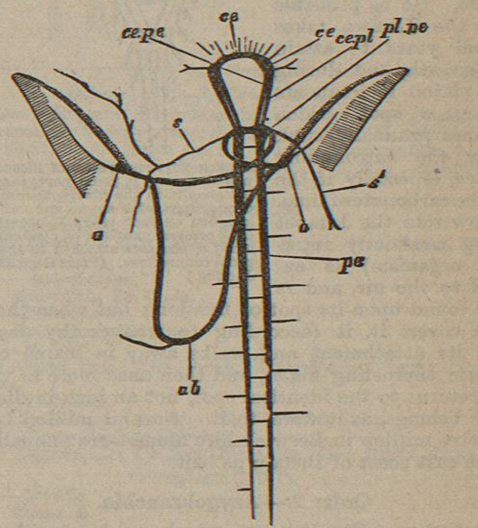


FIG. 35.—Nervous system of Haliotis; the visceral loop is lightly shaded; the buccal ganglia are omitted. *ce*, cerebral ganglion; *pl.pe*, the fused pleural and pedal ganglia; *pe*, the right pedal nerve; *ce.pl*, the cerebro-pleural connective; *ce.pe*, the cerebro-pedal connective; *s*, *s'*, right and left mantle nerves; *ab*, abdominal ganglion or site of same; *o*, *o*, right and left olfactory ganglia and osphradia receiving nerve from visceral loop. (After Spengel.)

between the mass of the liver and the muscular foot. The radula has 160 rows of teeth with twelve teeth in each row. Two pairs of salivary ducts, each leading from a salivary gland, open into the buccal chamber. The œsophagus leads into a remarkable stomach, plaited like the manyplies of a sheep, and after this the intestine takes a very large number of turns embedded in the yellow liver, until at last it passes between the two renal sacs to the anal papilla. A curious ridge (spiral ? valve) which secretes a slimy cord is found upon the inner wall of the intestine. The general structure of the Molluscan intestine has not been sufficiently investigated to render any comparison of this structure of Patella with that of other Mollusca possible. The eyes of the Limpet (**28**) deserve mention as examples of the most primitive kind of eye in the Molluscan series. They are found one on each cephalic tentacle, and are simply minute open pits or depressions of the epidermis, the epidermic cells lining them being pigmented and connected with nerves (compare fig. 118).

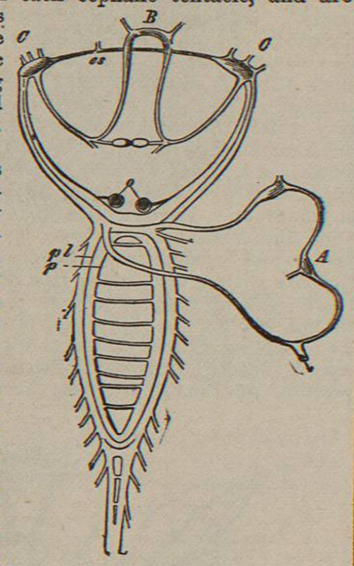


Fig. 36.—Nervous system of Fissurella. *pl*, pallial nerve; *p*, pedal nerve; *A*, abdominal ganglia in the Streptoneurous visceral commissure, with supra- and sub-intestine ganglion on each side; *B*, buccal ganglia; *C*, *C*, cerebral ganglia; *es*, cerebral commissure; *o*, otocysts attached to the cerebro-pedal connectives. (From Gegenbaur, after Jhering.)

The Limpet breeds upon the southern English coast in the early part of April, but its development has not been followed. It has simply been traced as far as the formation of a Diblastula which acquires a ciliated band, and becomes a nearly spherical Trochosphere. It is probable that the Limpet takes several years to attain full growth, and during that period it frequents the same spot, which becomes gradually sunk below the surrounding surface, especially if the rock be carbonate of lime. At low tide the Limpet (being a strictly intertidal organism) is exposed to the air, and is to be found upon its spot of fixation; but when the water again covers it, it (according to trustworthy observers) quits its attachment and walks away in search of food (minute encrusting algæ), and then once more as the tide falls returns to the identical spot, not an inch in diameter, which belongs, as it were, to it. Several million Limpets —twelve million in Berwickshire alone—are annually used on the east coast of Britain as bait.

Order 2.—**Azygobranchia.**

Characters.—Streptoneura which, as a sequel to the torsion of the visceral hump, have lost by atrophy the originally left ctenidium and the originally left nephridium, retaining the right ctenidium as a comb-like gill-plume to the actual left of the rectum, and the right nephridium (that which is the smaller in the Zygobranchia) also to the actual left of the rectum, between it and the gill-plume. The right olfactory organ only is retained, and may assume the form of a comb-like ridge to the actual left of the ctenidium or branchial plume. It has been erroneously described as the second gill, and is known as the parabranchia. The rectum itself lies on the animal's right shoulder. The presence of glandular plication of the surface of the mantle-flap (fig. 46, *x*) and an adrectal gland (purple-gland, fig. 47, *gp*) are frequently observed. The sexes are always distinct; a special genital duct (oviduct or sperm duct) unpaired is present, opening either by the side of the anus or, in the males, on the right side of the neck in connexion with a large penis. The shell is usually large and spiral; often an operculum is developed on the upper surface of the hinder part of the foot. The dentition of the lingual ribbon is very varied. In most cases the visceral hump and the foot increase along axes at right angles to one another, so that the foot is extended far behind the visceral hump in the ab-oral direction, whilst the visceral hump is lofty and spirally twisted.

This is a very large group, and is conveniently divided into two sections, the Reptantia and the Natantia. The former, containing the immense majority of the group, breaks up into three sub-orders, the Holochlamyda, Pneumonochlamyda, and Siphonochlamyda, characterized by the presence or absence of a trough-like prolongation of the margin of the mantle-flap, which conducts water to the respiratory chamber (sub-pallial space where the gill, anus, &c., are placed), and notches the mouth of the shell by its presence, or again by adaptation to aerial respiration. The sub-orders are divided into groups according to the characters of the lingual dentition. In some Azygobranchia the mouth is placed at the end of a more or less elongated snout or rostrum which is not capable of introversion (Rostrifera); in the others (Proboscidifera) the rostrum is partly invaginated and is often of great length. It is only everted when the animal is feeding, and is withdrawn (introverted) by the action of special muscles; the over-worked term "proboscis" is applied to the retractile form of snout. The term "introversible snout," or simply "introvert," would be preferable. The presence or absence of this arrangement does not seem to furnish so natural a division of the Reptant Azygobranchia as that afforded by the characters of the mantle-skirt.

Section *a.*—*REPTANTIA.*

Characters.—Azygobranchia adapted to a creeping life; foot either wholly or only the mesopodium in the form of a creeping disc.

Sub-order 1.—*Holochlamyda.*

Characters.—Reptant Azygobranchia with a simple margin to the mantle-skirt, and, accordingly, the lip of the shell unnotched; mostly Rostrifera (*i.e.*, with a non-introversible snout), and vegetarian; marine, brackish, fresh-water, terrestrial.

a. Rhipidoglossa (x.4 to 7.1.4 to 7.x).

Family 1.—*Trochidæ.*
Genera: *Turbo*, Lin.; *Phasianella*, Lam.; *Imperator*, Montf.; *Trochus*, Lin.; *Rotella*, Lam.; *Euomphalus*, Low.
Family 2.—*Neritidæ.*
Genera: *Nerita*, L.; *Neritina*, Lam.; *Pileolus*, Low; *Navicella*, Lam.
Family 3.—*Pleurotomaridæ.*
Genera: *Pleurotomaria*, Defr.; *Anatomus*, Montf.; *Stomatia*, Helbing.

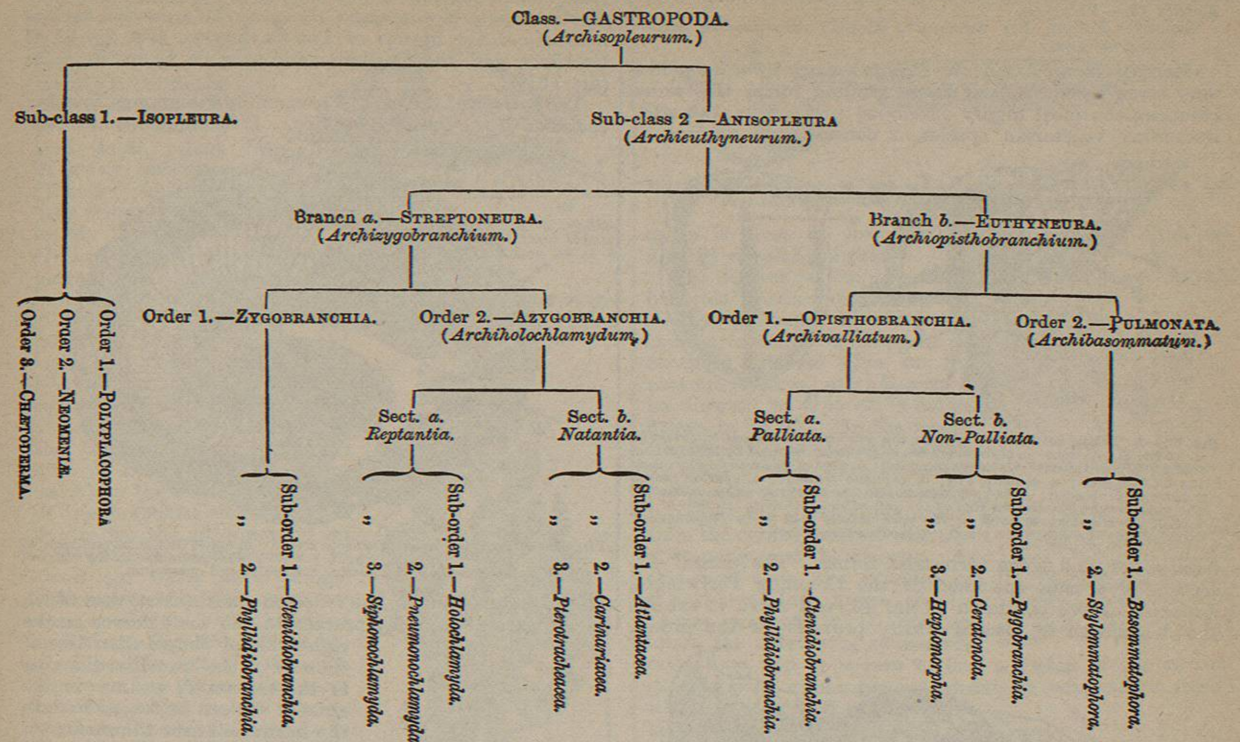
β. Ptenoglossa (x.0.x).

Family 4.—*Scalaridæ.*
Genus: *Scalaria*, Lam.
Family 5.—*Janthinidæ.*
Genera: *Janthina*, Lam. (fig. 44); *Recluzia*, Petit.

γ. Tænioglossa (3.1.3).

Family 6.—*Cerithidæ.*
Genera: *Cerithium*, Brug.; *Potamides*, Brong.; *Nerinæa*, Defr.
Family 7.—*Melanidæ.*
Genera: *Melania*, Lam.; *Melanopsis*, Fér.; *Ancylotus*, Lay.
Family 8.—*Pyramidellidæ.*
Genera: *Pyramidella*, Lam.; *Stylina*, Flem.; *Aclis*, Loven.
Family 9.—*Turritellidæ.*
Genera: *Turritella*, Lam.; *Cæcum*, Flem.; *Vermetus*, Adans.; *Siliquaria*, Brug.
Family 10.—*Xenophoridæ.*
Genus: *Phorus*, Montf. (fig. 39).

Tabular View of the Subdivisions of the Class GASTROPODA, arranged so as to show their supposed Genetic Relationships.



Family 11.—*Naticidæ.*
Genera: *Natica*, Lam.; *Sigaretus*, Lam.; *Neritopsis*, Gratel.
Family 12.—*Entoconchidæ.*
The single genus and species *Entoconcha mirabilis*, discovered by Joh. Müller in 1851, parasitic in *Synapta digitata*. The adult form is not known.
Family 13.—*Marsenidæ.*
Genera: *Marsenia*, Leach; *Onchidiopsis*, Beck.
Family 14.—*Acmæidæ.*
Genera: *Acmæa*, Eschsch.; *Lottia*, Gr.; (probably these will be found to belong to the Zygobranchia).
Family 15.—*Capulidæ.*
Genera: *Capulus*, Montf.; *Calyptræa*, Lam. (fig. 40); *Trochita*, Schum.
Family 16.—*Littorinidæ.*
Genera: *Littorina* (the Periwinkles, fig. 46); *Modulus*, Gray; *Lacuna*, Turt.; *Rissoa*, Frem.; *Hydrobia*, Hartm.; *Assiminia*, Leach.
Family 17.—*Paludinidæ.*
Genera: *Paludina* (River-Snail) (figs. 7, 21); *Bithynia*. Gray; *Tanalia*, Gray.
Family 18.—*Valvatidæ.*
Genus: *Valvata* (fig. 45), fresh-water.
Family 19.—*Ampullaridæ.*
Genus: *Ampullaria* (can breathe air by means of the walls of the pallial chamber as well as water by the gill: fresh waters of tropical America, Africa, and East Indies).

Sub-order 2.—*Pneumonochlamyda.*

Characters.—Pallial chamber a lung-sac; no gill; mouth on a rostrum, not a retractile proboscis; terrestrial habit.

Family 20.—*Cyclostomidæ.*
Genera: *Cyclostoma*, Lam.; *Cyclophorus*, Montf.; *Ferussina*, Gratel.; *Pupina*, Vignard.
Family 21.—*Helicinidæ* (radula rhipidoglossate rather than tænioglossate).
Genera: *Stoastoma*, Adams; *Trochatella*, Swains.; *Helicina*, Lam.; *Proserpina*, Guild.
Family 22.—*Aciculidæ.*
Genera: *Acicula*. Hartm.; *Geomelania*, Pfr.

Sub-order 3.—*Siphonochlamyda.*

Characters.—Reptant Azygobranchia with the margin of the mantle drawn out to form a trough-like siphon which notches the lip of the shell; shell always spiral; usually an operculum, horny or lamelliform; either a rostrum or a retractile proboscis; exclusively marine; mostly carnivorous.

**Tænioglossa* (3.1.3).

Family 1.—*Strombidæ.*
Genera: *Strombus*, L.; *Pteroceras*, Lam.; *Rostellaria*, Lam (fig. 43).
Family 2.—*Aporrhaidæ.*
Genus: *Aporrhais*, Da Costa.
Family 3.—*Pedicularidæ.*
Genus: *Pedicularia*, Swains.
Family 4.—*Doliidæ.*
Genera: *Cassis*, Lam.; *Cas laria*, Lam.; *Dolium*, Lam.; *Ficula*. Swains.
Family 5.—*Tritonidæ.*
Genera: *Tritonium*, Cuv. (fig. 42); *Ranella*, Lam.
Family 6.—*Cypræidæ* (the Cowries).
Genera: *Cypræa*, L.; *Ovulum*, Brug. (fig. 41); *Erato*, Risso.

**Toxiglossa* (1.0.1).

Family 7.—*Conidæ.*
Genus: *Conus*, L.
Family 8.—*Terebridæ.*
Genus: *Terebra*, Adans.
Family 9.—*Pleurotomidæ.*
Genus: *Pleurotoma*, Lam.
Family 10.—*Cancellaridæ.*
Genus: *Cancellaria*, Lam.

**Rachiglossa* (1.1.1 or .1.).

Family 11.—*Muricidæ.*
Genera: *Murex*, L.; *Trophon*, Montf.; *Fusus*, Brug.; *Pyrula*, Lam. (fig. 38); *Turbinella*, Lam.
Family 12.—*Buccinidæ.*
Genera: *Buccinum*, L.; *Nassa*, Lam. (fig. 5); *Purpura*, Brug. (fig. 47); *Concholepas*, Lam.; *Magilus*, Montf.
Family 13.—*Mitridæ.*
Genus: *Mitra*, Lam.