

MOLLUSCA

The mollusca are soft bodied, non-metameric triploblastic, coelomate, fundamentally bilaterally symmetrical invertebrates, consisting typically of anterior head, a ventral muscular foot and a dorsal mass, surrounded by a thin fleshy envelope, mantle



General characters of molluscus

Mostly marine, a few freshwater and some terrestrial.

- » The body is soft, unsegmented without jointed appendages and made of four parts the visceral mass, the head, the foot and mantle.
- » Fundamentally bilaterally symmetrical.
- » The body covering or skin is a single-layered epithelium and mostly ciliated.
- » The anterior part of the body is usually modified into a distinct head, bearing a terminal mouth, eyes, tentacle and other sensory organs.
- » The visceral mass, containing most of the vital organs of the body closely compacted together.
- » The body is triploblastic.
- » The alimentary canal is simple and straight.

Classification on Mollusca

- Molluscs are classified into six classes according to their symmetry and the characters of food ,shell, mantel, gills ,nervous system ,muscles and radula .
- **Class- 1: Polyplacophora**
- Mostly bilaterally symmetrical, dorsoventrally flattened.
- Head distinct without eyes and tentacels .
- Sexes are separate .
- Ex:-Chiton

Class-3: Monoplacophora

- Body bilaterally symmetrical.
- Head without eyes and tentacles.
- Sexes are separate .
- Internal segmentation.

Ex:-Neopilina galathea

Class -4: Gastropoda

- Gastropods are marine, freshwater, terrestrial and a few parasitic on echinoderms.
- Body unsegmented, asymmetrical with a univalve, spirally coilshelled, head distinct bearing tentacles, eyes and mouth .
- Foot large and flat.
- Sexes are separate in most form .

Ex:-Pila

Class-5: Pelecypoda

- Mostly marine , some are freshwater.
- No head, tentacles, eyes, jaws and radula,
- Mostly filter-feeding.
- Usually dioecious, veliger or glochidium larva.

Ex:- Lamellidens, Mytilus

Class-6: Scaphopoda

- Exclusively marine.
- Tusk-shells.
- Eyes tentacles and gills are absent .
- Sexes are separate.

Ex:- Dentalium, Cadulus

Class-:7 Cephalopoda

- Exclusively marine .
- Body bilaterally symmetrical with head and trunk.
- Shell spiral, chambered or usually with or without reduced shell embedded the mantle.
- Sexes are separate.

Ex:-Octopus, Sepia

Economic importance of Mollusca

The mollusca has a great economic importance. Beside importance there has also harm for mankind .

Beneficial mollusks :

Mollusc s are beneficial to mankind and other animal in the following way-

As food: Molluscs are a great source of human food in various part of world. Scallopas and mussels are eaten in Japan, China , Europe and America.

In industry: Shells of freshwater mussels are used in the pearl buton industry in all parts of the world .

Shell are used for road construction .

Molluscs create the valuable pearl.

Molluscs shell are used in poultry feed .

(2) Harmful mollusks:

Some mollusks are indirectly harmful to men . The harmful molluscs are slugs and shipworms. Slugs are injurious in gardens and cultivation, they not only eat the leaves but also destroy plants by cutting up their roots and stems. Teredo, the shipworm burrows into wooden structures immersed in the sea, it causes serious damage to piers and ships.

Sepia(The cuttle- fish)

Systematic position:

Phylum: Mollusca

Class : Cephalopoda

Order : Dibranchita

Family : Sepiidae

Genus : sepia

Habit and Habitat

The cuttle-fish is a marine mollusca living usually in shallow coastal water. It is widely distributed especially in warmer seas like the Mediterranean. It is a good swimmer and swim either forwards or backwards by its fin and funnel. They are found in groups either swimming freely or resting on the sea bottom. Breeding occurs late winters and summer when they migrate into deep or shallow water, according to the species. It feeds on fish, crabs, shrimps and prawns and can eject a jet of ink to distract the attention of the enemy.

External morphology

Shape and size: The cuttle- fish has a fishy, bilaterally symmetrical and dorso-ventrally flattened body which tapers towards the posterior end. The anterior and posterior ends of the body in fact represent the dorsal and ventral ends due to much elongation of the dorso-ventral axis of the body .The average size is about 50cm. the smallest cuttle-fish, belonging to the genus *ideosepius*, measures about 15mm. in length. The body is divisible into an anterior prominent head and a posterior trunk, united by a constricted neck.

Head

The head bears a pair of large, highly developed eyes at the sides and a mouth at the free extremity, surrounded by 5 pairs of tapering, muscular circumoral appendages. These are differentiated into 4 pairs of short and stout arms and pairs of long tentacles, retractile into large pit at their base. The tentacles are used in the capture of prey and in copulation. The inner flat surface of each arm bears four longitudinal rows of suckers. Each sucker is a muscular, shallow cup with a narrow, horny rim and supported on a short, thick stalk. The suckers can be firmly applied to the body of the prey or to any other object a partial vacuum inside. In tentacles, the suckers are found only on their terminal expanded portions. The apex of each tentacle bears a curious small terminal pad.

Trunk

The rest of the body or trunk is elongated and shield-shaped, with its base directed anteriorly and the aboral end and or apex posteriorly. It is slightly convex above and flat below, and bordered by a narrow frill-like fin on either lateral side. The fins are separated by a cleft at the aboral end and are used in leisurely locomotion.

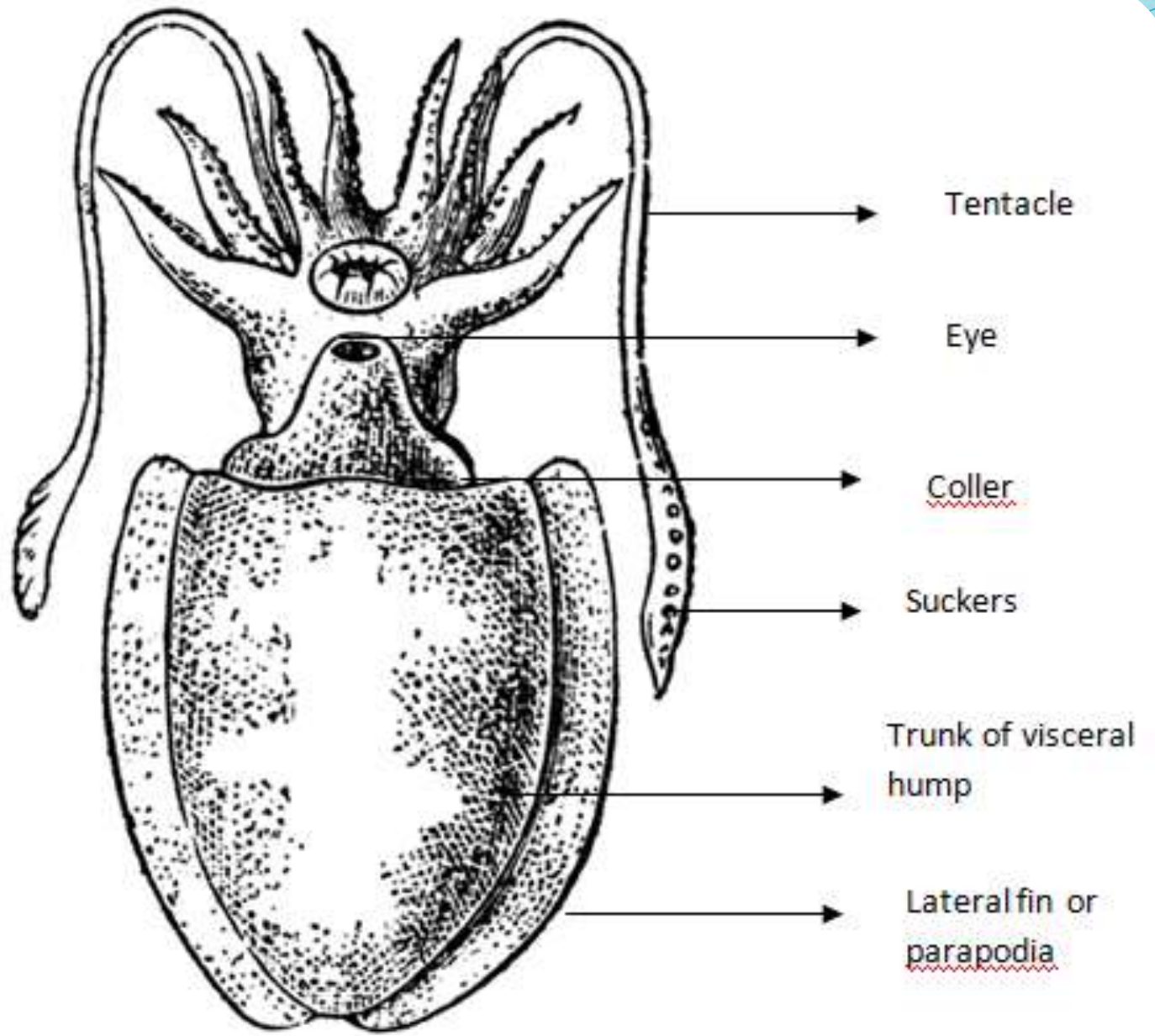


Figure: 1: *Sepia officinalis*

Mantle

Trunk is covered by a thick, muscular mantle, enclosing on the ventral side a large mantle cavity, which contains the viscera. Towards the oral end, the free mantle edge, encircling the narrow neck, forms a rounded lobe above and collar below.

Funnel

Below the head lies a large conical muscular tube, the siphon or the funnel, projecting beyond the neck. It is open externally by a wide aperture, into a mantle cavity. A pair of cartilaginous knobs on the mantle fits into corresponding sockets on the posterior ventral surface of the funnel. A typical molluscan foot is not present.

Shell

The shell of the cuttle-fish is internal , lying embedded in the upper side, completely enclosed in a sack of the mantle and secreted by its epithelial lining. The shell is entirely dead and composed of calcareous rather than horny matter. The hard and resistant shell provides rigidity to the trunk like an endoskeleton. The calcareous matter is arranged in fine parallel layers ,the septa or laminae ,enclosing spaces containing fluid and gas ,so that the light shell serves as a hydrostatic organ or float, and owing to its dorsal position,helps in maintaining the equilibrium of the body.

Chiton

Systematic position

Phylum- Mollusca

o- chitonina

c- Polyplacophora

Family- Chitonidae

Genus- Chiton



Habits and habitat

Chitons are popularly known as the sea-mice or coat-of-shells. They are found all over the world, except in polar waters. Approximately 600 living species are known. They are widely distributed marine animals and are mostly littoral or sublittoral, occurring in shallow waters between tide marks. They are very sluggish in nature and live firmly attached to a hard substratum, such as rocks, empty shells, corals and other solid objects. They creep slowly, but when dislodged, they promptly roll up like a pill bug or millipede, perhaps a defensive mechanism. The dorsal shell plates protect them against their enemies. They are nocturnal, shy and generally herbivorous molluscs remaining under sheltered places by day but creeping about on the rocks at night to feed on diatoms, or small encrusting algae, scraped by the use of radula.


External feature

Shape and size : The body is elliptical , bilaterally symmetrical and dorso-ventrally flattened with a convex dorsal surface. It consists of the mantle and shell ,foot ,head and visceral mass.

Most species grow 2 to 8 cm. in length. However, the length ranges from 1 cm. in little Atlantic Coast chiton ,*Chaetopleura apiculata* ,or the gulf of Mexico chiton, *Ishnochiton papillosus*,to 30 cm.in the giant pacific species ,*Amicula atelleri*.

Colouration: Colour varies from turquoise and slaty blue to grey and white . They are usually dull in colour.Drab shades of red ,brown,yellow and green are common.


Shell : The shell of chiton is made of eight transvers , overlapping , calcareous Plates or valves, arranged in a longitudinal row . It forms a solid armour covering the dorsal surface.The shell plates are moveable upon one another and allow the animals to roll up like a wood- louse The first (Cephalic) and the eighth (Anal) shell plates are hemispherical in shape ,while the others , called intermediate shell plates ,are some what rectangular and often keeled mid-dorsally. The posterior edge of each plate overlaps the anterior edge (wing) of the next behind.



Mantle : The shell is secreted by the mantle , which lies beneath the shell covering the dorsal and lateral surface . The thick , fleshy outer mantle edge,surrounding the shell plates and partly covering them , is called the girdle .The girdle surface may be naked or smooth ,or it may contain thousands of pointed calcareous spicules ,bristles or scales of various shapes,which are responsible for the animals resemblance to a mouse.

Foot : There is a large , elliptical muscular and sucker -like ventral foot with a flat sole. It is abundantly supplied with a slimy secretion and is adapted for creeping as well as clinging.

Head : A small , cylindrical and inconspicuous head lies just in front of the foot beneath the anterior mantle edge . It contains the mouth opening mid-ventrally,but lacks the eyes and tentacles . The head is separated from the foot by a narrow groove .On each lateral side of the head is a somewhat angular labial palp.



Mantle cavity and grooves : The dorso-ventral flattening of the body in chiton has much reduced the spacious posterior mantle cavity .It is represented by a linear shallow cavity,the pallial or mantle groove on each side of the body ,between the foot and mantle edge.Numerous lancet-shaped gills or ctenidia ,arranged in a single row ,lie in the groove on each side .The groove also contains the mid-ventral anus immediately behind the foot ,two renal apertures one on each side in front of the renal apertures.

Unio or freshwater mussel

Systematic position:

Phylum: Mollusca

Class: Pelecypoda (Bivalvia)

Order: Eulamelli bronchia

Family: Unionidae

Genus: Unio

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Habit and habitat

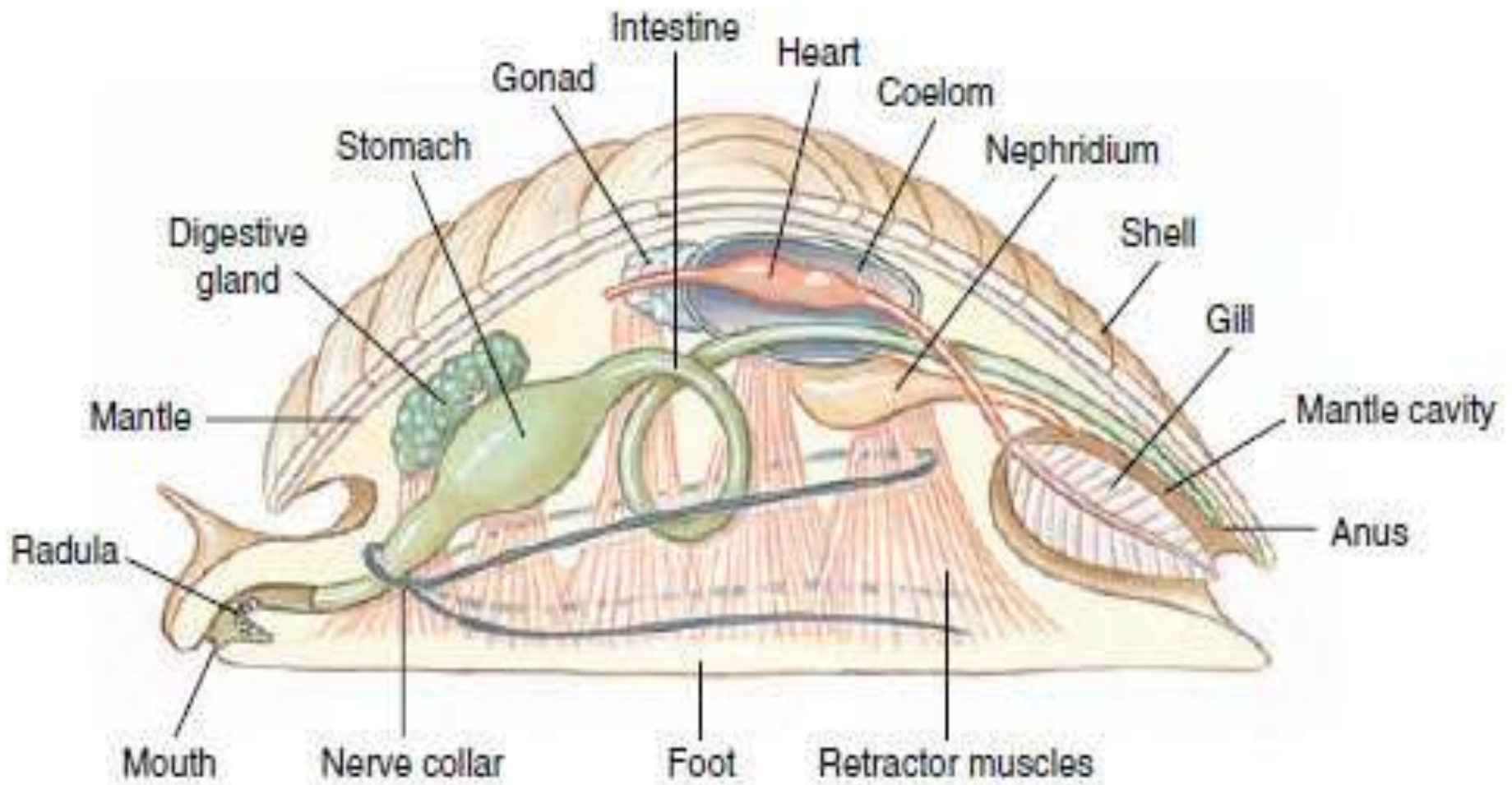
Freshwater mussels are found in fresh water lakes, rivers and ponds, streams inhabiting the surface layers of the muddy beds of rivers and lakes. In a buried position the posterior tip of its shell remains exposed in water to facilitate entry and exit of the water current. Which is helpful both in breathing and feeding. It crawls slowly with the help of its plough-like, wedge-shaped muscular foot that leaves a deep trail all along its journey. It usually moves to shallow places by nights and retires to deeper places by day. It feeds on a microscopic organism, both animals and plants which are fed upon by filter-feeding mechanism.

The digestive system of mussel

- ❖ The digestive system comprises of an alimentary canal and a paired digestive gland.
- ❖ **Alimentary canal:**
The alimentary canal is a long coiled tube and consist of the following parts:
 - ❖ **Mouth:** The mouth is a transverse slit, lying immediately postero-ventrally to the anterior a duetor muscle. On each side of the month is a pair of oval and flattened floshg flops, called the labial palps. The upper lip and lower lip enclosed the ciliated oral groove leading into the mouth. There are no jaws and radula.
 - ❖ **Oesophagus:** The mouth leads dorsally into a short and narrow tube, the esophagus. Its inner wall is ciliated

Stomach: The oesophagus widens to form a sac-like stomach which is surrounded by a large paired digestive gland or liver. The stomach is divisible into two regions a dorsal portion into which open the oesophagus and the ducts of the digestive gland, and a ventral tubular style sac. Containing crystalline style. The crystalline style contains digestive enzymes amylase and glycogens.

Intestine: The intestine arises from the posterior end of the stomach. It runs ventrally into the food coiling its way through the visceral mass, where it is closely surrounded by the gonad. The coiling is of a characteristic pattern the ascending limb runs parallel the descending limb and continues into the rectum .



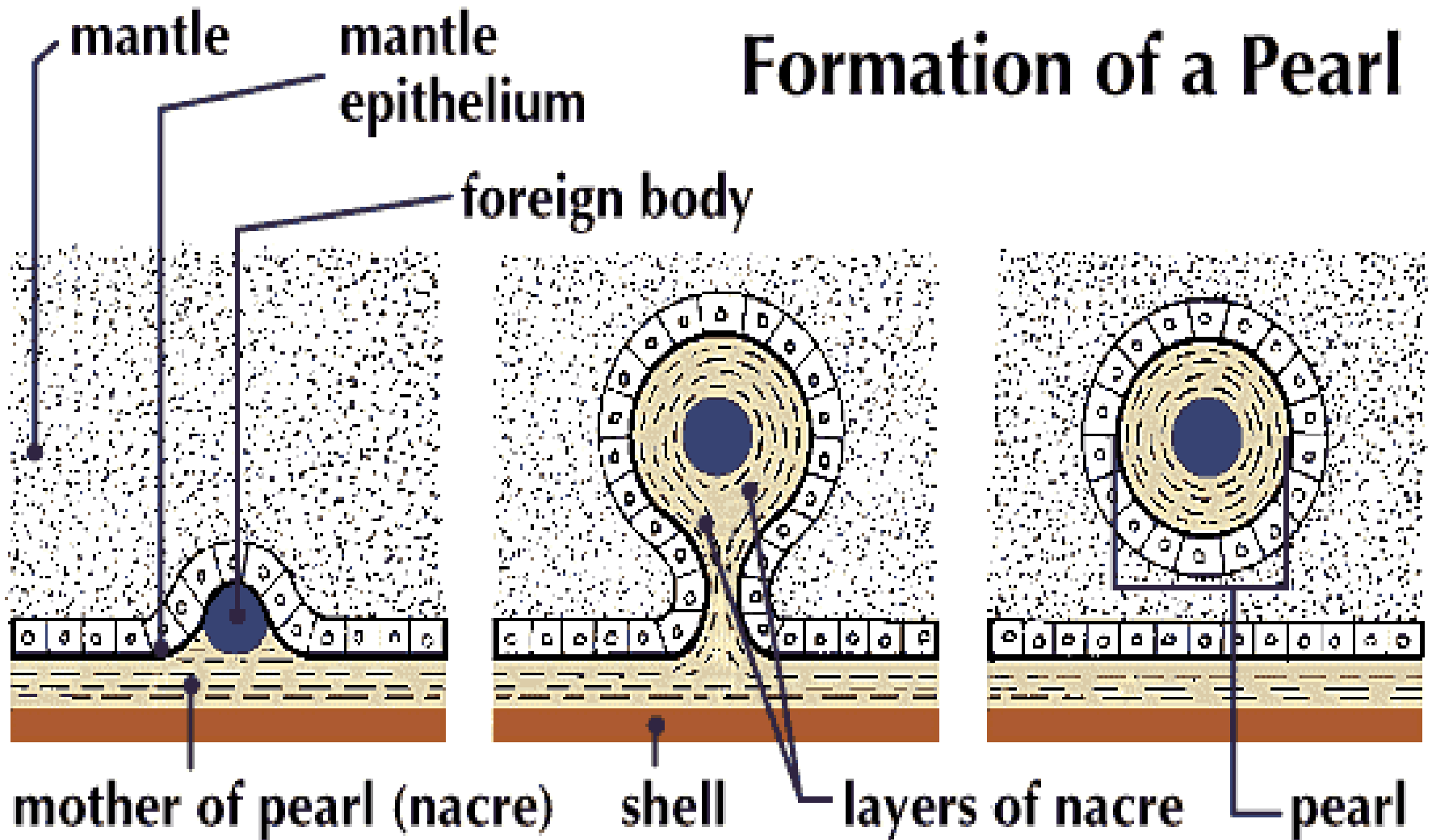
Rectum : The post terminal part of the intestine is called the rectum. Its wall is produced internally into a longitudinal, midventral fold called typhlosole. It runs posteriorly through the pericardial cavity, embraced by the ventricle of the heart and then passes over the posterior adductor muscle and finally opens through the anus into the posterior part of the suprabranchial chamber or the cloaca.

Digestive gland: It is also called the digestive diverticulum or liver. It is a large and paired structure of dark brown or green colour surrounding the stomach. It opens into the dorsal portion of the stomach by many ducts. This gland not only secretes digestive enzymes but also its cells reading ingest fine food particles bringing about their intracellular digestion

The mechanism of pearl formation in mollusca

- **Pearl:** pearl is a valuable gem known to mankind since ancient times. The pearl in fact is of animal origin and produced by certain bivalves of mollusca. The pearl producing bivalves are marine oysters of the genus unio and anodonta also can produce pearl but inferior quality and rarely of any use.
- **Pearl formation:** The pearl is secreted by the mantle as a protective measure against foreign objects like sand, particles, parasites and any object of organic and inorganic origin. In fact as soon as a foreign object somehow enters the body of a bivalve in between the shell and mantle, the mantle immediately gets irritated and at once enclose it like a sac. The mantle wall then starts secreting layers of nacre around the foreign object from defense point of view. Thus mantle wall secrets contain several layers of finally pearl is formed.
- Now a days, the pearl producing bivalves are more and pearls are produced artificially by introducing some foreign objects between the mantle and shell in different part of the world.

Formation of a Pearl



The system of shell formation in Mollusca

- ❖ The molluscan shell is formed by the deposition of crystals of calcium carbonate in an organic matrix of a protein substance called conchioline. Its structure is highly ordered and falls ideally into three zones-
- ❖ An outer organic layer or periostracum through to be a quinone-tanned protein.
- ❖ A prismatic or columnar crystalline layer, added to along the edge of the mantle
- ❖ An inner layer, sometimes naereous, formed of thin, laminate crystalline sheets and produced by the mantle's inner surface. Calcium supply is taken up from the food or the sea water environment and land and freshwater shells, where calcium may be deficient are very thin. Carbonate is derived from the CO_2 or biocarbonate pool available in the or mantle or general body tissue shell formation takes place in the thin layer of extrapallial fluid lying between the mantle and the inner shell surface. Here the two solid phases of the shell-organic and crystalline are formed and the composition of the fluid determines the chemical nature and pattern of the matrix and manner of crystal growth. At the microscope to be a fenestrated sheet. With a characteristic pattern of holes at which crystal growth takes place.

The digestive system of sepia

- ❖ In sepia the digestive system is consist of alimentary canal, digestive glands and Ink gland.
- ❖ Alimentary canal: Alimentary canal is consist of mouth and oesophagus.
- ❖ **Mouth:** Mouth lying in the midst of the oral arms is surrounded by a fleshy, circular lip, beset with numerous pepillar. Just within lip is a pair of sharp, powerful, hory jaws, looking like the inverted beak of a parrot. Mouth leads into a large thick walled, muscular pharynx or buceal cavity, containing tonue or odontophore and radula.
- ❖ **Oesophagus:**
- ❖ Oesophagus is a long narrow tube running straight backwards between two lobes of liver to open into a rounded thick walled and slightly called pouch, caecum is connected to stomach close to starting point of intestine. Short intestine runs ateriorly nearly parallel with oesophagus and merges into rectum wich opens into mantle cavity by anus.

Sepia, Alimentary canal



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Digestive glands:


Sublingual glandular tissue of unknown function lies on ventral side of tongue. A pair of anterior salivary glands on either side of radula. A pair of posterior salivary glands lying in front of liver one on either side of oesophagus, open by a common duct at the tip of tongue in buccal cavity. Salivary glands have been misnamed because they are really poison glands and their secretion is used to paralyse the prey. The large brown digestive gland or liver extends from near posterior salivary glands up to the posterior end of body.

Ink gland:

As already stated, a pearshaped ink gland lies over the posterior ventral surface of visceral dome and opens by a duct dorsally into the rectum close to the anus. Terminal part of the duct forms an ejective ampulla. Ink gland lying inside the wall of the large reservoir or ink sac. Secretes a brown or black fluid or ink. It contains a high concentration of melanin pigment and it stored in the ink sac. Ink of sepia provides sepia pigment used by artists for hundreds of years.

The circulatory system of sepia

Blood vascular system is well developed with a complete separation of various and arterial blood. It consist of the heart arteries, veins and a system of capillaries. There are three hearts in sepia, as in all the dibranchiate cephalopods. Systematic or arterial heart lies in the middle of the viscera mass enclosed in the pericardium. It consist of thick-walled medium ventricle and two thin walled lateral auricles, all spindle-shaped. Ventricle is slightly constricted into two lobes. It supplies arterial blood through a large anterior or cephalic or oral aorta and a small posterior or aboral aorta to the anterior and posterior regions of the body, respectively.



Aorta branch into arteries which lead into a system of capillaries and then into veins. Venous blood of the head returns by a large venacava which bifurcates in front of the rectum into right and left branchial veins, leading into the so-called branchial hearts, lying one at the base of each ctenidium. Each branchial on gill heart also receives directly a small pallial vein from the mantle and an abdominal vein from the posterior body region. Unpaired genital and ink sac veins join the right branchial vein.

Each branchial heart pumps blood to the ctenidium of its side through an afferent branchial vein, running through the axis of the gill and giving off branches as it goes. Blood containing haemocyanin and amoebocytes, is colourless when venous and pale blue when oxygenated.

Reproductive system of sepia

Sexes are separate. Males are usually smaller less rounded dorsally and passes slightly longer arms-

- **Male reproductive system:**

Large, oval, yellowish and sac-like testis lies near the apex of the visceral mass. Sperms produced in the testis are passed into its lumen which open into a coelomic sac by a small ciliated aperture on its ventral side. Coelomic sac leads on the left side into a long narrow coiled tube the spermiduct or vas deferens, which opens into a long seminal vesicle. Here the sperms are rolled up into long and narrow bundles enclosed in elaborated chitinous capsules, called the spermatophores. A spermatophore is like an automatically explosive bomb. Terminal part of vesicle gives off two blind folds, one of them being the prostate or accessory gland.

Female reproductive system:

Large rounded white and saccular ovary is also situated, like the testis in the male in a coelomic sac near the apex of the visceral mass. Oviduct leading from the coelomic sac is a short, thin-walled, wide tube which opens into mantle cavity to the left of the anus. Narrower distal end of the oviduct has thick-glandular walls forming the oviducal gland, the function of which is to secrete the outer coat of the ova. A pair of large oval and flattened, nidamental glands lies one on either side of the oviduct, each opens by its duct anteriorly into the mantle cavity. A pair of orange coloured accessory nidamental glands opening into the mantle cavity by numerous minute pores. All these glands serve to secrete the elastic egg capsules.

Respiratory system of sepia

- **Respiratory organs:**

These include a pair of large, plume-shaped ctenidia, lying in the mantle cavity, one on either lateral side. Each ctenidium or gill is bipinnate with numerous delicate lamellae on either side of a central axis. Surface of the lamellae is much folded to increase the respiratory surface. Cilia are absent as removal of sediment is not a problem in pelagic animals and easter current is created by mantle contractions. Each gills receives venous blood through an afferent branchial vessel from the branchial heart of its side. Inside the gill it passes through the lamellae and is collected finally into an efferent branchial vessel leading to the avricle.

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Respiratory Mechanism:

Muscular mantle rhythmically expands and contracts, so that the mantle cavity alternately increases and diminishes in size. Consequently the oxygen bearing in halent current of water enters the mantle cavity through the wide aperture around the neck and the exhalent current eseapes through the funnel, exchange of gasses occurs when the water passes over the ctenidia which are richly vascular.

Glochidium larva of mollusca

- Glochidium larva is found in the development of pelecypoda or bivalvia.
- It is a minute larva measuring 0.1 to 0.4 mm. comprises a shell and mantle.
- Shell consist of two triangular valves united dorsally and free ventrally.
- Ventral free end of each valve of the shell is produced into a curved hook bearing spines.
- Mantle lobes are small and bear brush-like sensory organs.
- Adductor muscle is well-developed extending between the two valves at the vasis.
- Glochidium larva; attaches itself to the skin or gills or fins of a fish and leads a parasitic life for about 10 weeks and metamorphoses into adult.

Oyster

- i. Pinctada is commonly known as pear oyster
- ii. exclusively marine
- iii. Oysters shell secretes pearl when any organism enter the shell.
- iv. The two valves of shell unequal.
- v. there has only one adduction of oyster.

Mussel

- i. unio is commonly known as fresh water mussel.
- ii. usually freshwater, or terrestrial
- iii. cannot secretes pearl
- iv. the two valves of shell equal.
- v. there are two anterior and posterior adduction in mussel.

Different larval stages of molluscs

Thorson has recognised three ecological types of larvae, each represents in molluscs. there are given bellow-

1. Veligers larvae:

First, there are planktonic larvae with a long larval life of upto two or three months as in most lamelli-branches and many pro-so-branches. These are least modified larve of all and are small and cheap to produce on a large scale. They are effective poineers and subtoropical and the species secure wide distribution. Planktonic larvae are most usual in tropical and in high arctic seas. Such molluscan veligers are all ciliary feeders, coarse or unsuitable particles are removed by rejectory tracts upon the food.

Example: *Mytilus edulis*

2. Nudibranch larvae:

Secondly, there are planktonic larvae with a short swimming life of never more than a week in the plankton. The velum is never elaborate and planktonic feeding is never elaborate and planktonic feeding is of secondary importance, distribution being the main object of larval life. There is little growth between hatching and settling.

Example: *Hydrobia ulvae*.

3. Yolk Larvae:

The third type of larvae take no food in the plankton. They are lecithotropic, hatching from very yolky eggs and developing into large. They swim little and are passively carried about in the plankton. They spending only six hours to a few days in the plankton. Being independent of adverse condition species required very constant number from year to year. The chief disadvantage of yolk larvae is their small number and expensiveness to produce.

Example: *Scaphopoda*, *Amphimuera*

Cuttle fish

1. Sepia is commonly known as cuttle fish.
2. Body is bilaterally symmetrical, dorsoventrally flattened.
3. Five pairs of arms surrounding the mouth
4. A pair of large plume-shaped ctenidia or gills performs the respiratory function.
5. Single kidney is excretory organ.

Star Fish

1. Asterias is commonly known as star fish.
2. Body is radially symmetrical and pentamerous.
3. Five to fifty long or short arms radiating symmetrically from a central disc.
4. Respiration by papulae.
5. Excretory system is wanting.

Gastropoda

1. Gastropods are marine, fresh water, terrestrial and few parasitic on echinoderms
2. Body unsegmented, asymmetrical typically with a univalve. Spirally coiled shell.
3. Head distinct eyes, tentacles and mouth.
4. Circulatory system is open and the heart is enclosed in a pericardium.
5. Development includes trocophore and veliger larval stages.

Example: *Pila*

Cephalopoda

1. Cephalopods are exclusively marine.
2. Body bilaterally symmetrical with head and trunk.
3. Head bears a large eyes and mouth.
4. circulatory system closed heart with two or four auricles.
5. Development meroblastic without metamorphosis.

Example: *Octopus*



 The End 