BIOLOGY DEPARTMENT
COLLEGE OF SCIENCE

Laboratory Notes

Practical invertebrate Zoology

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2019

Phylum: Protozoa

General characters:

1- Protozoa occur wherever moisture is present in the sea (marine) in all type of fresh water and in the soil.

2- Although most protozoa occur as solitary individuals, there are numerous colonial forms, both solitary and colonial species may be either free moving or sessile.

3- Majority of protozoa are microscopic.

4- Body symmetry non-radial, spherical or bilateral.

5- They are either naked or covered by pellicle; sometimes an exoskeleton also present.

6- Body shape is usually constant but in some cases it is unstable and in other it may change with the environment or age.

7- Their locomotory organelles are finger, like pseudopodia, flagella, cilia or absent as in sporozoans.

8- Nutrition may be holozoic (animal like), holophytic (plantlike), sparozoic or parasitic. The organelles of ingestion and egestion may be present or absent. Digestion occur intracellulary inside the food vacuoles in most cases.

9- No specific respiratory and excretory organelles are present. Both are carried through general body surface by diffusion. Excretion sometimes carried with the help of contractile vacuoles.

10- In fresh water protozoa excess water usually eliminated by conractile vacuoles. Thus, they are mainly osmoregulatory in function.

11- A sexual reproduction by binary fission, multiple fission, or budding. Meiosis, gamete formation and fertilization have been observed in many species.

Protozoa have been classified into four subphyla:

Subphylum I	Sarcomastigophora
Sub phylum II	Sporozoa
Sub phylum III	Cnidophora
Subphylum IV	Ciliophora

Phylum:	Protozoa
Sub phylum:	Ciliophora
Class:	Ciliata
Sub class:	Holotricha
Order:	Hymenostomatida
E.g.:	*Paramecium*

1- *Paramecium* is cosmopolitan in distribution. It is found in fresh water, laks, ponds, sewage pipes. It is abundant in stagnant water containing decaying organic matter.

2- It has oval or spindle shape with blunt anterior end and pointed posterior end.

3- Oral groove was located on the ventral surface extending back-ward into a funnel shaped depression known as vestibule consisting of in vaginated body pellicle. The vestibule leads into buccal cavity which

directly leads into cytostome or mouth which is fixed oral opening. The cytostome directly opens into the wide cytopharynx.

4- The motile organs are fine thread-like cilia regularly arranged over the body surface.

5- The protoplasm consist of an outer ectoplasm which contain large number of minutes sacs called trichocysts which used for defense and inner endoplasm which contain the following structures:

a. **Macronucleus**: Has bean or kidney shaped body lying in the center and controls the vegetative activities of the animal.

b. **Micronucleus**: It has vesicular or spherical shape and concerned with reproduction.

c. **Contractile vacuoles**: There are two contractile vacuoles occupying fixed positions in the endoplasm, one vacuole located at the posterion end and other one at anterior end of the body, each contractile vacuole surrounded by radiating canals.

d. **Food vacuoles**: These are roughly spherical varying in size, they contain ingested food material, mainly bacteria and smal amount of water.

6- Nutrition takes place by holozoic method.

7- Respiration take place by diffusion through the general body Surface.

8- It reproduce a sexually by binary fission and sexually by conjugation.

Binary fission:

1- *Paramecium* usually multiplies by simple binary fission.

2- In binary fission the organism divides transversely. It is an a sexual process in which one fully grown individual divides into two daughter organisms.

3- First the micronucleus undergo mitosis and its substance is equally divided between the two resulting daughter, these micronuclei, separate and finally come to lie one near each end of the body.

4- The macronucleus elongates and then divides transversely by a mitosis into two daughter macronuclei.

5- The cytopharynx produces a bud which develops into another cytopharynx.

6- A new water expulsion vesicle a rise near the anterior end of the body, another one just back of the middle line.

7- While these events are taking place, constriction appears near the middle of longitudinal axis of the body, this cleavage furrow becomes deeper and deeper until only a slender thread of protoplasm holds the two halves of the body together.

8- This connection is finally severed, and the two daughter paramecia are freed from each other.

Conjugation:

1- At the beginning of conjugation two ciliates come together and become attached first at deciliated area near the anterior end of their ventral surface, and cytoplasmic bridge formed be tween them.

2- The macronucleus of each conjugant starts disintegrating, the micronucleus of each conjugant now grows in size and divides twice the first division being meiotic and the other being mitotic , result in the formation of (4) haploid nuclei.

3- Three micronuclei degenerate and disappear from cytoplasm of each conjugant leaving behind one nucleus , the remaining nucleus divides again unequally forming one bigger and othre smaller nuclei ,the smaller nucleus is active and called migratory or male pronucleus, the bigger one is inert and stationary or female pronucleus.

4- The male pronucleus of one conjugant passes into the other conjugant through the protoplasmic bridge, similarly the male pronucleus of other conjugant passes into first conjugant. Now the male and female pronuclei fuse result in the formation of zygote nucleus.

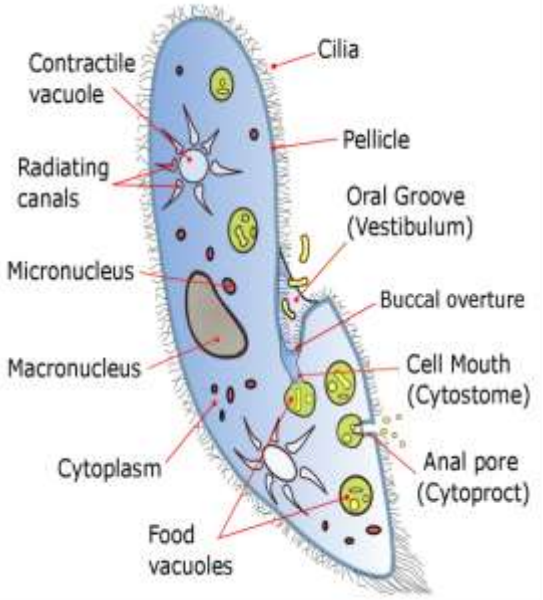
5- After about 12 hours or so the conjugants separated and a new termed as exconjugants, the zygote nucleus divides three time (thrice) in each exconjugant resulting in (8) nuclei, the divisions are mitotic out of the (8) nuclei 4 assume large size and become macronuclei, remaining four are micronuclei. Out of these (4) micronuclei (3) disappears leaving behind only one micronucleus. It divides again forming two and at the sametime the exconjugan divides by binary fission into two cells.

Each cell having two macronuclei and one micronucleus. The micronucleus again divides into two micronuclei and at the sametime the

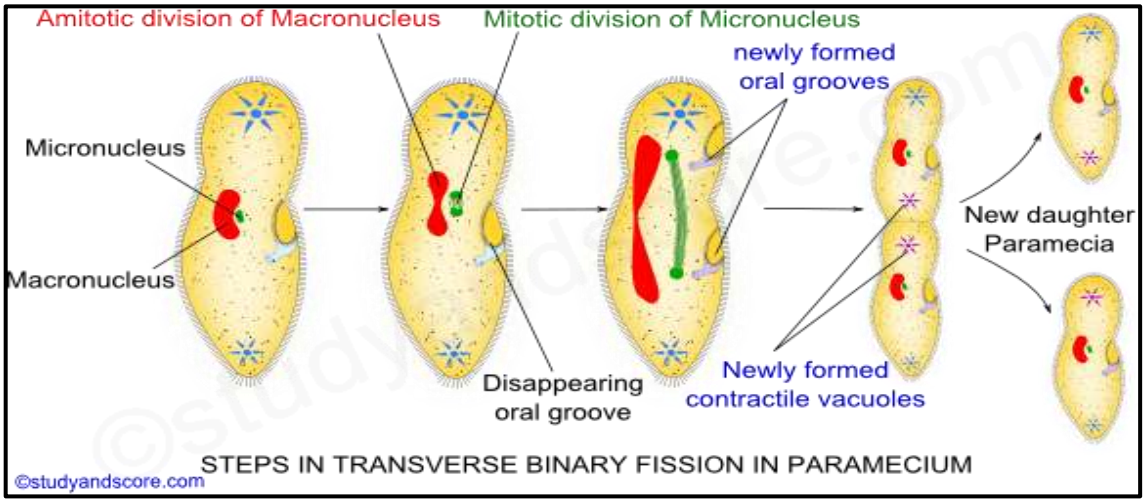
cell divides into two daughter paramecia by binary fission. Each daughter having one macronucleus and one micronucleus. Thus each conjugant produces four daughter individuals in the end of conjugation.

The whole process of conjugation takes about 96 hours to complete.

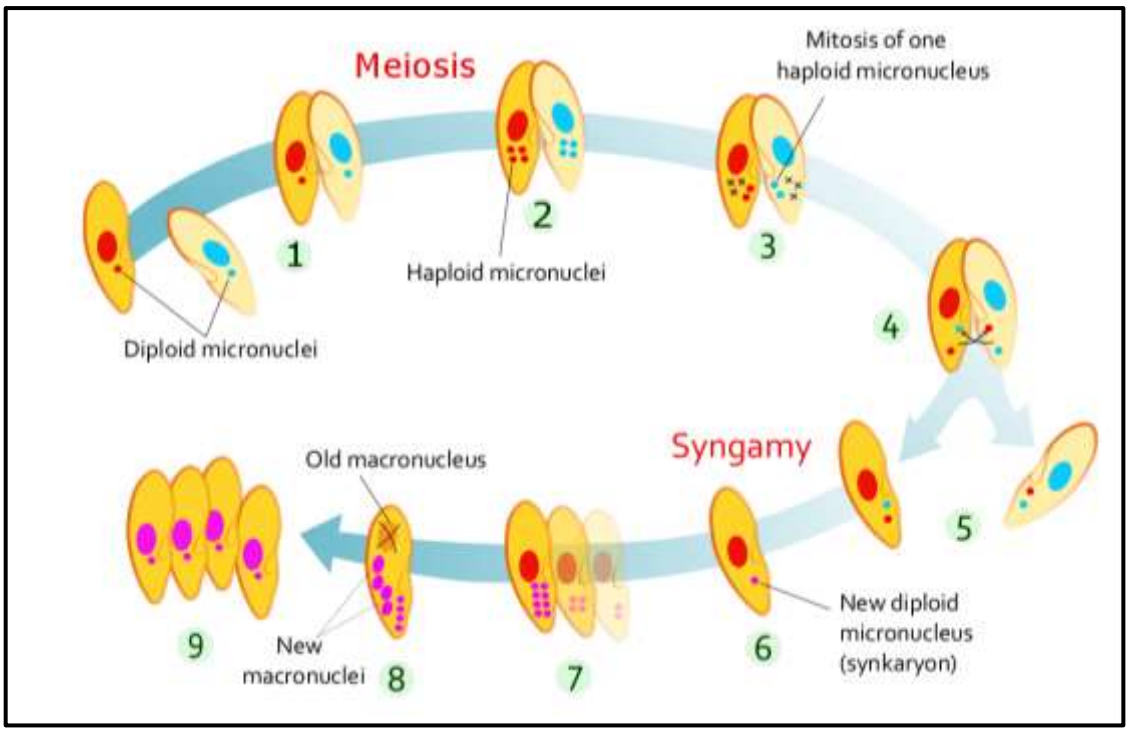
Binary fission



Paramecium



Binary fission



Conjugation

Phylum: **Protozoa**

Sub phylum: **Ciliophora**

Class: **Ciliata**

Subclass: **Peritrichia**

Order: **Peritrichida**

E.g.: ***Vorticella***

1- It is generally found in lakes, rivers, ponds and streams with aquatic vegetation. It is sedentary ciliate.

2- Its shape is like that of solid inverted bell attached to the submerged objects by a slender and contractile stalk enclosing an elastic spirally disposed contractile axial fibre called spasmoneme.

3- It is solitary, but usually social.

4- Body surrounded by pellicle.

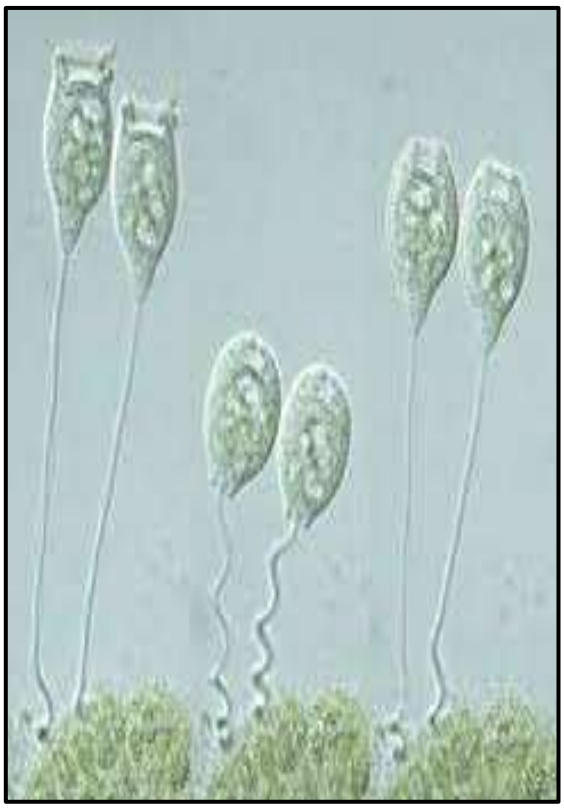
5- The margin of the anterior end is thickened and called peristomial colla inside which is a narrow, shallow and circular depression called peristome. The peristome surrounds a broad central disc, the peristomial disc.

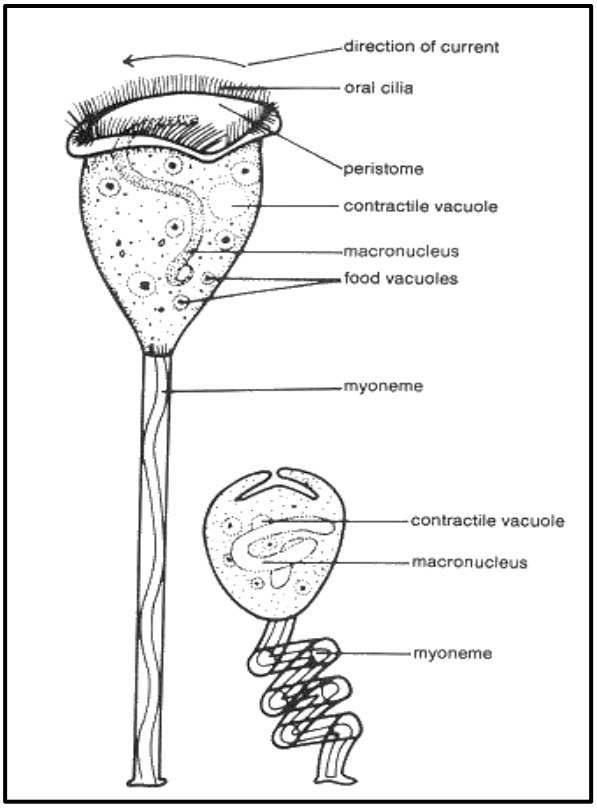
6- Between the peristome and peristomial disc is the vestibule from which a narrow cytopharynx lead inside, the peristome is surrounded by a rows of cilia but the body devoid of cilia.

7- There is a reservoir near the cytopharynx beside which is a single contractile vacuole.

8- The interior of the body contains various food vacuoles.

9- There are two nuclei: **macro or meganucleus** elongated band shaped or horseshoe shaped whereas the **micronucleus** is minute spherical in shaped close to the meganucleus.





Vorticella

Phylum: **Protozoa**

Sub phylum: **Ciliophora**

Class: **Ciliata**

Subclass: **Holotricha**

Order: **Gymnostomatida**

E.g.: ***Didinium***

1- It is a rounded, oval or barrel-shaped.

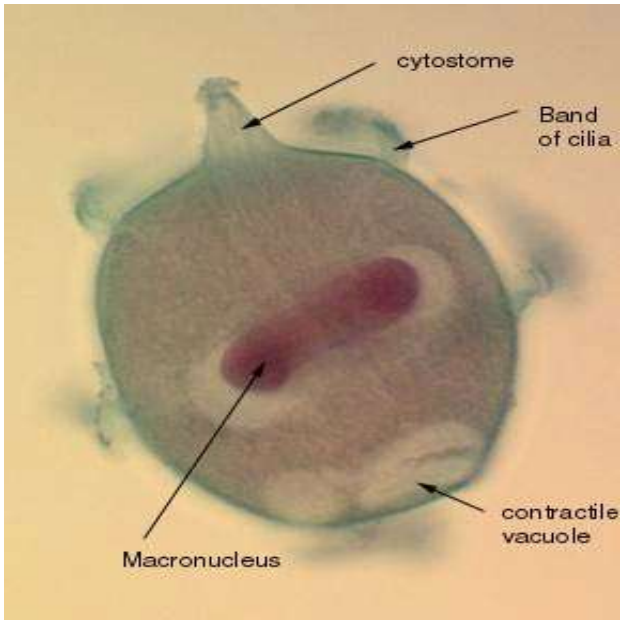
2- Body encircled by two ciliary bands.

3- At the anterior end a cone like structure protrudes, supported by palisade of stiff microtubular rods (nematodesmata). This cone encloses the cytostome or mouth opening.

4- The macronucleus is long and may be curved, horseshoe- shaped or twisted into a shape resembling a figure 8, micronucleus, small, round like macronucleus .

5- A contractile vacuole and anal aperture are in the posterior of the cell.

6- It reproduce a sexually by (via) binary fission or sexually through conjugation.



Didinium

Phylum: Protozoa

Subphylum: Ciliophora

Class: Ciliata

Subclass: Spirotricha

Order: Heterotrichida

E.g.: *Stentor*

1- It is a large, sessile, fresh water ciliate.

2- It has pyriform shape.

3- Body covered over by cilia arranged in longitudinal rows.

4- The animal attaches itself to aquatic plants, animals and other solid objects by its lower narrow end, which gives out pseudopodia to serve as holdfast.

5- In some species the lower end covered by a loose gelatinous tube.

6- The anterior ends bears a broad peristome encircled by a single row of adoral membruanelles arranged spirally in a clock -wis manner.

7- The peristome spirals down to the cytosome that leads into a short tubular cytopharynx.

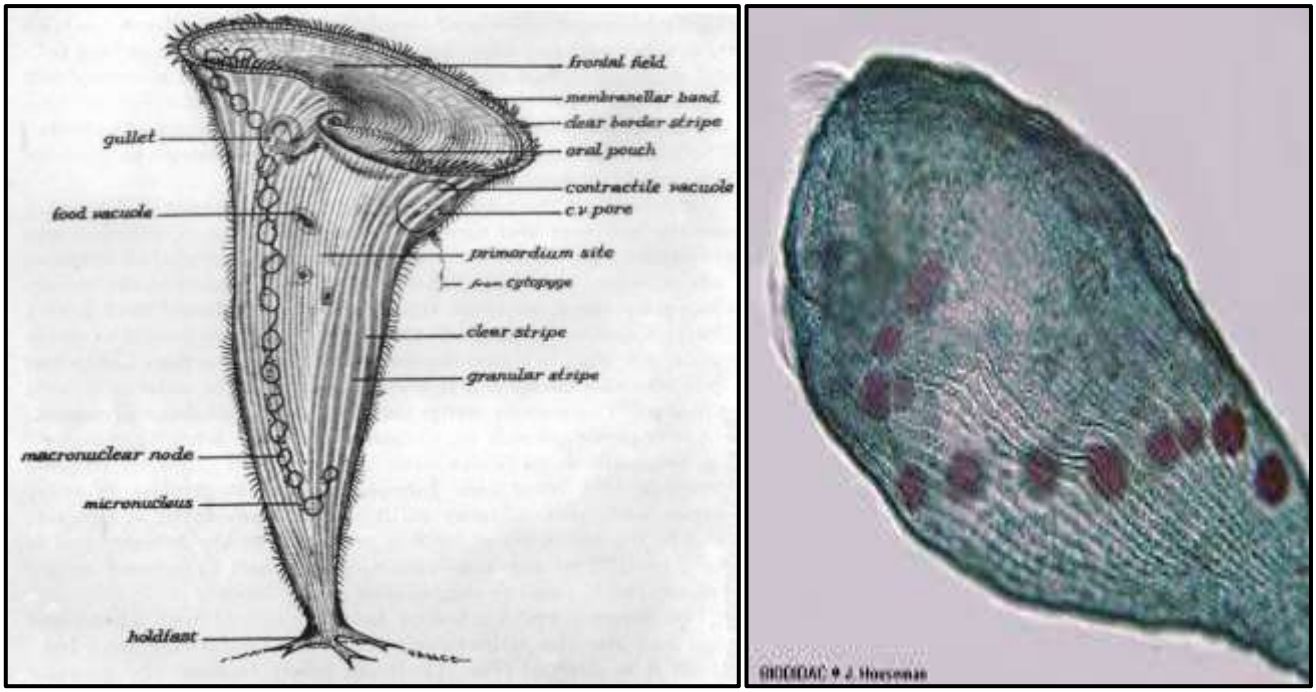
8- The macronucleus consist of many beads or lobes, the micronucles lying close to the macronucleus.

9- There is a single contractile vacuole with a very long feeding canal.

10- Nutrition is holozoic.

11- Food consist of small flagellats and rotifers.

12- Reproduction takes place by binary fision. Conjugation also occurs in late spring.



Stentor

Phylum: **Protozoa**

Subphylum: **Sarcomastigophora**

Class: **Phytomastigophora**

Order: **Dinoflagellida**

E.g.: ***Noctiluca***

1- Noctiluca is a marine and pelagic organism occurring near the shores often in large numbers.

2- It has large melon-like, bilaterally symmetrical and enclosed in a firm cuticular pellicle.

3- The cytoplasm is highly vacuolated and differentiated into ectoplasm and endoplasm.

4- At the ventral pole has longitudinal oral groove representing the sulcus.

5- The oral groove has an oval mouth leading into guilet and it has two flagella, a long, coarse transversely striated one called tentacle, other is delicate flagellum.

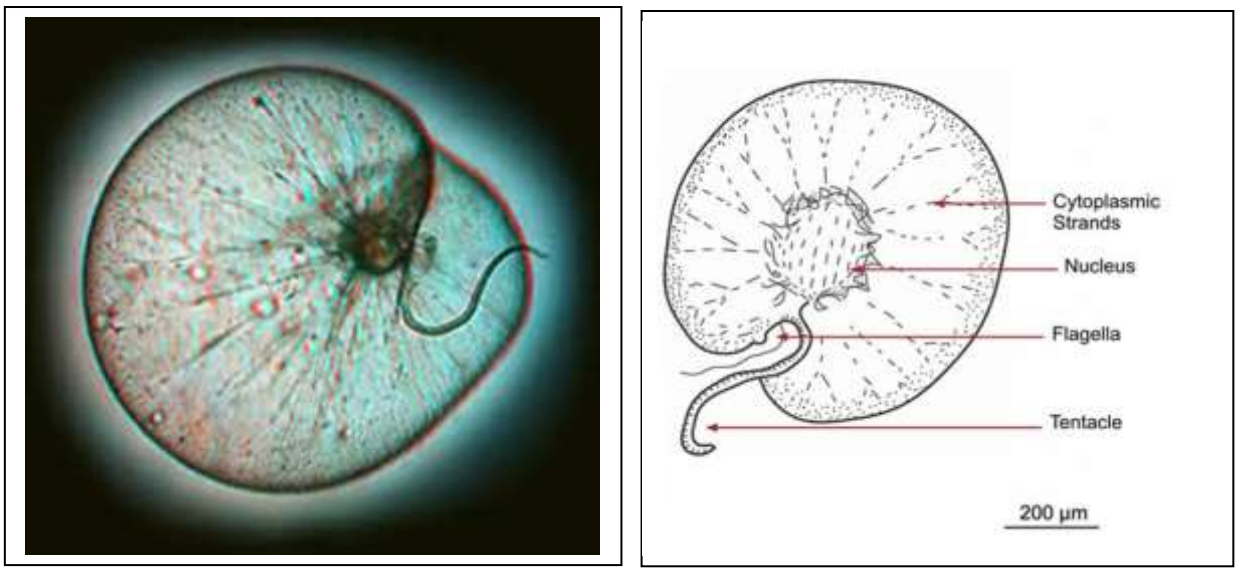
6- From the central sulcus and clump of protoplasm containing the nucleus, various delicate strands run through the watery interior to the periphery.

7- Nutrition is holozoic (i.e. aminal like).

8- Reproduction takes place a sexually by binary fission.

9- When agitated, it glows with bluish or greenish light.

10-The luminescence is caused by photogenic granules luciferin, which under the influence of enzyme luciferase, emits light.



Noctiluca

Foraminifera

Phylum: **Protozoa**

Subphylum: **Sarcomastigophora**

Super class: **Sarcodina**

Class: **Rhizopoda (Sarcodina)**

Subclass: **Granuloreticulosia**

Order: **Foraminifera**

E.g.: ***Foraminifera***

1- *Foraminifera* is chiefly marine and some live in fresh water.

2- It possess a delicate, elongate and branched pesuodopodia and unite to from netweok.

3- It possess one or many nuclei.

4- The contractile vauoles is absent in the marine form.

5- All the faraminiferidae possess shells, which may be chitinous, calcareous and few have siliceous shells.

6- The shells may include one, two and many chambered (unilocalar, multilocular) and may be imperforated or perforated.

7- The shells is classified according to the arrangement of the chambers into many types:

a- **Spiral**: The chambers are found in flat or conical form each new chamber being larger than the other.

b- **Cycloid**: The chambers found in a spiral concentric in which the newer chambers overlap the older one.

c- **Textualarid**: The chambers located alternately on opposite sides of the original chamber.

d- **Globular**: The chambers are found in an irregular spiral of globular chambers.

Foraminifera

Phylum: Porifera

General characters: known as sponges also:

1- All sponges are aquatic, mostly marine but a few are fresh-water.

2- They are multicellular organisms with cellular grade of body organization, without forming tissues or organs.

3- They are sessile, solitary or colonial.

4- They have asymmetrical or radially symmetrical bodies.

5- They have Cylindrical, tubular or uase-like body shape.

6- Body wall is diploblastic with outer dermalepithdium and inner gastral epithelium with a gelatinous non-cellular mesenchyme in between .(mesogloea).

7- Body surface bears numerous minute pores (i.e. ostia for the ingression of water).

8- They possess peculiar canal system through which water current flows drawing food and oxygen inside the body and carrying away excretory and reproductive products.

9- It have internal skeleton located in mesenchyme, in the form of calcareous or siliceous spicules or of proteinous spongin fibers.

10-Digestion was entirely intracellular.

11-Nervous and sensory cells are absent.

12-All sponges possess great power of regeneration.

13-A sexual reproduction takes place by budding, fission or gemmule formation and sexual reproduction by sperms and ova.

Phylum: Porifera

Class: Calcarea

Order: Homocoela

e.g.: *Leucosolenia*

1- *Leucosolenia* is a small marine sponge.

2- It Is a colonial sponge. The colony is permanently fixed to the substratum.

3- Digestion is intracellular as in protozoa.

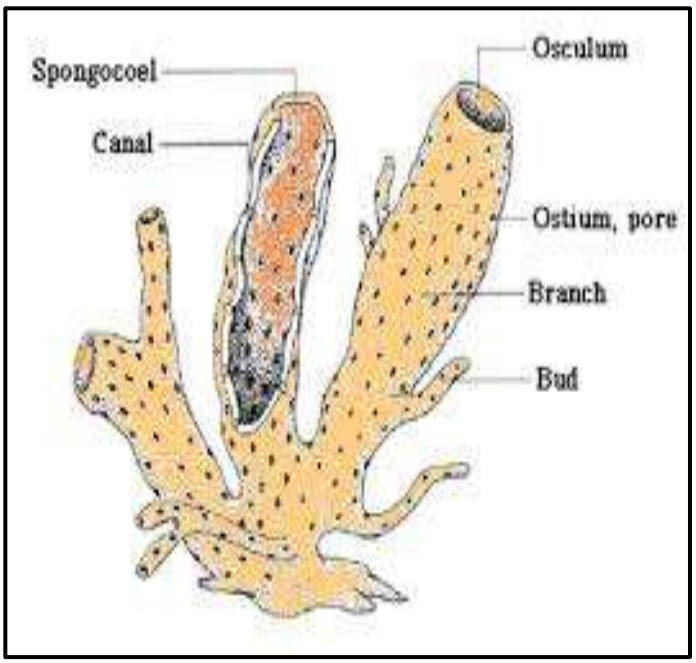
4- The colony of *leucosolenia* consist of numerous cylindrical structures; each of which is a complete animal.

5- It has radically symmetrical goby.

6- All the cylinders of the colony are attached to each other at the base, due to which the colony appears as a thick branched bush-like structure. It is whitish or yellowish in color.

7- In the center of each cylinder is a cavity called spongocoel which opens to the outside by a large aperture known as osculum. The wall of the cylinder is perforated by numerous pores which are intracellular and called incurrent pores or ostia, they lead into spongocoel.

8- *Leucosolenia* reproduces both by a sexual and sexual means.



Leucosolenia

Spicules

1- They are definite bodies of either calcium carbonate or hydrated silica, developing from scleroblasts.

2- Spicules of various types:

a- **Manaxon**: Which looks like a simple small needle pointed at one or both ends. It is common in class Demospongia.

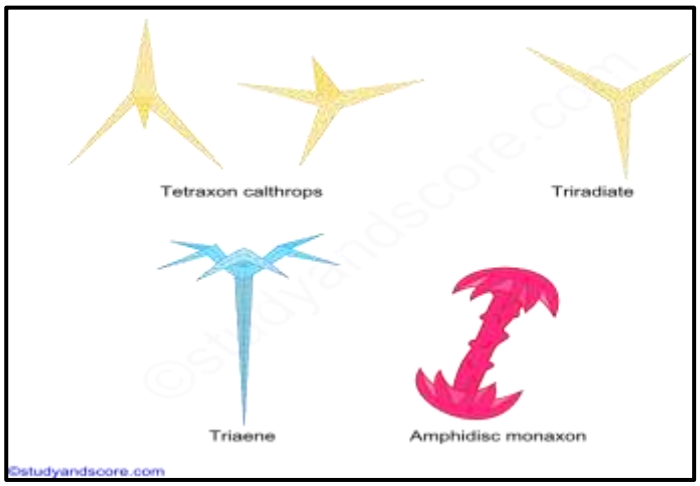
b- **Triaxon:** They are also called hexactined and occur only in the Hexactinellida.

Each consist of 3-axis crossing at right angle. Thus six rays appear which extend from a central point at right angles to each other.

c- **Tetraxon** (Tetractines): Has typically 4 rayes radiate from one point in various directions (not in the same plane).

d- **Troid**: Consist of 3 rays or 3 branches, it is found in class calcarea.

e- **Amphidisc**: Consist of middle adapter link between two disc shape, found in body wall of Gemmules.



Spicules

Spongin fibers

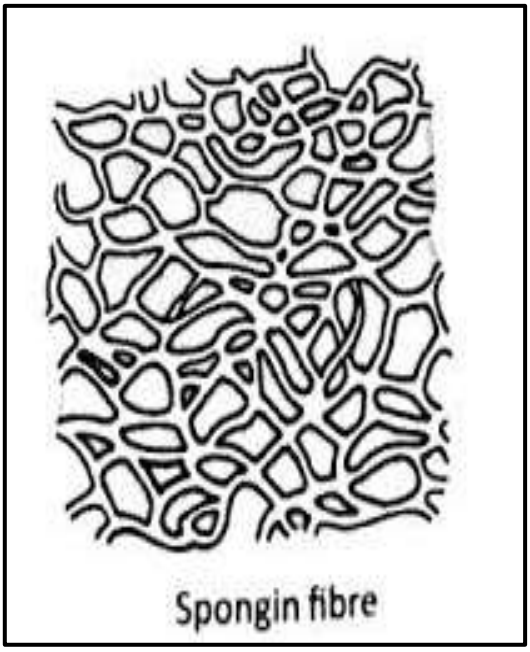
1- Spongin is an organic, horny, elastic substance, resembling silk in chemical composition.

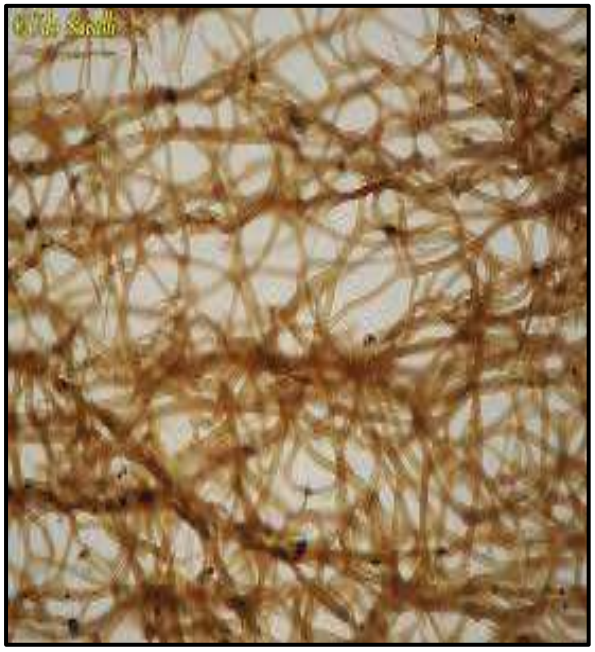
2- Spongin occurs in class Demospongia.

3- The spongin fibers are a fine threads consist of a soft granular axial core or medulla surrounded externally by concentric layers of spongin.

4- The fibres are secreted by flask-shaped mesenchyme (mesogloea) cells called spongioblast, which are seen coating the fibres.

5- These fibers branch and combine many times to form a network which is an elastic and supports the body wall.





Spongin fibers

Gemmules

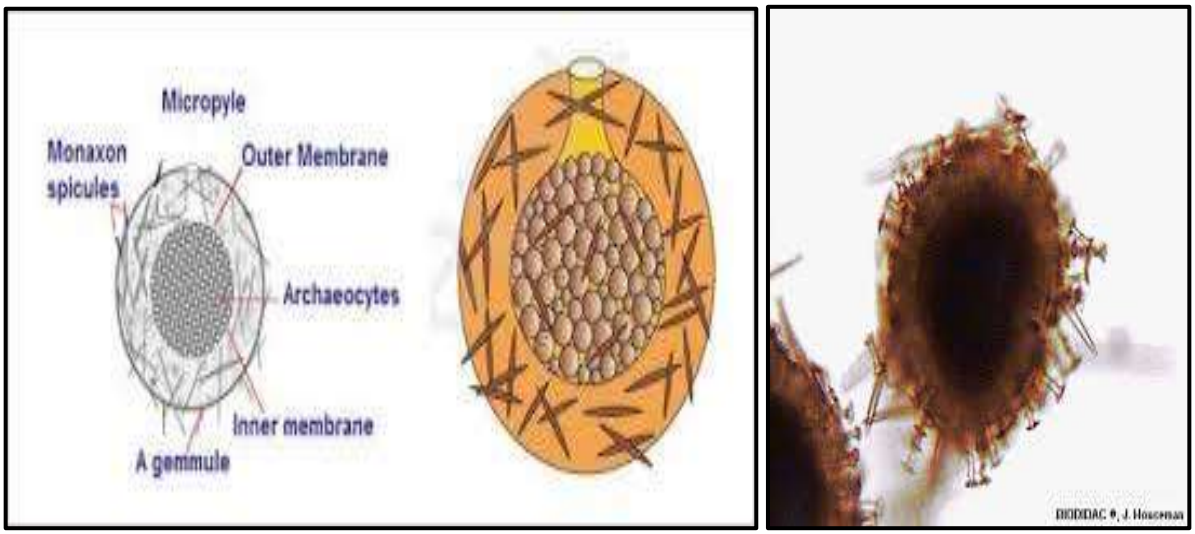
1- They represents method of a sexual reproduction, which are resistant to unfavorable condition.

2- Each gemmule consist of a spherical mass of food-filled mesenchyme cells (amoebocytes). Termed mass of archaeocytes surrounded by heavy protective coat strengthened by amphidisc spicules.

3- The coat has an internal chitinous layer and external thin layer where amphidisc spicules present in between them.

4- The amphidisc spicules with disc at both end arranged radically between the inner and outer membrane.

5- A completed gemmule has a small outlet; the micropyle which is ordinarily closed.



Gemmules

Phylum Coelenterata (Cnidaria)

General characters:

1- All the members of this phylum are aquatic, most of them are marine, other are found in fresh water.

2- They are either colonial or solitary. They are sedentary or free-swimming.

3- Symmetry is usually radial. In some forms, however is biradial.

4- They exhibit two different body forms, the medusa which is adapted for pelagic existence; and the polyp, which is adapted for an attachment benthic existence. Colonial forms have evolved in many polypoid forms.

5- One or more whorls of tentacles encircling the mouth at one end of the body. These are used for food capturing, ingestion and defence.

6- The soft and delicate body may be supported by horny or calcareous exoskeleton or endoskeleton.

7- The body-wall composed of two layers of cells (diplobastic), the outer epidermis (ectodermis) and inner endodermis or gastrodermis, and an intervening mesogloea. The mesogloea may be thin or thick, cellular or a cellular and is secreted by the epidermis and endodermis.

8- There are special stinging cells, the cnidoblasts which produce in them the peculiar nematocyst the organelles of offense an defense.

9- Only one cavity lined with endodermal cells, is found in the body called gastrovascular cavity. It performs the function of digestion of food and distribution of digested food. It opens out through the mouth which opens into stomodaeum.

10-Mouth serves for ingestion of food as well as egestion of undigested food.

11-Nervous system is primitive consisting of neuron.

12-Asexual reproduction takes place by budding, while sexual reproduction takes place by forming gametes in gonads. Gonads are simple without duct.

13-The life-cycle usually exhibits metagenesis in which free-swimming sexual generation (medusa) and sedentary a sexual generation (polyp) alternate with each other.

Phylum: coelenterate

Class: Hydrozoa

Order: Hydroida

e.g.*:* ***Hydra***

1- Hydra lives in fresh-water ponds, lakes and streams attached to submerged water plants through its adhesive basal disc, and is easily visible to the naked eye.

2- The body of *hydra* has a form of a tube like. Its proximal end closed by flat disc called the basal disc or foot which is used for attachment or fixes the body to the substratum and also helps in locomotion.

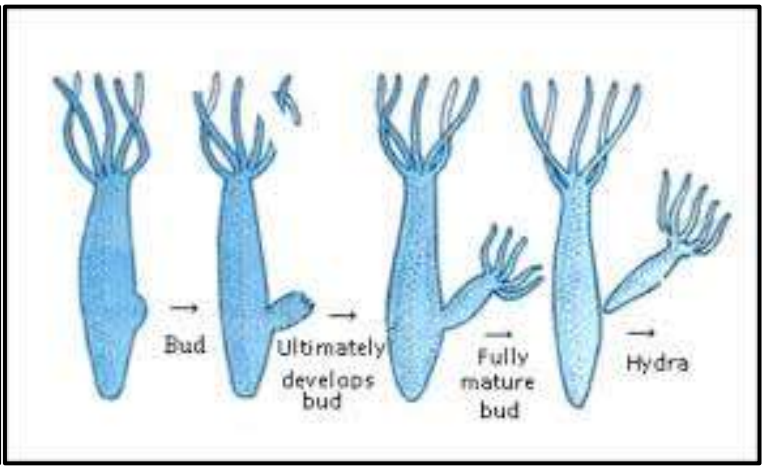
3- The distal free end of the body has small conical projection the hypostome or oral cone, perforated at the apex by a circular aperture, the mouth. A ring of 4-12 fine hollow processes, thetentacles, surrounds the base of the hypostome which carry nematoblasts.

4- For defense between the basal disc and the hypostome there is the body proper or column.

5- Female hydra characterized by the presence of knob-like ovary towards the basal disc. While the male hydra was distinguished by the presence of tests; usually two or more in number which are commonly appear near the hypostame as a conical swellings.

6- The buds are found as projection connected to the body of the parent which will grow forming the tentacles at its end and finally separate from the parents leading to an independent organism. Budding represents method of a sexual reproduciotn.

Hydra



***Hydra* budding**

Cross section in *Hydra*:

Hydra is diploblastic i.e made up of two layers: the ectoderm (epidermis), and the gastro dermis.

Ectoderm composed of various types of cells:

1- **Epitheliomuscular cells**: They are cone-shaped, large-sized, having their broader part outside and inner part drawn out into contractile process called muscle tails.

Muscle-tails have longitudinal running contractil fibers, the myofilaments that branch and anastomose, and one or more non-contractible

supporting fibrils called tonofibrils. Longitudinal arrangement of muscle-tails allows contraction of the body along the long axis.

2- **Interstitial cells:** Are small, rounded and filled the spaces between the musculoepithelial cells.

They are undifferentiated cells and seem to retain the properties of embryonic cells as they may give rise to any kinds of the other cells, especially the nematoblasts and germ cells.

3- **Cnidoblasts**: They are oval in shape and are extremely specialized cells for defense and offense

4- **Nerve cells**: The nerve cells are small and elongated having one or more processes. They are situated at the base of the epithel iomuscular cells just above their processes.

5- **Sensory cells**: Are narrow columnar cells. Each has a small projection exposed to the surface and is connected at its base with nerve-net.

Endoderm: (gastro-dermis)

1- **Musculo-nutritive cells**: Are tall columnar cells drawn out at their bases (i.e toward the mesogloea) in to contractile processes which run paralled to the circumference of the body. Their contraction causes a lengthening of the animal.

Some of these cells carry flagella (producing a water current) while others thrust out pseudopodia, and both contain food vacuoles in which some food particles are digested (intracellular digestion) .

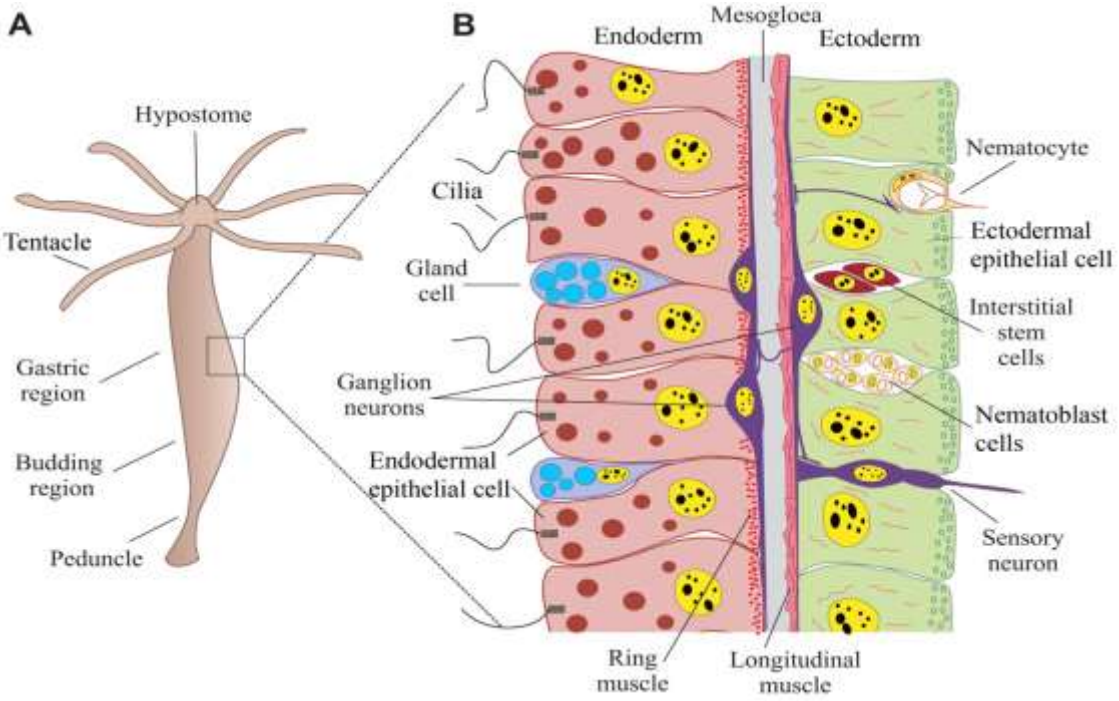
2- **glandular cells**: Found in between the musculo-nutritive cells and have no contractile processes.They are heavily granular and pour out their enzymatic secretion into the enteron (for extracellular digestion)

3- nerve cells:

4- Sensory cells:

5- **Interstitial cells**:

All these cells resembles that of ectodermic



Phylum: Cnidaria

Class: Hydrozoa

Order: Clyptoblastea

e.g.: *Obelia*

1- *Obelia* lives in colonizing groups in the seas.

2- The colonizing construction consists of two main parts, Horizontal Fibrous combinations called Hydrorthizea roots which construction vertical branches called Hydrocauli stems.

3- Body wall in the colonization consist of two cellular layers, the epidermis and the Gastrodermis, in which the Mesoglea layer splits

between the two previous layers, thus these three layers are known as Coenosarc.

4- The colonization is covered with a transparent chitinic cover called the colonization cover, or Perisarcyperiderm.

5- The colonization cover takes many different special forms in a specific areas, in which it might took the cup form around the Hydranth, then it called as Hydrotheca, while it takes the scepter form when it surrounds the Blastostyle, then it called Gonotheca, whereas in its top exists a vent for the Medusa projection, thus this vent called the Gonopore vent. As this colonization cover takes the Annuli form especially near the Hydranth and the Blastotyle, thus it become a form that is similar to the shelf in the bottom of the Hydranth base that the animal stabilizes on.

6- The Trimorphic colonization, means that it contains three types of animals,Hydranth which is a nutritive or feeding polyp and the Blastostyle is a reproductive polyp and the Medusa buds, thus the Colonization is constructed throughout the sexual breading.

7- The Conical Hydranth carries in its peak end a comination called an Oral cone or the Manubrium or Hypostome that open in the mouth end, therefore surrounds the conical mouth 24 solid tentacles supplied with a cnidocytes. The microbial stem has a Club-shape that lacks to the mouth and tentacles; its function is to form the Medusa buds by the buds method. While the Medusa buds are very similar to the umbrella, hanging into the outer stem by its arched surface, then it came out from the Gonopore after its maturity and its separation from the microbial stem.

Medusa Obelia

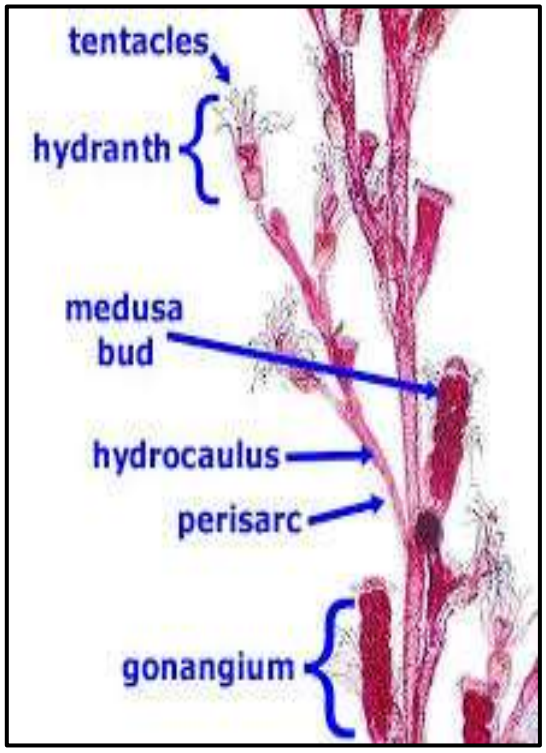
1- Its form is very similar to the Umbrella shape, means it has two surfaces one of them is arched, thus it called Ex-umbrella(outer surface) , while the is a concave called Subumbrella (inner surface)

2- Dangling from the concave surface, a tubular composition called Manubrium that carries in its peak the mouth vent with quatrain angels. In which the Manubrium cavity in the Umbrella center leads into four radical canals separated from each other equally, so that dividing the animal into four exact quarters, thus the radical canals connects in the Medusa edge with the Circular canal.

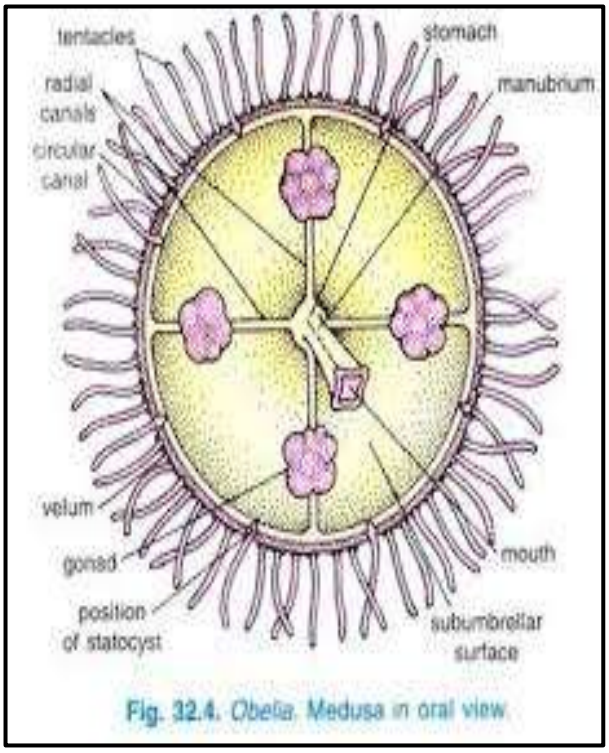
3- In the center of each radical canal, exists a genital gland or gonad (testis or ovary).

4- Medusa edge buckle slightly to form what is called velum, that dangling from it the tentacles that inflates in its base forming Tentacular vesicle or Bulb.

5- Eight organs exists for equilibrium which called Statocysts, two of them in each quarter of the body, means two respectively radical canals, in which each cyst located at the base of the tentacular root as small spherical compositions.



Obelia



Medusa

Medusa

Phylum: Coelentrata

Class: Hydrozoa

Order: Gymnoblastea

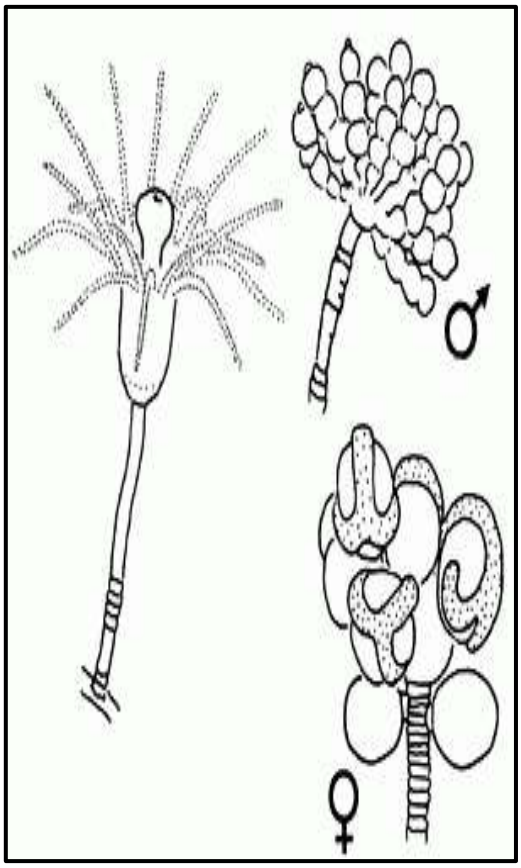
e.g.*:* *Eudendrium*

1- Forming abranching colony; the polyps rise form reticulated hydrorhiza.

2- It has trumpet-shaped hypostome and has a signal whorl of filiform tentacles.

3- No medusa but sporosacs present.

4- The Sporosacs was red in male and orange in female.



Phylum: Coelenterata

Class: Hydrozoa

Order: Siphonophora

e.g.: *Physalia*

1- It is marine, pelagic, polymorphic hydroid.

2- It is commonly called "Portuguese man of war" because it has a large, brilliant coloured pneumatophore or float which is like the cap of great Napolean.

3- The dorsal side of float was called crest or sail.

4- The float was fillied with a gas.

5- The float or pneumatophore has a pore called pneumatopore.

6- There are hanging from the underside of pneumatophore those are three types of zooids:

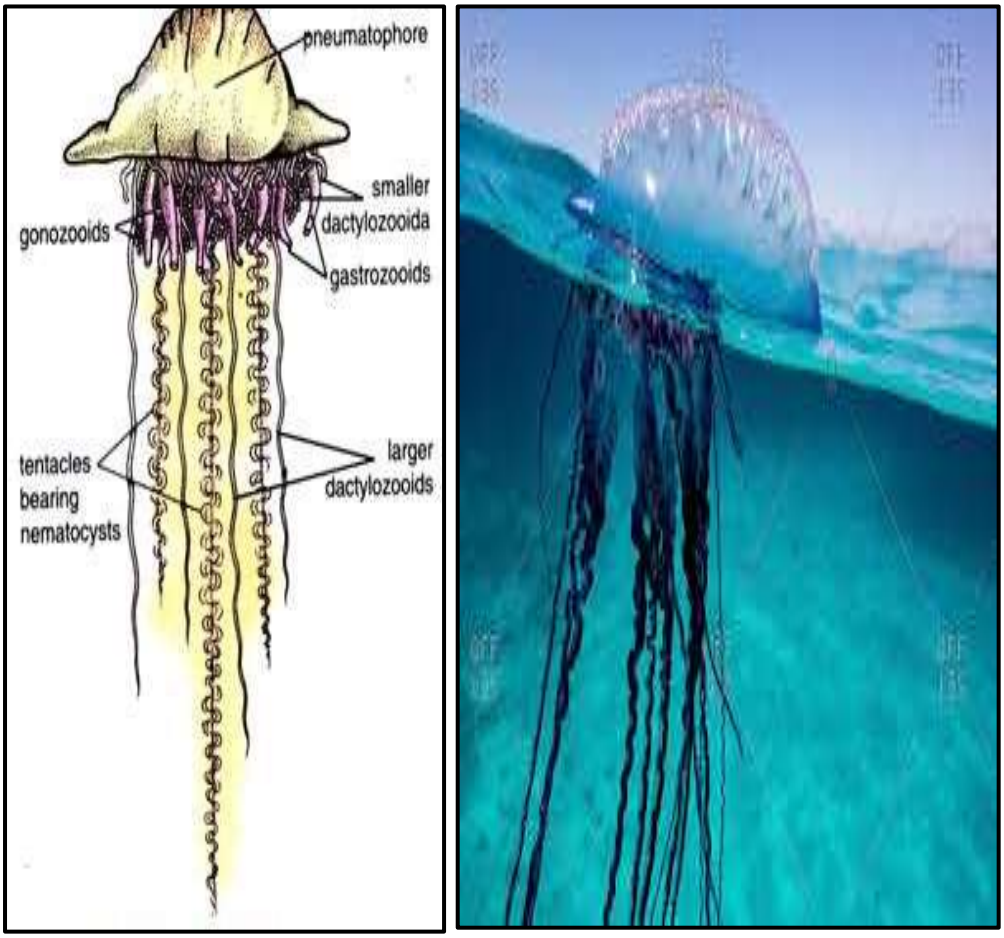
   a. **Gastrozooids:** nutritive zooids without tentacle.

   b. **Blastostyles:** reproductive zooids containing served.

   c. **Dactylozooids:** protective zooids with medusae tentacles and nematocysts.

7- The female gonophores are medusoid and free swimming, while male ones are small and remain attached it the cottony.

8- The sting of *physalia* very poisonous and the nematocysts so highly poisonous as to cause danger to men.



Physalia

Phylum: Cnidaria

Class: Scyphozoa

Order: Semaeostomeae

e.g: *Aurelia*

1- It is common jelly fish of a world-wide distribution.

2- The body is very much like that of hydromedusa having the form of an umbrella, a convex exumbrelaar side and concave subumbrellar side.

3- In the center of the subumbrella side is a short and inconsipicuous manubrium. The manubrium have a square mouth at its free end.

From each corner of mouth hangs down, tapering much frilled and delicate process, the oral arm.

4- Each arm has aventral ciliated groove leading into the mouth, the edges of the arms have a large number ofnematocysts.

5- The gastrovascular system (enteron), the mouth leads into a small centrall gastric carity which is extended into four gastric pouches. These contain the gonds, and close inside each gonda ring is a prominent row of gastric filaments which carry nematoblasts and digestive gland cell.

6- From each gastric pouch two unbranched a dradial cancels (total 8) lead into a marginal circular canal and a continuous current of water passes through them conveying food particles from the gastric pouches from the circular canal four branched interradial canal and four branched perradial canals lead inwards towards the gastric cavity and pouches conveying the current of water oute.

Reproduction:

The sexes are sparte; fertilization occurs inside the female medusa. A planula larva is formed which after leaving the mother, swims for some time, and then settles down transforming into a polyp know as the syphistoma. This stores food, multiplies a sexually and sooner or later it develops a series of horizontal fissions which gradually deepen forming a number of disc, simulating a pile of saucers. The process is known as strobilizalion (or strobilation). The discs separate successively giving rise each to an ephyra, which is a small larval medusa. This type of life-history is characteristic of scyphozoan.

*** Planula larva:**

Is a void, with ciliated outer ectoderm, and inner endoderm.

*** Scyphistoma:**

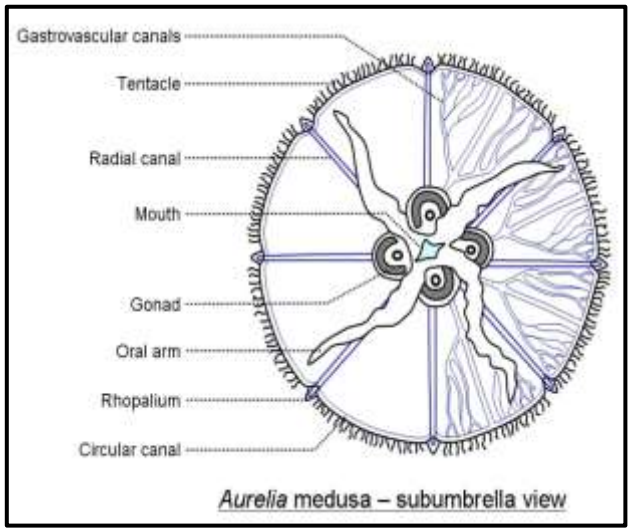
Is trumpet-shaped with 16 tentacles and signs of horizontal fission.

*** Ephyra:**

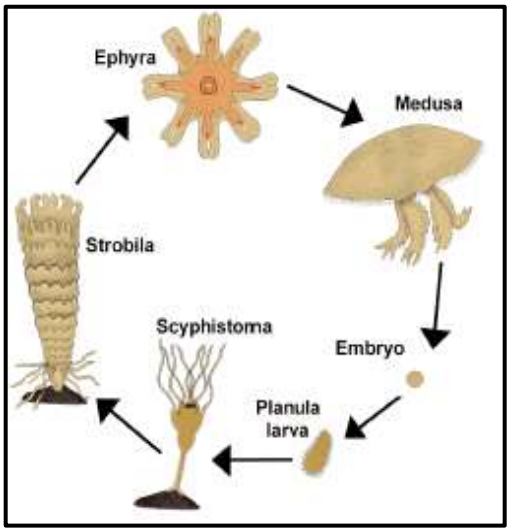
Is a small medusa with the umbrella divided into 8 long forked arms, a manubrium with the mouth in the middle gastric cavity, gastric filaments, and 8 prominent tentaculocysts.

*** Scyphistoma before stobitation:**

Resembles *Hydra* with a circle of tentacles and mouth but with the gastric cavity divided into four gastric pouches.



Aurelia



Life cycle of ***Aurelia***

Aurelia

Phylum: Cnidaria

Class: Anthoza

Order: Zoantridium

E.g.: *Metridium*

1- The sea-anemone is a large, sessile, marine polyp.

2- It has a thick columnar body and numerous short tentacles.

3- The peristome or oral disc is expands horizontally to form a round saucer-shaped in the upper or distal free end of the body.

4- Many small and hollow tentacles are present a long its margin in the form of a crown, these tentacles are arranged in several circles around the slit-like mouth present in the centre of the oral-disc.

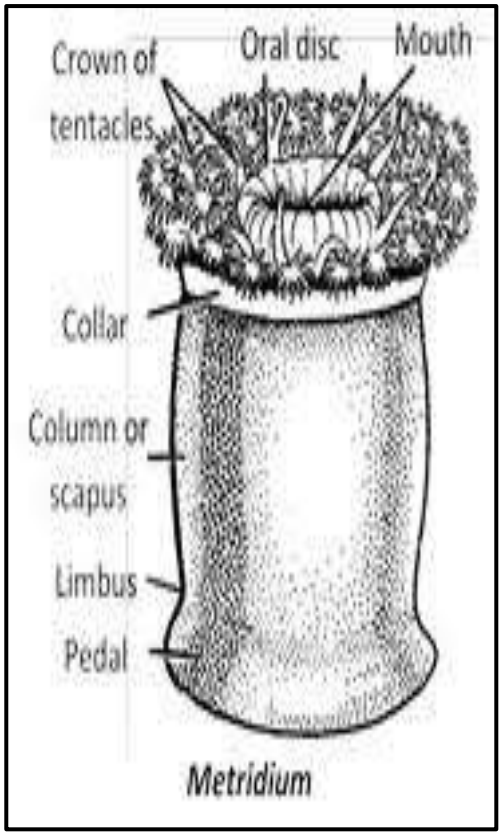
5- The upright part of the body is thick walled and called the column.

6- The column may be differentiated into an upper short region the capitulum and a lower thick walled region, the "scapus".

7- Scapus just before joining the capitulum stands up as a distinct fold, the collar or parapet, and a groove called fosse results between the collar and base of the capitulum.

8- In some of the sea-a new ones the column wall is provided with a number of pores, called as cinclids through which a contia protrude out.

9- The base is demarcated externally from the column by a groove, the limbus, and is expanded to form a circular pedal disc for attachment to the substratum.



Mouth

Metridium

Phylum: Cnidaria

Class: Anthoza

Order: Alcyonaria

e.g.: *Tubipora*

1- It is marine, colonial animal found in shallow waters of tropical and temperature regions.

2- It is commonly called "Organ pipe coral".

3- Colony consist of long parallel and upright tubes closely fitted, and joined together at definite interval by horizontal calcareous tubes.

4- The skeleton is internal and is covered by ectoderm in living condition.

5- The mesogloeal spicules become closely fitted together and form a continuous tube for each polyp.

6- A sexual reproduction by pculiar budding.

7- The base of original polyp eexpands from which new polyps originale.

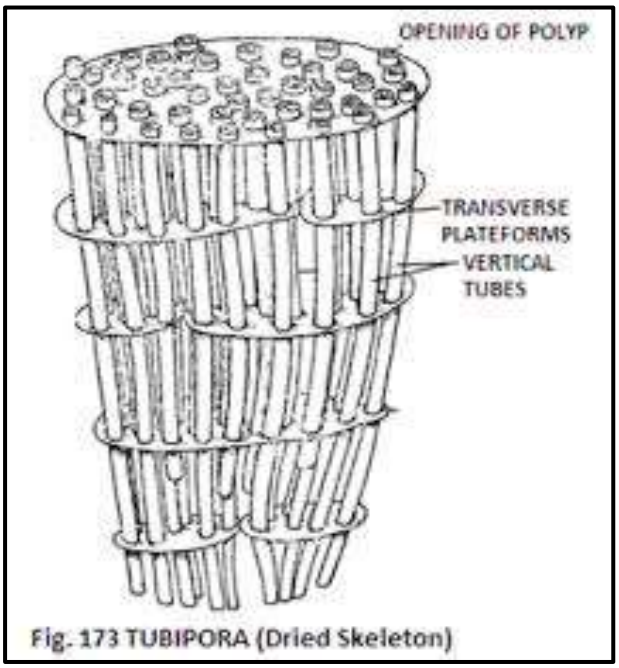


Fig. 173 TUBIPORA (Dried Skeleton)

Tubipora

Phylum Platyhelminthes:

1- The armed worms are characterized with its body Dorse-ventrally flattened.

2- The triploblastic worms, means that its bodies constitutes of three germinal layers: ectoderm, endoderm and Mesoderm.

3- Its Bilateral symmetry.

4- Doesn't have any somatic bore, so that it is Acoelomate, in which the bore exists between the body wall and the digestive canal is filled with the Parenchyma.

5- The system contains flame cells.

6- The genital system is very complex in its structure. The animal normally being unisex and sometimes they might be separated.

7- The digestive system ends if its exists with a closed end, means there is no anus vent in the flattened worms, in addition to the absence circulatory system and respiratory system.

8- Most of this class members are parasitic, as some of them lives freely.

9- The appearing of the cephalic area clearly (Cephalization).

Phylum: Platyhelminthes

Class: Turbellaria

Order: Tricladida

Eg : *Planaria*

1- It lives a free in the fresh water, often exists stick underneath rocks. This creature is form Carnivorous clas, feeding on the Crustacea, worms small smooth things and on a parts of a big dead animas, thus it commonly cover the nutrition materials with a clingy substance excreted by special kind of Epidermis cells, then eating these

nutrition materials by the pharynx that is able to be extended and launching outside the mouth vent. Therefore this creature moves from one place to another because of its muscles and lashes movement spread on its Epidermis especially the ventral side.

2-The animal has a flat body from the dorsal-ventral side, the cephalic area has two bumps on the sides called Auricles. The anterior is wider than posterior end, that the worm sharpen from the posterior end.

3-In the dorsal side of the cephalic area, there is two eyes sensitive to the light, but they don't formulate images.

4-The mouth ventrally located after the middle of the body, the Genital opening is located behind the mouth.

5-The animal has great ability to regeneration, means recovering the missing parts from his body. Animal characterized with its ability to tolerate hunger for long time periods.

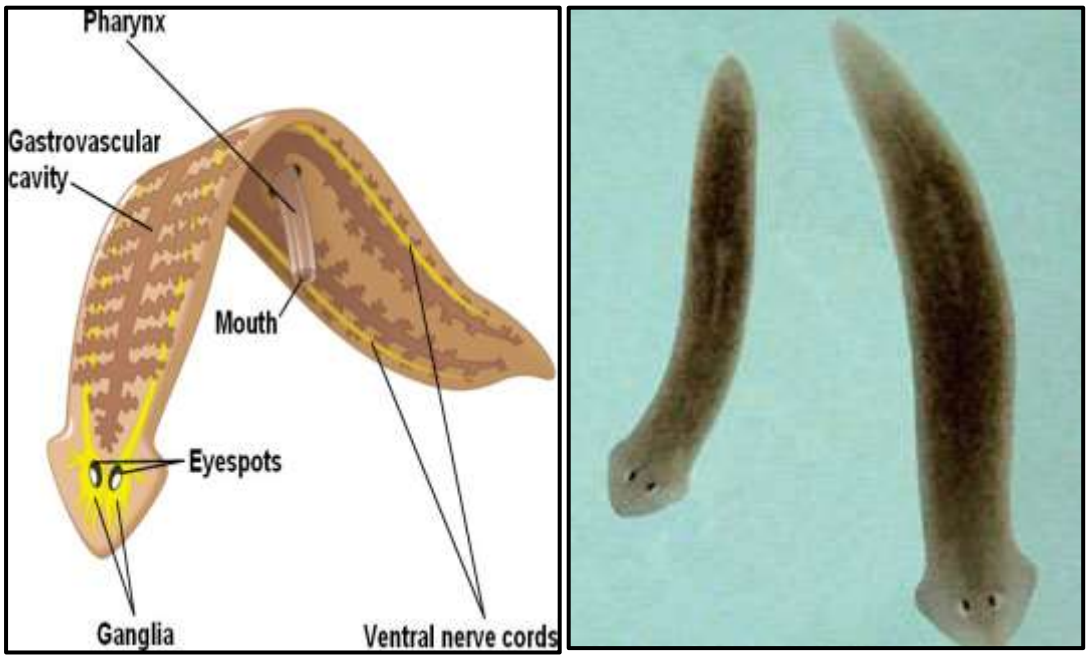
Digestive System of *Planaria*:

1- The mouth ventrally located in the ventral side near the body center.

2- The mouth leads to a space containing the cylindrical muscular pharynx which has ability to retractile, it might be extending from the mouth vent into the outside during the nutrition process.

3- The pharynx leads to the intestine, which splits into three branches or intestinal caeca, one of them extends forwardly in the middle, the other two bends backwardly, one on each sides of the body till its posterior tip approximately.

While from the intestinal caeca envolving a lateral forked branches of diverticula, with a dead end. The animal doesn't have an anal opening.



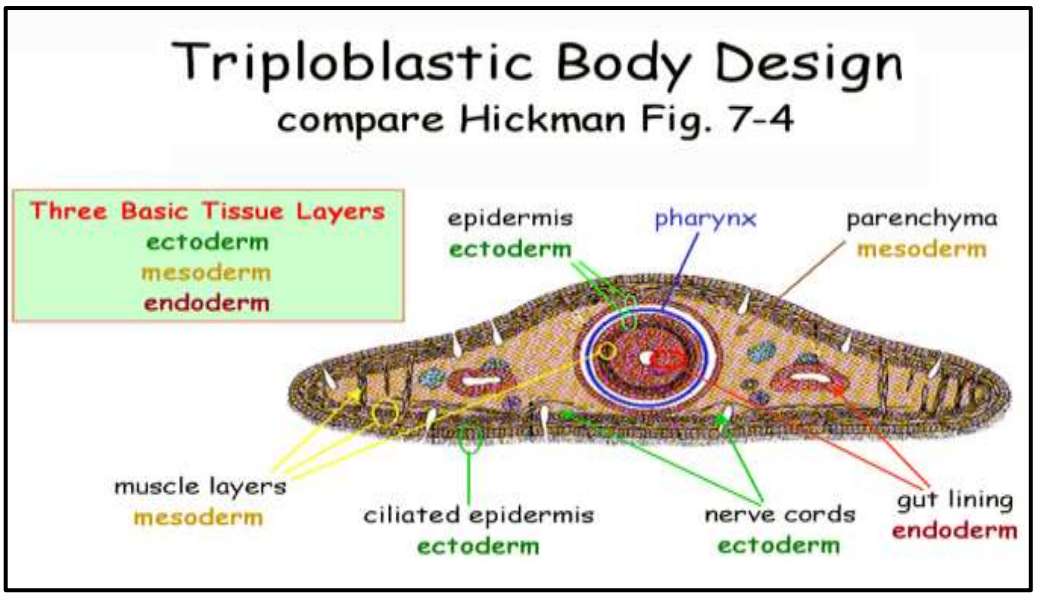
Planaria

Cross Section of *Planaria*:

1- **The Epidermis:** consisting of a vertical fringed covering cells layer, enriched with mucous cells, and there are another covering cells containing a stick-like bodies known as Rhabdites, in which it melts when touching water and converting into a clingy solution, that might help to stick on and hunt the prey, also helps in protecting from the enemies. Therefore the Epidermis placed on a basement membrane.

2- **Musculature:** consisting of circular muscles directly located under the basement membrane, besides it lays a slanting tissues and longitudinal muscles. In addition to these muscular layer, exists a dorsal-ventral muscles.

3- **Parenchyma or Mesenchyme tissue:** this tissue constituted from a disassembled cells, containing a long unordered, in addition to the existing numerous spaces between the cells, in which this tissue fills the inner part from the section, you can notice in it some transversal sections from the digestive canal, the excretory organs, and the genital organs and so on.



Phylum Aschelminthes:

General Characteristics:

1- Triploblastic animal.

2- Containing apseudocoel body.

3- Characterized with its lateral symmetry.

4- Body covered with cuticle.

5- The digestive system either being complete starting with the mouth and ending with the anus or with the compiler or without anus, and might completely lack to the digestive system, as in the males of some rotary worms.

6- The excretory system is protonephridial, its substructure from flame cells or Flame bulbs or inner cellular canals.

7- The nervous system consisting of a mass of nerve tissue located in the cephalic region of the body, it might surround the digestive canal pharynx, in which two or more long nerve cords extending from it.

8- Lacks the True metamerism, in which some of them reveals a superficial metamerism.

9- Lacks to the circulatory system and respiration system.

10-These sexes commonly being separated.

11-Some of them are dangerous parasitic life on the animals and plants, while the other part lives freely.

Phylum: Aschelminthes

Class: Rotifera

Order: Monogonontidea

E.g. : *Asplanchna*

1- The body is short cylinrical, anterior end is wide while the posterior is narrow thus the animal has two big lateral wings on the sides of the trunk.

2- The body splits into two parts: the head and the trunk, in which the head area is characterized by carrying a Ciliary apparatus in its forefront, which is a discoid structure carrying a large numbr of long lashed, assisting the animal to move appropriately, and in collecting the food fragments via generating water waves. This structure is called Corona or Wheel organ or Trochal disc. Depending on the shape and movement style of this structure, these animal called as the Rotifera, or wheel or rotary worms. The Rotifera disc might be lobed.

3- The mouth located in the ventral side of the Rotifera disc, that leads to a short muscular pharynx relatively big called the Mastax, in which it is filled with a very thick layer of cuticle, transformed later into something similar to the strong jaws used for cutting and grinding the food, whereas the pharynx leads to a closed cystic shaped stomach. While the mouth is used as a mouth and as an anus regarding its function, in which discarding the undigested materials throughout the mouth. Also there is a couple of big digestive glands, one on each side of the stomach. Thus, the digestive system misses the intestine and anus.

4- The Y shape ovary is located near the backside of the animal.

5- The trunk is surrounded by a protective layer of cuticle known as preventive plate or Lorica.

6- This animal lacks to the foot which containing the Cement glands and the Toes.

7- It is possible to see or notice some muscular tissues extended between the Lorica and the Rotifera disc, therefore it plays in important role in the movement and shrinking of the Rotifera disc.

Asplancna

Phylum: Annelida

General Characters of Annelida:

1- Most of Annelida lives in fresh water or sea water also some of them lives in the soil.

2- Their bodies characterized by metamerically segmented, which means it's consist of number of segments or meta mores which are almost similar to each other (it may combine, or mutate, or specialize to do certain function) which is separated by septa.

3- They have True coelom.

4- They are triploblastic animals.

5- Body wall consist from outside to inside of the following layers:

Cuticle layer, Epidermis, circular muscles layer, longitudinal muscles layer and they may have obliqne muscles, finaly the peritoneum layer.

6- The Gut is complete and provided with some glands.

7- Most of them have spinal chitin structures called setae (chaetae).

8- Excretory system consist of tubular funnel-shape fringed structure called Nephridium, where each segment has pair of it.

9- Before mouth opening, usually there is a lobe known as prostomium,which is not a true segment.

10-Respiration takes place by body wall and Gills.

11-Sexes are usually separated,or in the same animal (Hermaphyodite).

12- Nervous system consist of cerebral ganglion (or the brain) and also it is called a supra-pharyngealganglion. Brain consist of two .These commissures connect with a merged pair of nervous nodes ,the sub pharyngeal ganglion,from which extend the double ventral nervous cord .Nervous cord swells in each body segment , forming a ventral

nervous node which gave a numerous nerves supply to different parts of the body .

13-Circulatory system from closed type, where the blood moves through blood-vessel.

14-They have direct or indirect development.

Phylum: Annelida

Class: Oligochaeta

Order: Opisthopora

Eg *:* *lumbricus terrestris* (Earthworm)

External Feature or Morphology Earth Warm:

1- The body is long and cylindrical but little flat from the ventral side and the long of the worm could reach to 30cm. and almost consist of 150 clear segment. The worm lives in the humid soil.

2- Before the mouth and to the top there is a clove (segment) called prostomium. And it's not a true segment.

3- The first segment has the mouth opening and called peristomium.

4- The body ends with a segment called anal segment that has the anus.

5- There is a swelling on the back and side roof for the body starts from the segment 32 or 33-37 as called the clitellum forms the cocoon.

6- Each segment except the first and last segment has four pairs of Katan bristles in the ventral (Abdominal) side.

7- Segment number 15 has on it's ventral roof two small thickening each of it surrounded by an opening form the two nale genital openings.

8- The worm's body has the following segments:

A-**mouth segment**: Crescent shaped located in the first segment.

B- **Openings of seminal receptacles**: two pairs of exact openings, one of them lactates within the separation groove between the segment number 9 and 10, another pair between the segments 10 and 11 from the ventral side.

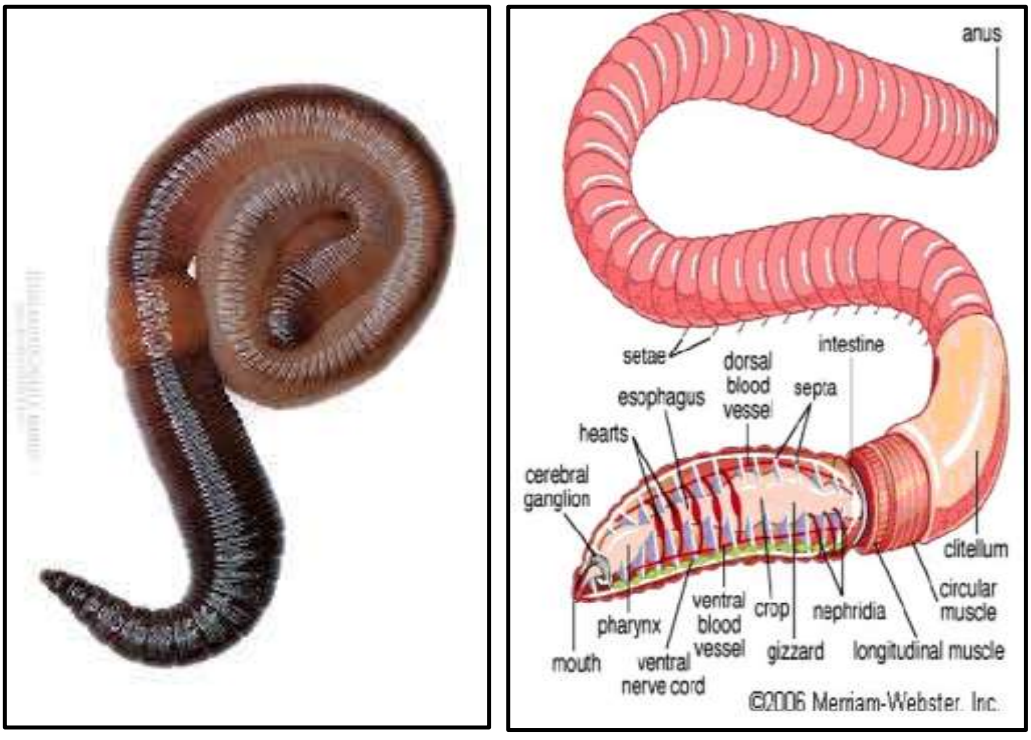
C- **Female genital openings**: pairs of small opening which locate on the ventral roof for the segment number 14.

D- **Male genital openings**: pair of big opening surrounded by clear lips, the two opening locate in the ventral side of the 15the segment.

H- **Dorsal pores**: one opening in every groove in the back middle line, starts from the segment umber 8 or 9 until the body end. It's useful to let the liquid out to surface to make it wet.

O- **Nephridial pores**: pair of it in every segment in the ventral side except the first three and last segment.

Z- **Anus**: Oval shaped big opening locates at the end of the body.



Lumbricus terrestris

Transverse section (in the intestinal region) of earthworm:

The body wall constitutes of the following layers:

a- **Cuticle:** which is a very delicate smooth layer covering the external surface of the body, secreted by the epidermis layer.

b- **Epidermis**: it constitutes of one layer of cell, in which their peaks might not reaches the Cuticle layer, so that the epidermis looks like as Pseudostratified, there are many types of cells in this layer such as:

1- Supporting cells: they are vertically longitudinal.

2- Basal cells: very small spherical or cylindrical cells, that its peak doesn't reach the Cuticle layer.

3- Sensory cells: they are fusiform shaped carrying on its peak a sensory capillary in which these cells might exists in groups or individually.

4- Gland cells: they splits into two types, big Mucous cells and albumen or albuminous, which is very small, flask shaped filled with cereals or secreted material.

c- **Basement membrane**: a very thin layer, in which the epidermis cells based on it.

d- **The muscular layer**: it is a very thick layer consist of two types of muscles according to its arrangement, that is the circular muscles and the longitudinal muscles. The first type located under the basal membrane directly, in which the muscles take acicular position, thus this muscular area is characterized with less thickness than the longitudinal muscles that exists underneath it. In which the muscles inside it take the longitudinal shape, thus, the longitudinal muscles splits into seven groups separated from each other slightly.

e- **Peritomeum**: a thin layer consist of one row of covering flattened cells which entourage the coelom. Next to the peritomeum layer exists the true coelom that surround the Alimentary canal, that shows different combinations, according to its different parts, also the coelom shows many compositions as the anal organs (normally) or the male-female genital organs according to the section in the body.

If the section passes the intestinal area we will see the following layers that contributes in Alimentary canal formation.

1- The external covering layer: it represents the Peritomeum, it is a thick layer of special cells called Chloragogen cells, functions to built and save glycogen and fat, thus it might perform an anal function, as some think that is a foot source for the mature eggs.

2- The muscular layer: that consists of two layers of muscles, longitudinal muscles followed by circular muscles that is the reverse of its arrangement in the body wall.

3- The basal layer.

4- Covering vertical cells that represent the inner entourage of the intestinal.

The most significant thing noticed in the section passing the intestinal area is the **Typhlosole**, which is a dent in the intestinal dorsal wall and its entourage along its length, that is behind the capacity of the intestine to absorb, adding a new surface for the sucking surface.

Besides to, it is possible to notice the double ventral nerve cord located between the intestine and the body wall from the ventral side.

Also there are sections in the blood vessels such as:

1- The dorsal blood vessel (supra-intestinal), a big section located above the intestine directly.

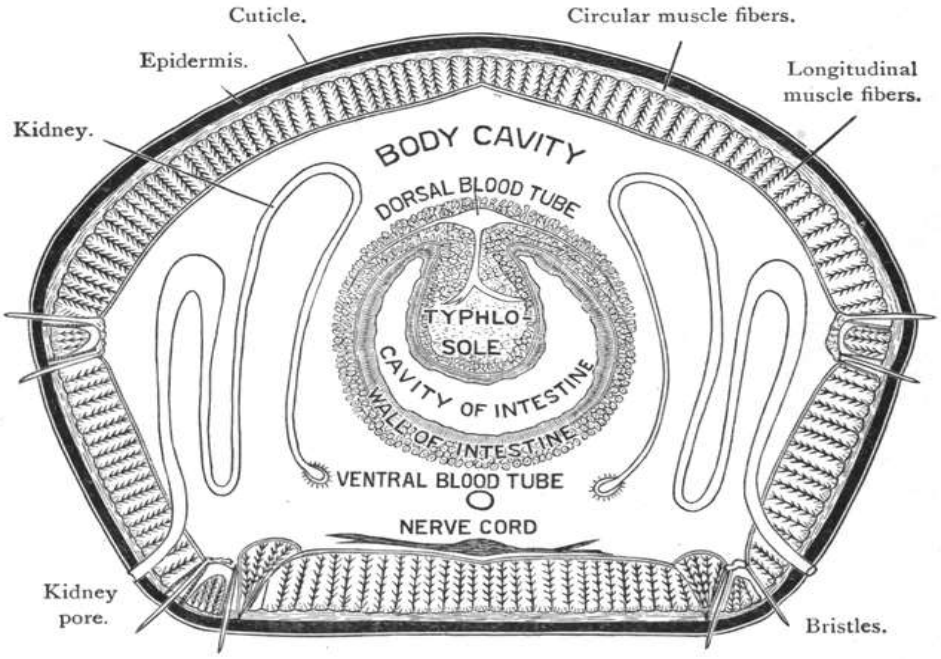
2- The ventral blood vessel (subintestinal) also kind of big section, located between the intestine and the ventral nerve cord.

3- The subneural blood vessel, a small section underneath the nerve cord directly near the enter line of the section.

4- The two lateral neural blood vessels, very small sections, sometimes it is difficult to identify them, unless being careful and precise in examining it, each one is located on the nerve cord sides.

5- Typhlosolar blood vessel, kind of big section, easily noticed in the Typhlosolar.

Some sections might appear in a lateral section passing in the body wall as a stinger cationic compositions that is chaetae or setae, organs used in moving or it might transform into a secondary function.



The layers of body wall

Lateral section of the earthworm passing through the gizzard area:

The gizzard is considered as a stiffen muscular organ entourage from the inside with cuticle that secretes from the covering layer, whereas the muscular layer's wall developed very well.

The body wall is similar to what we've studied in the intestinal area, in which noticing inside the body bore, the existing of:

1- Muscular buffers (constituting of longitudinal and circular muscles) between the rings.

2- The blood vessels in abundance in the section around the muscular wall of the gizzard (between the covering, muscular and circular layers).

The muscular layer of the gizzard wall is very thick, that is from the circular muscles, therefore the thickness is clearly shown from the dorsal and lateral side, while the longitudinal muscles are in a very thin layer shape around the circular layer heading into the outside then next to it is the inner covering layer entourage with cuticle.

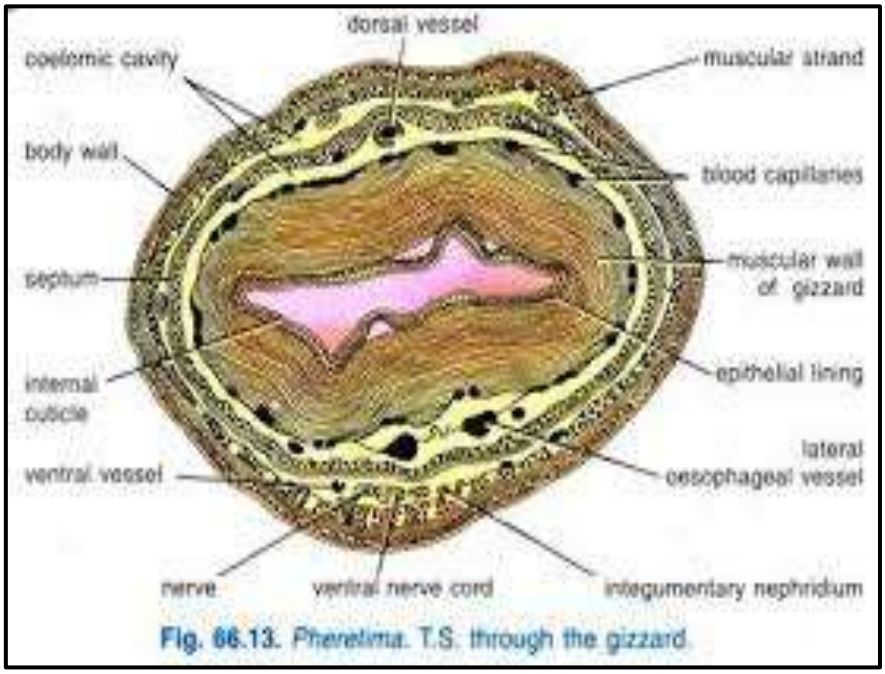


Fig. 66.13. *Pheretima*. T.S. through the gizzard.

Cross Section of Clitellum:

The cross section of clittelum resemble the section of intestine except that in section of clitellum the epidermis is thick in dorsal surface and lateral side and contain cells called clitellar cells.

Cross Section of Sex-organ:

1- The body wall consist of same layers that found in C.S of intestine.

2- In the middle of this section we there is oesophagal gland, above it dorsal blood vessel and below it ventral blood vessel and nerve cord sections , also found pseudohearts. Seminal vesicles occupies most of the cavity in this section. 2 pairs of finger-shaped testes and many sections of vas defere.

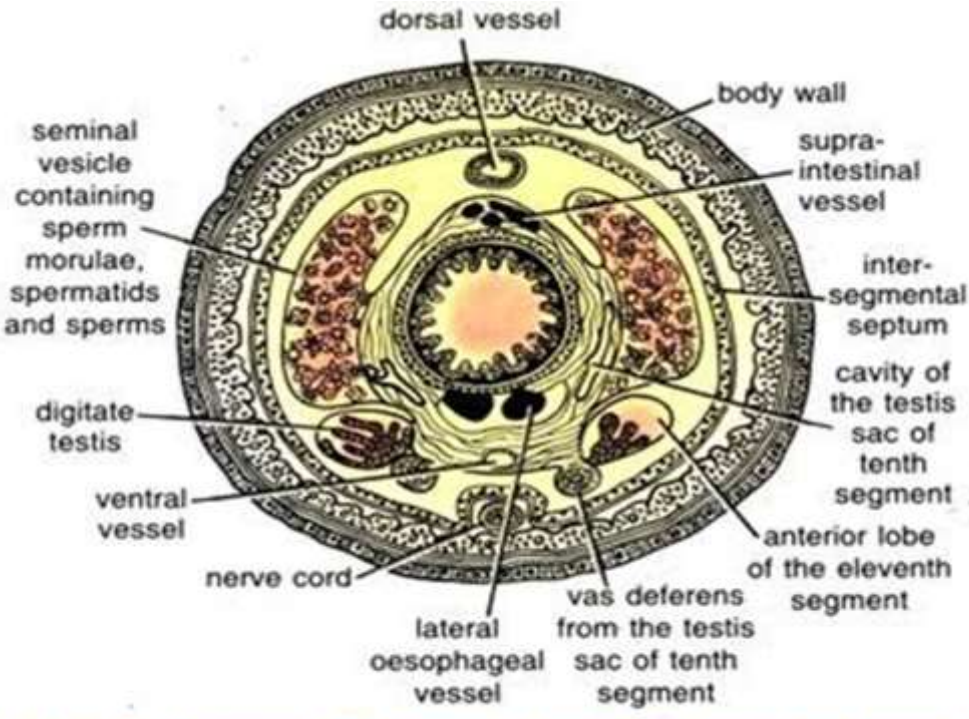


Fig. 66.30. *Pheretima.* T.S. passing through the testis sacs, testes and seminal vesicles in the anterior region of 11th segment.

Phylum: Annelida

Class: Polychaeta

Order: Errnatia

e.g.*:* ***Nereis***

External morphology of *Nereis*:

1- The body is long slender and cylindrical, consist of about 120 segments or more this worm called as sand worm or clam worm according to its manner in sand or with clams.

2- All segments except for the head and the last segment are externally alike ,the body of the worm is long (2-12 inches) dorso-ventrally flattened with small dorsal convexity and flattend ventrally.

3- Body is divided into two parts , head and body segments, the head consist of two parts: the

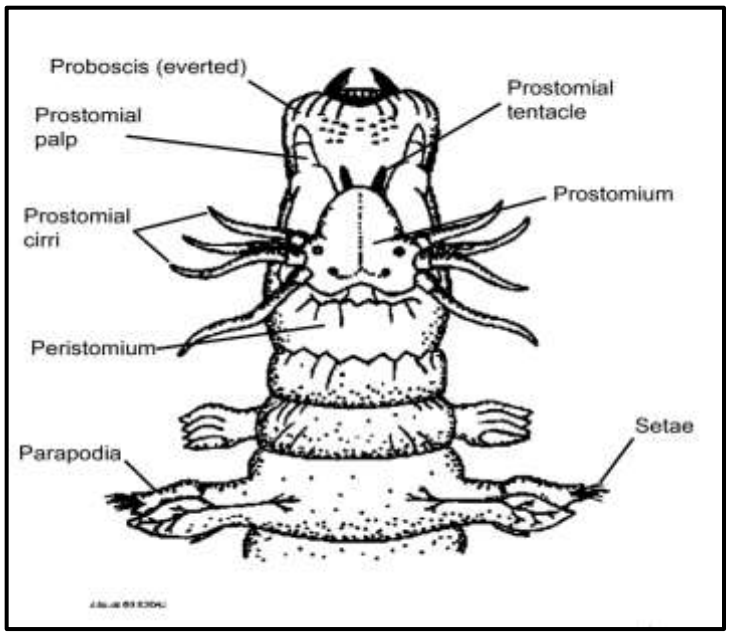
   a. **Prostomium** which is triangular anterior lobe, and has four large rounded eyes on the dorsal surface sensitive to light, a pair of short cylindrical tentacles at its anterior tip ,and ventrolaterally a pair of stout fleshy contractile palps(each palp consist of two lobes large basal and small apical it bears the beain).

   b. **The preistomium**; it is a ring like portion and represent the first true segment. It carries four pairs of lateral cirri and bears the mouth opening ventrally from which afarynx is com out with its jaws .

4- Each body segment except the proistomium and the last segment bear laterally a pair of movabl muscular proceses called **parapodia**, used for swimming and respiration.

5- The last or anal segment bear the terminal anus the parapodia are absent and carries a single pair of elongated ventral cirri called the anal cirri.

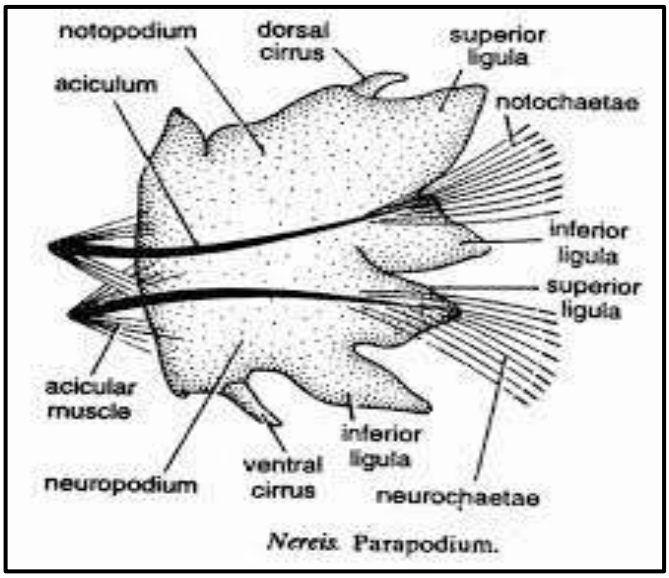
6- On the ventral surface of each segment except the first and last one there is a pair of nephridiopores near the base of the parapod.

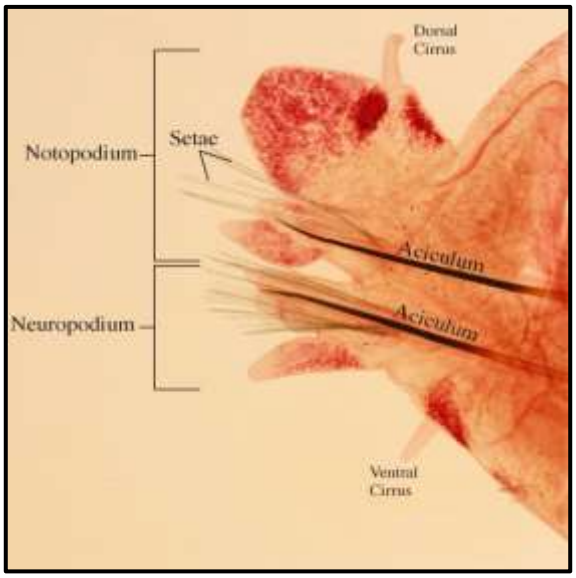


Head of ***Nereis*** ***Nereis***

Parapodia of Nereis:

It is a flattened fleshy projection, divided into two parts a dorsal part, called as notopodium and ventral part called neuropodium. Each part consist of two 2 small finger-like structures one of them attached to the notopodium and called dorsal cirrus, while the other one attached to the neuropodium and called ventral cirrus . Also each parapodia bears a large straight dark coloured setae called aciculum and supported by large bandle of long setae . The function of parapoida is for swimming and respiration.





Parapodia

Cross Section of *Nereis*:

Body wall consist of the following layers:

1- Cuticle:which is a thin layer.

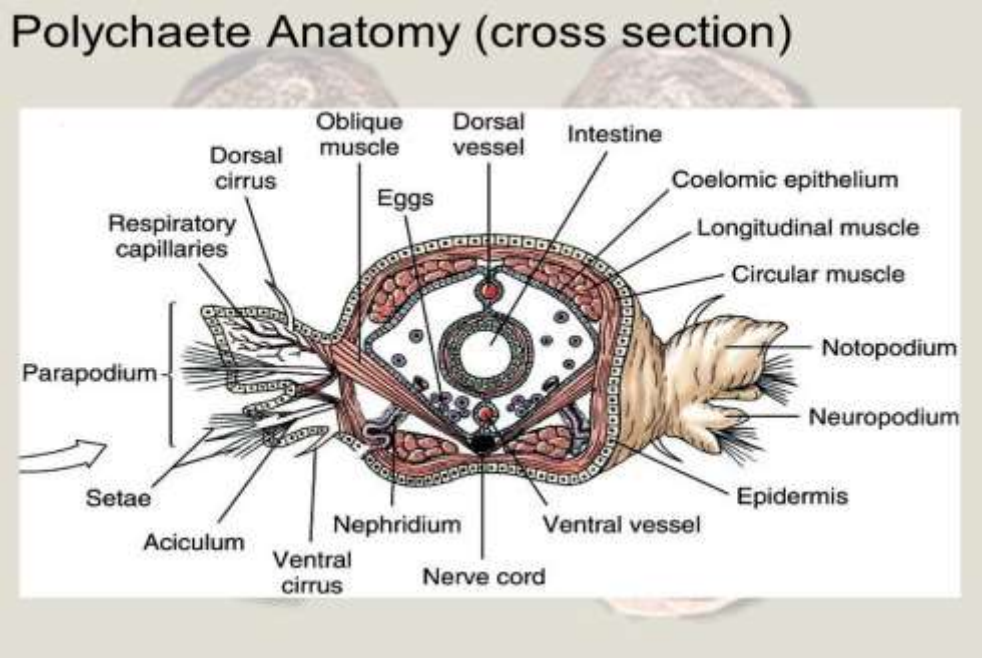
2- Epiderm: consist of simple columnar epithelial cells.

3- Muscle layer:consist of circular muscles which is continuous around the section longitudinal muscles arranged in four big bundle two dorsal and two ventral one,and oblique muscle fibres arranged in two groups one on each side of the body.

4- Somatic layers of coelomic (or peritoneal) epithelium.

5- Splanchnic layer of coelomic ephithelium surrounding the intestine (which is lined with columnar epithlium).

6- Dorsal and ventral blood vessels, ventral nerve cord, parts of nephridia, muscles which more the acicula and parapodia.



Phylum: Annelida

Class: Hirudinea

Order: Gnathobdellida

e.g.: *Hirud* (Leech)

1- The medical leech lives on the blood of vertebrates, (Like frog-fish-which lives in pond lakes and it sucks there blood).

2- Man has long made use of this power of leech by letting it to such the blood of patients, and so is called the medical leech.

3- Body is dorsoventrally flattened with greenish-brown colour, with paler that of dorsal surface .

4- The Dorsal surface is marked with yellowish longitudinal band spotted with black pigments, while the ventral surface is irregularly spotted.

5- Body consist of 33 true segments, but the external surface of each segments is further divided by transverse grooves into annuli, so the animal with this superficial segmentation appear to be consisted of more than 100 segments

6- Each true segment in the middle of the body is divided externally into (5) annuli and this division is less at the anterior and posterior end .

7- Worm posses two suckers anterior or oral sucker and posterior suckers.

8- **The anterior sucker**: is consist of prostomium and the four anterior segment ,it is ventrally located, oval in shape, small in size and bear a mouth opening .

The posterior sucker: is formed by the complet fusion of the last seven body segments, it has cup or circular disc-shape ventrally located and larger than oral one.

Its function for attachment and locomotion but the anterior sucker also helps in the feeding .

body of leech has a number of apertures these are as follows:

a. Mouth: It is a narrow triradiate aperture situated in the center of pre-oral chamber of anterior sucker.

b. Anus: It is a small aperture situated mid-dorsally on the 26^{th} segment at the junction of the body and posterior sucker.

c. Nephridiopores: (17) pairs of minute nephridiopores present on the ventral side of the body , which located in segments number 7-23 .

d. Male gametal pore-leech is hermaphrodite so it has male and female pores in the same worm , it is a mid-ventral opening situdated in a groove between the second and third annuli of the 10^{th} segment.

e. Female genital pore: it lies mid-ventrally in the groove between second and third annuli of the 11th segment.

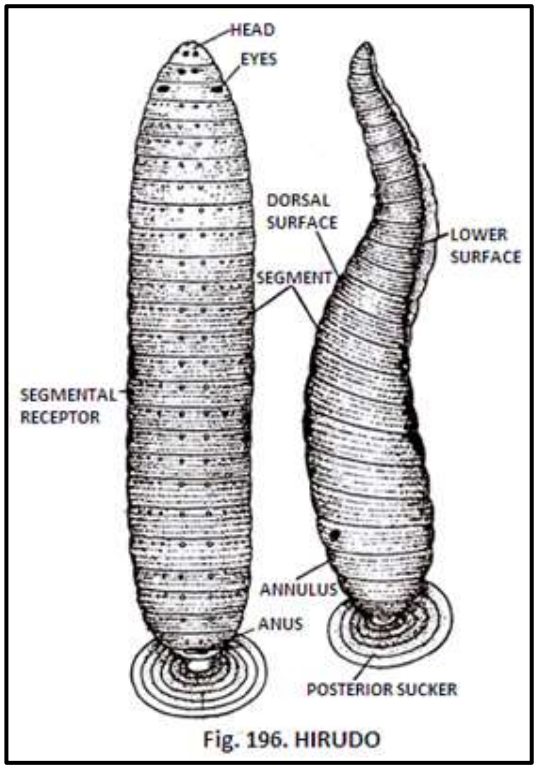


Fig. 196. HIRUDO

Leech

Phylum: Arthropoda:

General Characters:

1- Arthropodas are triploblastic bilaterally symmetrical .

2- Body consist of three regions:

a. Head.

b. Thorax.

c. Abdomen.

3- Body segments usually bear paired lateral and jointed appendages.

4- Body is covered with a thick chitinous cuticle forming an exoskeleton.

5- Body cavity is haemocoel. The true coelom is reduced to the spaces of the organs (reproductive and excretory).

6- Alimentary canal consist of three regions:

a. Fore gut.

b. Mid gut.

c. Hind gut.

7- Excretory organs are green glands, coxal glands or malipighian tubules.

8- Respiration takes place by general body surface, gills, tracheae or book-lungs.

9- Nervous system consist of brain and double ventral nerve cord. Brain consist by integration of some pairs of nervous ganglia and may be divided into two brains ,mid brain and hind brain .

10-Sexes are generally separated.

Phylum: Arthropoda

Class: Crustacea

Order: Cladocera

E.g.: ***Daphnia***

1- It is a fresh water crustacean found in ponds, pools.

2- It is commonly known as water flea.

3- Body is compressed laterally consist of head and trunk.

4- The body except head is covered by folded (bivalve) carapace.

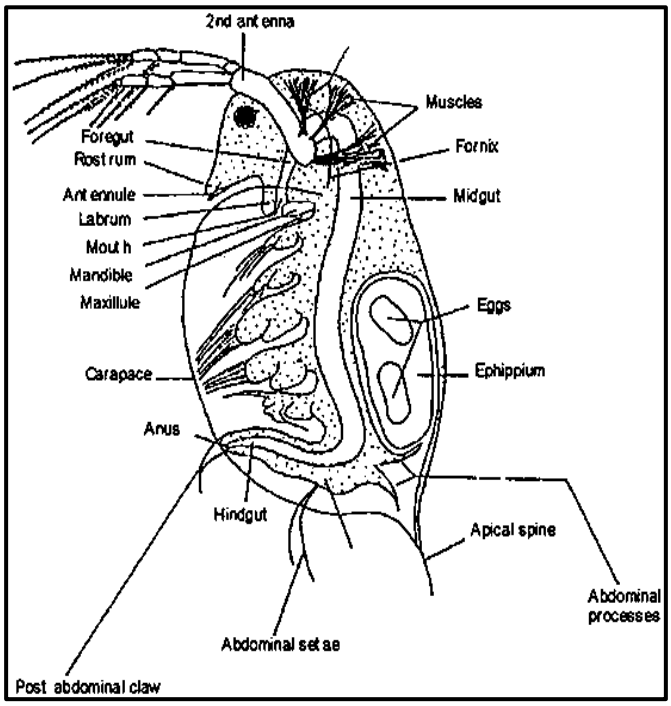
5- Head is reflexed downward producing rostrum and carries a pair of combined sessile eyes ,and a nuchal sense organs above it ,a pair of small antennules, a pair of large biramous antennae a pair of large mandibles and two pairs of maxillae the large biramous antennae are the organ of locomotion.

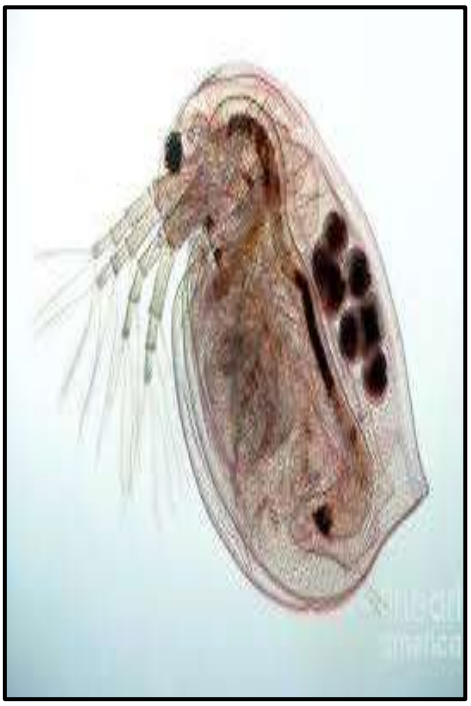
6- Thorax bears usually (5 pairs) of leaf-like appendages.

7- Abdomen is devoid of appendages. It is turned downward provided by two post-abdominal claws . Between the abdomen of the female and posterior part of the carapace is a large broad-pouch in which the eggs are stored.

8- It has sharp caudal spine.

9- Internal organs ,may be seen as , heart, alimentary canal ,and terminal anus.





Daphnia

Phylum: Arthropoda

Class: Crustacea

Order: Decapoda

E.g.: *Astacus*

1- *Astacus* is found in fresh water ponds, streams and lakes, it is commonly called cray-fish.

2- The body is long and roubust, somewhat compressed.

3- Body is divided into cephalothorax and abdomen.

4- The cephalothorax (5 cephalic + 8 thoracic segments), is covered on all sides except ventrally by strong carapace produced anteriorly into a long serrated, pointed extension, called rostrum.

Also dorsally on the carapace note the presence of 3 grooves. Two of these are longitudinal the **branchocardiac grooves** and the third one is transverse lies in between and called **rostral groove** continuous with the rostrum.

The part of carapace bounded by two former grooves is called the **cardiostegite** for it overlies the heart.

The two large convex flaps of the carapace lying on both sides of this part are called **branchiostegites.**

On both sides of rostrum two prominent eyes are present, carried on long stalks.

5- The line of demarcation between the head and thorax is possible indicated by cervical groove.

6- Abdomen consist of (6 flattened segments), easily distinguished both dorsally and ventrally, it terminate with a small tail piece or telson ,anus opens on its ventral surface.

7- Externaly skeleton of abdominal segment consists of convex dorsal tergum ,transversal ventral sternum and two lateral plates pleura, the 1st abdominal segment.

Appendages:

The cephalothorax region carries the following appendages:

Cephalic region:

Carries 5 pairs:

1- Pair of antennules: for touch, chemical sense (smell and taste). And also specialized for balance and hearing.

2- Pair of Antennae: for touch.

3- Pair of mandibles: for crushing food and pushing it to mouth.

4- 2 pairs of maxillae its function for catching food.

Thoracic region:

carries 8 pairs of appendages:

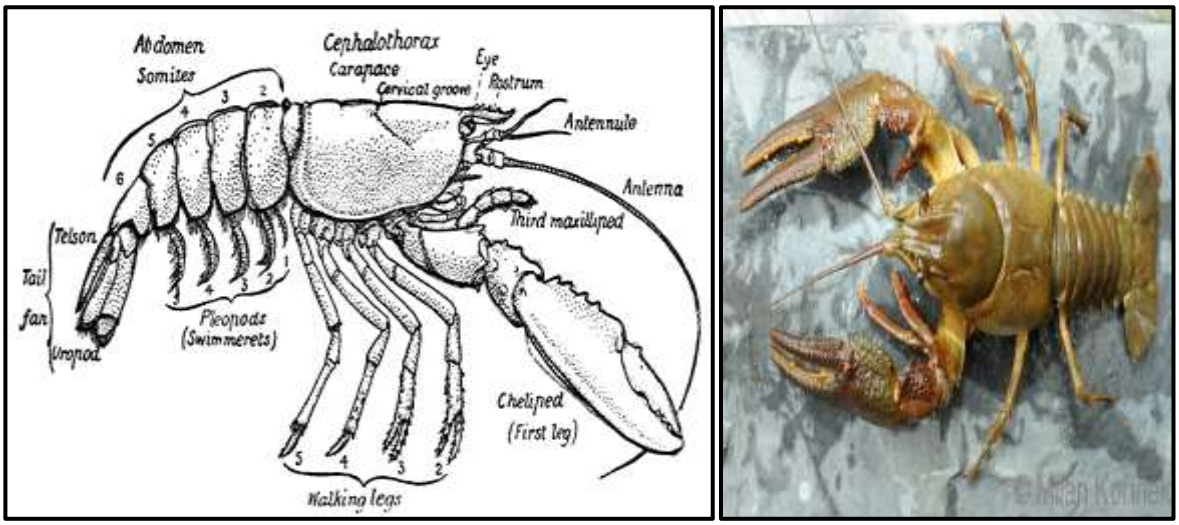
a. 3 pairs of maxillipedes (1st, 2nd and 3rd). used for taste, touch and catching food.

b. 5 pairs of walking legs. First pairs is cheliped termenal with forceps-like end and used for offense and defense. 2nd and 3rd pairs terminate with chela 4th and 5th pairs terminate with claws. 2nd pair for tearing and filtering the food , the 3rd pair for catching food also.

Abdominal appendages:

5 pairs of swimmerets or pleopods 6th pair of abdominal appendages called uropods.

The uropods consist with the telson tail fan used for swimming. Sexes are separated and can be differentiated externally by the appendages of 1st abdominal appendages.



Astacus

Phylum: Arthropoda

Class: Chilopoda

E.g.: *Scolopendra*

1- It is found under stones, in cervices and other dark places.

2- It is commonly called centipede.

3- Body is elongated and dorsoventrally flattened with numerous segments.

4- Head is distinct covered dorsally by cephalic carapace and bears two groups of simple eyes , upper lip, a pairs of antennae, a pair of mandibles and two pairs of maxillae.

5- Trunk segments numerous and simillar (about 22), each bearing a single lateral pair of legs.

First pair of trunk appendages are the maxillipedes which bears a sharp calw connected with a poison gland.

The last pair of legs are usually longer than the rest and called anal cirri and directed backward.

6- Anus lies at the posterior end.

Phylum: Athropoda

Class: Arachnida

Order: Scropionida

e.g.: *Buthus*

1- Scorpion is dangerous arthropod, widely spread in tropical and temperate regions.

2- It is nocturnal, hides away in the day time and becomes active during the night, and it feed on insects and spiders, only the body juice is sucked.

3- Body is divided into two regions : **cephalothorax** (prosoma) consist of head and thorax and **abdmen** (opisthosoma) which is subdivided into broad thick anterior (mesosoma) and narrow, terminal part post-abdomen (metasoma) which is habitually turned upward over the back constituting the tail at the end of which the sting is placed.

4- Cephalothorax covered by carapase ,it bears a pair of large median eyes and several pairs of lateral small eyes on each side.

Mouth is small on the ventral anterior end on each side of which is 3-jointed appendages the chelicerae, which is terminated by chela.

5- Behind chelicerae there are very large 6-segmented pedipalpi terminating by powerful chela.

6- There are 4 pairs of walking legs following the pedipalpi.

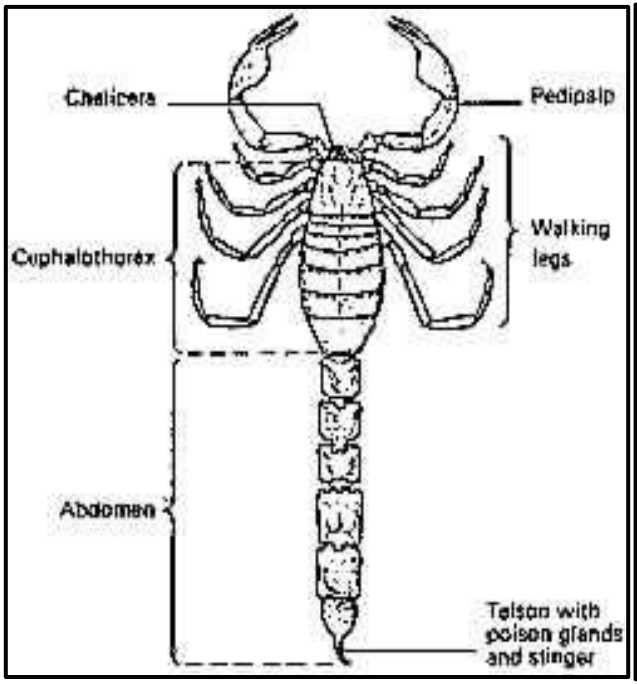
7- Mesosoma: consists of six segments:

   a. The 1st segment carries on its ventral surface a genital operculum, which covers the single median genital aperture. This operculum is divided by a median longitudinal cleft into two semicircular plates and is considered as a 1st modified pair of mesosomal appendages.

b. The second segment caries a pair of comb-like structures known as pectens (modified appendages, tactile in function) with teeth-like processes on their posterior edges. (The pectens longer in the male than in the female).

c. On the ventral surface of the following 4 segments lie paired stigmate or spiracles in the form of oblique slits which lead into – book-lungs.

8- The metasom consist of 6 limbless segments, and terminates with the telson. This forms the sting which is bulbous at the base and curves to form a sharp spine,anus lie ventrally .



Buthus

Phylum: Mollusca

Class: Lamellibranchiata

Order: Eulamellibranchiata

E.g.: *Anodonta* (Fresh water mussel)

1- It lives on the bottom of river , where it lies with its front end burried in the mud and moves but very slowly by means of the foot.

2- Body has bilaterally symmetry.

3- Shell is formed of (2) lateral equal valves hinged together along the dorsal edge, but gape ventrally and the foot protrudes out between them.

4- The soft parts are all enveloped by the shell valves, but the mantle projects at one end (posterior) in the form of 2 short tubes, the inhalant and exhalant siphons.

5- Umbo is a small swollen knob on the shell valves which is found antero-dorsally and represents the apex or oldest part of shell from which growth of the valve has procceded.

6- On the dorsal surface of the shell there are a parallel concentric lines called line of growth extending around the umbo, parallel with free edge of the valve.

7- The two valves united and hinge with one another by tough, dark brown elastic cord found at the dorsal surfaced called hinge ligament.

8- Foot large muscular mass look-like hatchet directed anterior-ventrally.

9- Insertions (impression) muscles: appear as roughened areas on the smooth inner surface of shell note the insertion of :

a. **Anterior and posterior adductor muscles**: two large, one anterior and another posterior, and the muscles serve to close the shell.

b. **Anterior and posterior retractors**: two small insertions, the muscles serve to withdraw the foot.

c. **Protractor**: a large antero ventral insertion and this muscle serve to extend the foot.

10- Pallial line: is a long streak extending between the insertion of the two adductors, parallel with the free edge of the valve, and this marks the insertion of muscle fibers which arise from the mantle edge and connect it to the shell.

Anadonta

Phylum: Mollusca

Class: Cephalopoda

Order: Dibranchiata

e.g.: *Loligo*

1. It is found in the bottom.
2. It has spinal body which divided into head and conical visceral hump separated from one another by a short neck and foot .
3. The head carries 2 large eyes, similar to those of vertebrates. It bears anteriorly the mouth opening surrounded by a prominent circular lip and 2 large horny jaws project from it.
4. The foot consist of two parts, anterior and posterior:

a. The anterior part is represented by (8) pointed arms equal in length, each arm provided by (4) rows of suckers on its inner surface and (2) much longer tentacles, carrying suckers only at their expanded tip.

The tentacles are used in catching the prey and the arms for holding it.

b. The posterior part of the foot represented by the large muscular found on the ventral side of the head through which water is forced out of the mantle cavity, causing the animal to with draw quickly backward.

The funnel has a narrow anterior opening and a broad open base which project backward into mantle cavity.

5. The trunk or visceral hump is conical and bluntly painted at posterior end. Trunk is expanded at two lateral sides into 2 thin lateral fins by which the animal swims forward.
6. the dorsal side of the hump is hard due to the presence of an internal shell, on this side, just beneath the skin.

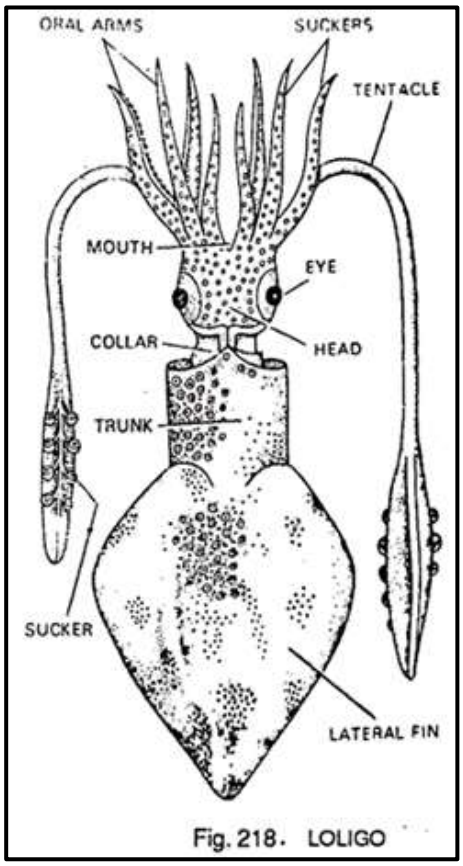
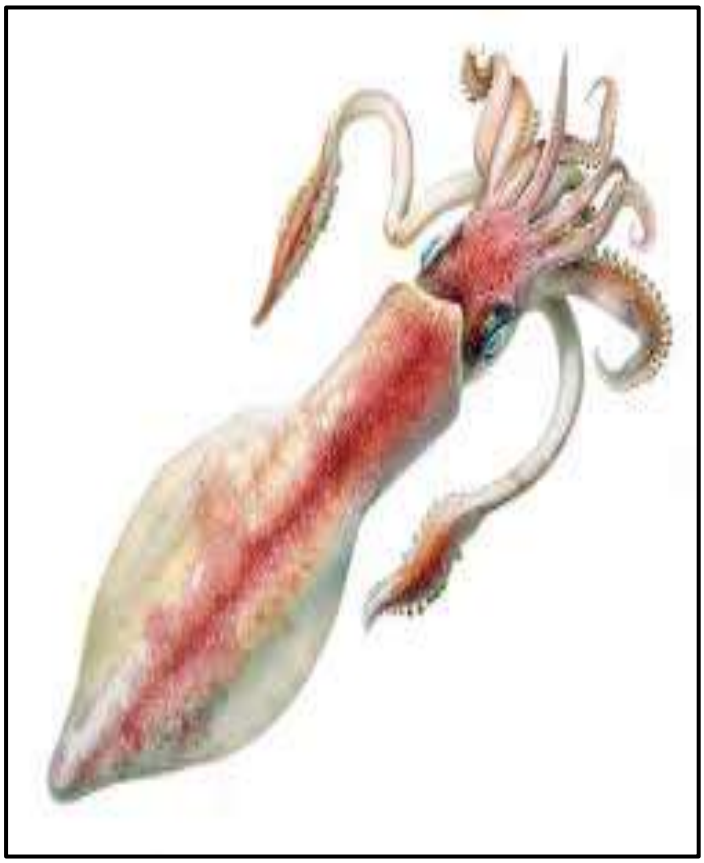


Fig. 218. LOLIGO



Loligo

Phylum: Echinodermata:

General Characets:

1- Small to large marine animals .

2- Body shape star-like, discoidal, or cylindrical with well differentiated oral and aboral surfaces.

3- Triploblastic, coelomate aniam without well marked cephalization and segmentation.

4- Radial symmetrical in adult condition but the larvae are bilaterally symmetrical.

5- The body wall is made up of three layers, another epidermis, middle dermis and inner most peritoneum.

6- Endoskeleton in the form of calcareous mesodermal plates provided with different shape spins.

7- A part of embryonic true coelom becomes modified into water vascular system or ambulacral hydrocoel with many tube feet. This system connect with the outside by madriporite and locomotion in animals

8- Sexes are usually separate with few exception.

9- Reperoduction is usually sexual, few reproduce a sexually or by rgeneration.

10-Thy have no definite circulatory system . Nephridiawere absent.

Phylum: Echinodermata

Class: Asteroidea

Order: Forcipulata

E.g.: *Asterias*

1- Strafishe are live on most sea-coasts and in the shore-water.

2- Body is star-shaped consisting of a central disc from which radiate 5 flexible triangular arms with tapering tips.

3- The body is markedly flattened, with 2 distinct surfaces, a lower oral or ventral surface in the center of which the mouth is situated and an upper aboral or dorsal surface which is covered with spines of various lengths and carries the canal opening and madriporite (sieve – plate).

4- On the aboral surface there are a number of spines arranged in rows on the arms and are supported on irregularly shape ossicles burried in the integument, (some of spines are fixed and others a movable). In between the ossicles there are numerous minute dermal pores through which project small soft filiform cutanous retractile processe called papillae or dermal branchiae (gills), the function of these are for respiration and excretion.

5- Some of the spines are modified and known as pedicellariae found in the space between the spines, they are like pincers to protect the delicate breathing gill.

6- On the oral surface lies the five-rayed aperture the mouth which is surrounded by a soft membranous area the peristome and by oral spines. There are 5 narrow grooves extend out from mouth and pass each along the entire length of one of the arms to their extremities (the ambulacral groove) and there are either 2 or 3 rows of movable calcareous spines called ambulacral spines and also the groove contain

2 or 4 rows of soft tubular bodies ending in sucker-like extremities called tube-feet or podia which acts as locomotary organs.

7- At the end of each ambulacral groove there is a sensitive reddish pigment spot (eye) which is carried on a tentacle similar to tube feet but without sucker.

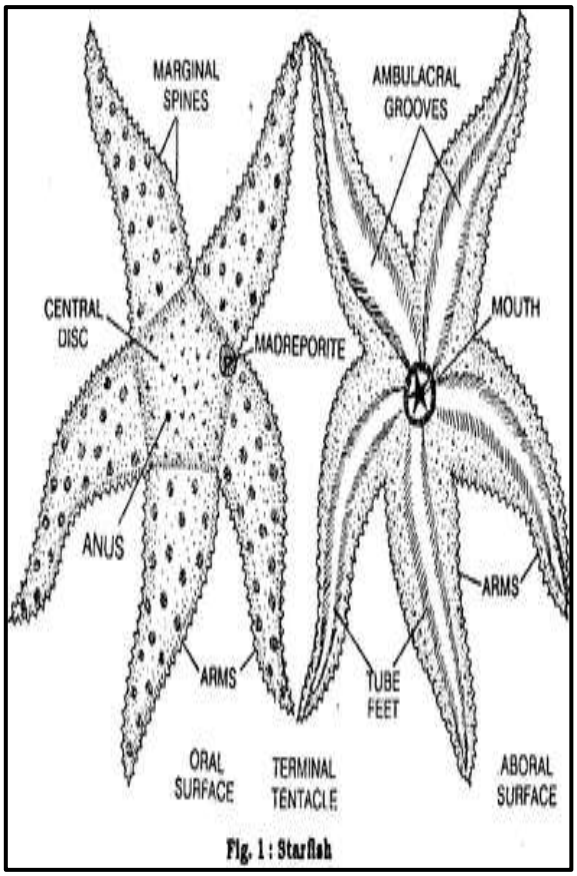


Fig. 1 : Starfish

Asterias

Phylum: Echinodermata

Class: Echinoidea

Order: Camarodonta

e.g.: *Echinus* (sea urchin)

1- Body is large globular, without projecting arms, and show 2 distinct the more compressed lower one is the oral pole, while the opposite upper one is the aboral pole or anal pole.

2- Body surface coverd densely by long and short spines as well as by small pedicellariae.

3- Among the spines, there are numerous tube feet, each ending with a sucker, project on 5 areas extending between the two poles the ambulacral areas.

4- These 5 ambulacral areas or plates are separated by 5 interambulacral areas or plates.

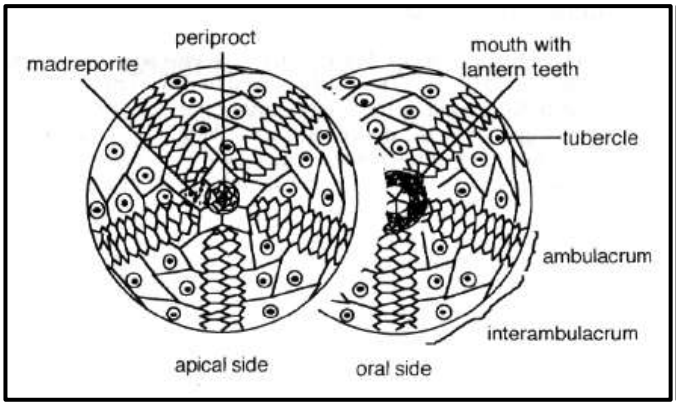
5- At the oral pole, there is the mouth opening, with a circular lip surrounding it and 5 strong pointed teeth projecting from it,known as Aristotles lantern

6- Around the mouth, there is a broad area, the peristome, through which 5 pairs of short sensory buccal tube feet.

7- There are 5 pairs of branched branchiae arise on the outer edge of the peristome.

8- In the aboral pole ,around the peri-anal membrane there are 10 polygonal plates forming the apical system . 5 large plates, the genital plates in each of them located one of genital pores which leads ti 5 reproductive organs. The largest one of these plate acts as madriporite.The remaining 5 plates of apical system were alternated

with genital plates and smaller than them , known as ocular plates from each of which project terminal tube feet sensitive to light.



Echinus