D.N.R.COLLEGE (A), BHIMAVARAM

Department of Zoology

SEMESTER-II

COURSE 3: ANIMAL DIVERSITY-I

BIOLOGY OF NON-CHORDATES

PRACTICAL MANUAL

SYLLABUS

Phylum Protozoa: Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax

Phylum Porifera: Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gemmule

Phylum Coelenterata: Obelia Colony, Medusa, Aurelia, Physalia, Velella, Corallium,Gorgonia, Pennatula

Phylum Platyhelminthes: Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium

Phylum Nemathelminths: Ascaris (Male & Female), Drancunculus, Ancylostoma,Wuchereria

Phylum Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva

Phylum Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus Larvae - Nauplius, Mysis, Zoea, Mouth parts of male &female Anopheles and Culex, Housefly and Butterfly.

Phylum Mollusca: Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva

Phylum Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva

Phylum Hemichordata: Balanoglossus, Tornaria larva

Dissections: Computer - aided techniques should be adopted or show virtual dissections Dissection of edible (Prawn/Pila) invertebrate as per UGC guidelines An "Animal album" containing photographs, cut outs, with appropriate write up about the abovementioned taxa.

D.N.R. COLLEGE (AUTONOMOUS), BHIMAVARAM
(Affiliated to Adikavi Nannaya University,Rajamahendravaram)
SINGLE MAJOR PROGRAMMES *w.e.f 2023-24*

I B.Sc II SEMESTER Subject- Zoology

Paper3: ANIMAL DIVERSITY-I BIOLOGY OF NON-CHORDATES

Practical Model Paper

Time 3Hrs Max.Marks: 50

I. Identify the following spotters 5x5= 25M

A) B) C) D) E)

II. Identify the following slides 3x5= 15M

1) 2) 3)

III. Record 10M

Caption work

ZOOLOGY RECORD

PROTOZOA

PORIFERA

COELENTERATA

PLATYHELMINTHES

NEMATHELMINTHS

ANNELIDA

ARTHROPODA

MOLLUSCA

ECHINODERMATA

HEMICHORDATA

DISSECTIONS

ZOOLOGY RECORD

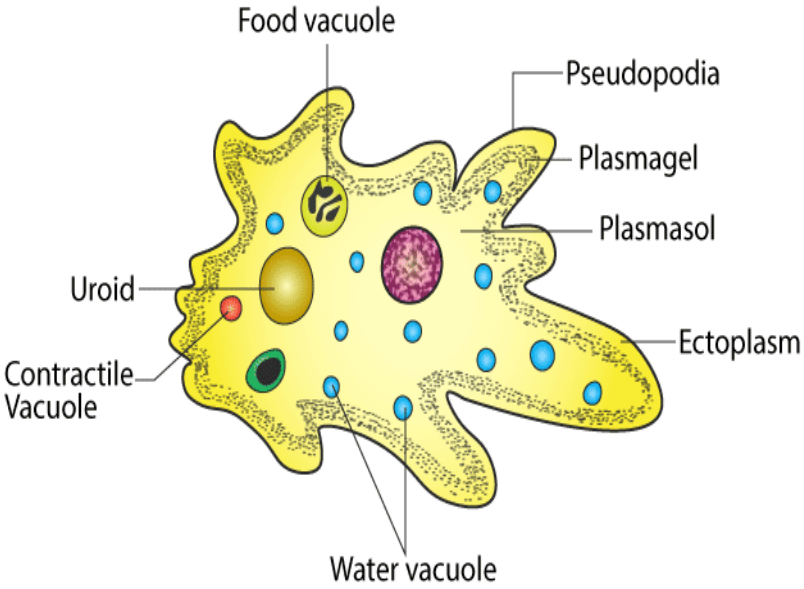
PROTOZOA

AMOEBA

Phylum: Protozoa

Class: Tubulinea

Order: Euamoebida



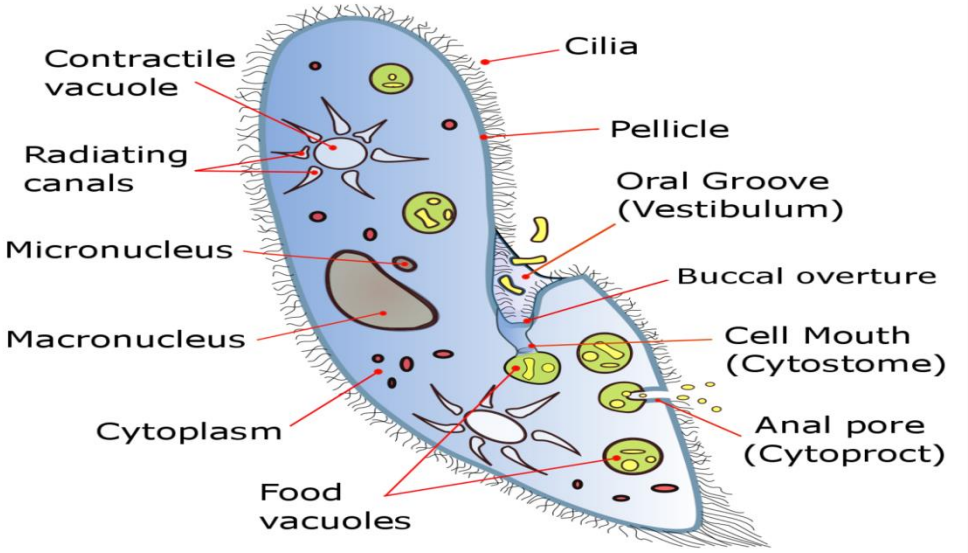
- The distinguishing feature of the amoeba is its ability to change shapes with the help of cytoplasmic extensions called pseudopodia.
- Pseudopodia, also called false feet, are tubular extensions that are rounded at the end and help in movement of the organism.
- The amoeba is made up of jellylike cytoplasm which differentiates to form a thin outer plasma membrane, a stiff layer of clear ectoplasm just inside the plasma membrane and a central endoplasm that is granular in nature.
- The endoplasm houses a granular nucleus, food vacuoles and a contractile vacuole.
- The amoeba possesses no mouth or anus.
- They feed by surrounding their cytoplasmic extensions around the food particle and then forming a vacuole. Enzymes are then secreted to digest the food particles.
- The contractile vacuole functions to remove excess water from the amoeba and thus maintain the osmotic pressure of the organism.
- The mode of reproduction is asexual and it divides by binary fission.

PARAMECIUM

Phylum: Protozoa

Class: Oligohymenophorea

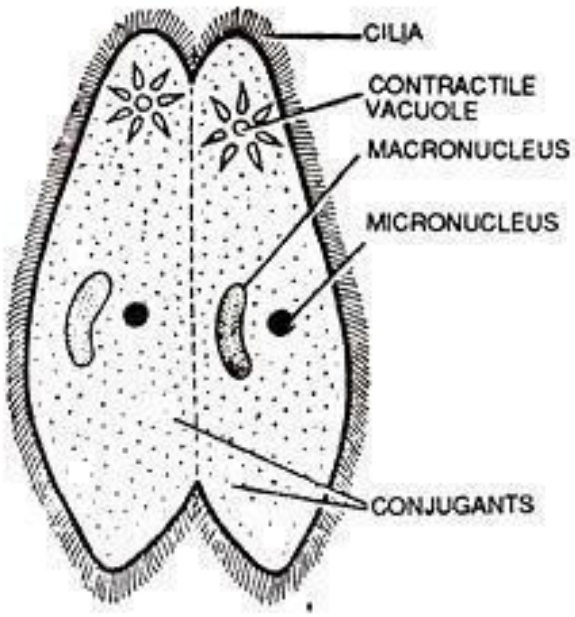
Order: Peniculida



Paramecia, because of their slipper-like structure, they are known as slipper animalcules

- Cilia are the hair-like fiber that covers the whole body. It primarily helps in locomotion and gathering food.
- A pellicle is a flexible, firm, and thin membrane that protects the entire body. It is elastic and consists of gelatinous material.
- Cytostome consists of several parts, including :
    1. **Oral Groove-** This large shallow oblique depression is on the ventrolateral side of the Paramecium, giving it an asymmetrical shape.
    2. **Cytopyge-** This part helps in eliminating all the undigested food.
    3. **Cytoplasm-** It consists of a jelly-like material that exists within the ectoplasm.
    4. **Ectoplasm-** A thin, clear, and dense layer is called ectoplasm that includes cilia, fibrillar structures, and trichocysts.
    5. **Endoplasm-** This particular part includes different granules like mitochondria, food vacuoles, nuclei, etc.
    6. **Trichocysts-** It is contained within the cytoplasm and filled with refractive fluid.
- **Nucleus-** Nucleus is further classified into two parts, micronucleus, and macronucleus.
- **Vacuole-** This organism has two types of vacuoles, food and contractile. While food vacuoles aid in food digestion, contractile ones help in excretion, respiration, and osmoregulation.

PARAMECIUM CONJUGATION

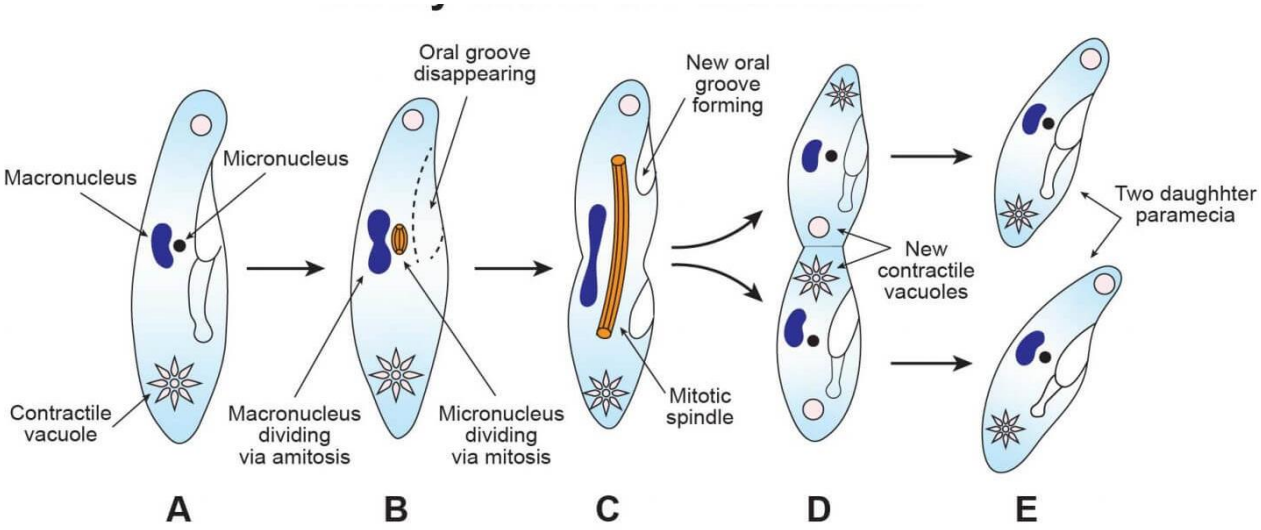


During this process, micronuclei undergo a meiotic division. Conjugation in Paramecium leads to haploid gamete formation.

After coming in contact with each other, two paramecia unite through the sides of their oral grooves. In this process, they are called conjugants.

- The macronucleus of each conjugant then disappears. Likewise, the micronuclei divide twice and create four haploid micronuclei.
- Three micronuclei out of the four then disintegrate. The remaining one forms two daughter pronuclei. The smaller one of these is a migratory male pronucleus while the larger one is a stationary female pronucleus.
- The male pronucleus travels through the protoplasmic bridge and fuses with the female one to form a zygote.
- The zygote nucleus is diploid and called amphinucleus.
- Once the zygote is formed, the nucleus divides and creates four daughter paramecia.
- Conjugation assists in transferring genetic materials and rejuvenation.

PARAMECIUM BINARYFISSION



- It is a common method of asexul reproduction in *Paramecium* which occurs during favourable condition.
- A fully grown Paramecium is divided into two daughter individuals. Division occurs at the right angle to the longitudinal axis of the body. Nuclear division is followed by the cytoplasmic division.

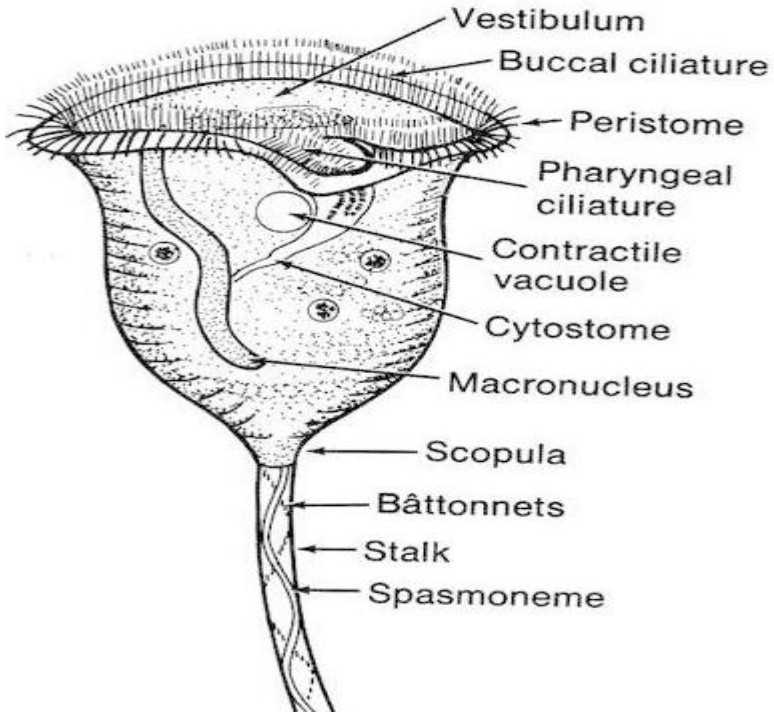
- *Paramecium* stops feeding before initiating binary fission and then its oral groove disappears.
- Macronucleus divides by amitosis and micronucleus divides by mitosis. After division, they move towards the opposite end.
- At the same time, the constriction develops at the middle part of the body which divides cytoplasm into two equal parts. In this way, two daughter-Paramecia are produced.
- Daughter from anterior end is called protor and another daughter from posterior end is called opisthe.
- They are of equal size and contain a complete set of cell organelles as in parents.
- Oral groove and cytopharynx are newly formed in both the daughters.
- One contractile vacuole goes to protor and another to opisthe.
- Other two are newly formed.
- The whole process is completed within 2 hours and may occur one to four times a day.

Vorticella

Phylum: Protozoa

Class: Oligohymenophore

Order: Sessilida



1. These are fresh water and solitary animals found attached to the aquatic plants or stones etc.
2. Body of these animals is devoid of ciliation except at the free anterior end which is surrounded by cilia.

3. Body bell-shaped and is connected with a contractile stalk at its base.

4. Ectoplasm has vertical and oblique rows of myonemes.

5. Endoplasm is having a large semicircular macronucleus and a small micronucleus attached to the former.

6. Stalk also has myonemes and is thus constrictable.

The anterior end of bell-shaped body is made of a collar and a peristomial disc separated by a peristomial groove. Three rows of long cilia are arranged anticlockwise and are inserted in peristomial groove.

8. Peristomial groove leads into cytopharynx and is having an undulating membrane.

9. Nutrition heterotrophic and reproduction through fission and conjugation.

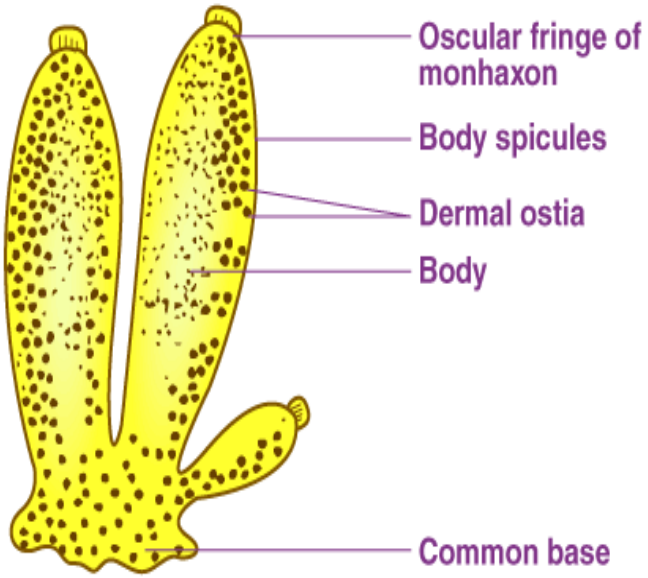
PORIFERA

SYCON

Phylum: Porifera

Class: Calcarea

Order: Leucosolenida



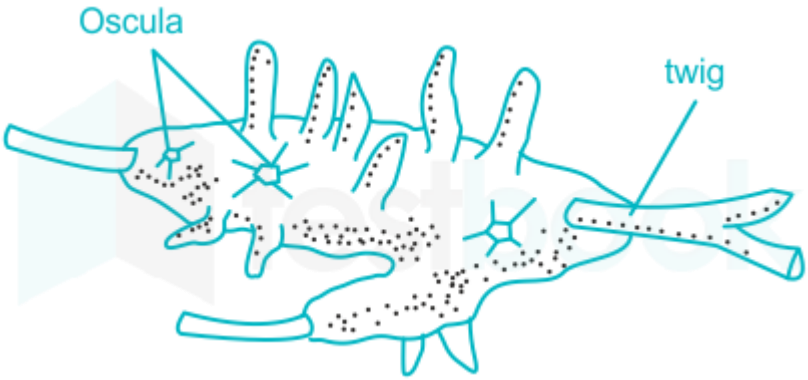
- It has a vase-shaped cylindrical body measuring about 20-30 mm in length
- Each cylinder opens to the exterior by an osculum
- Body surface contains numerous pores called Ostia or incurrent pores
- Osculum is encircled by a fringe of monoaxon spicules
- Their bodies are radially symmetrical or asymmetrical
- They can regenerate their lost parts
- Needle-like spines called spicules cover their body

Spongilla

Phylum: Porifera

Class: Demospongiae

Order: Spongillida



1. Spongilla is probably the best known of freshwater sponges.

2. The colony of Spongilla is profusely branched exhibiting various shades of green colour due to the presence of Zoochlorellae a green alga in the tissues.

3. The body wall consists of very thin dermal membrane provided with dermal pores or ostia and several oscula. 4. The canal system is rhagon type.

5. Skeleton consists of siliceous spicules in the form of network of smooth or spiny large and small oxeas embedded in the spongin.

6. Reproduction both asexual and sexual. Asexual reproduction by gemmules.

7. Sexual reproduction by way of unusual free swimming larva which is characteristic of Spongilla.

8. Gemmules are protected by the amphidisc spicules.

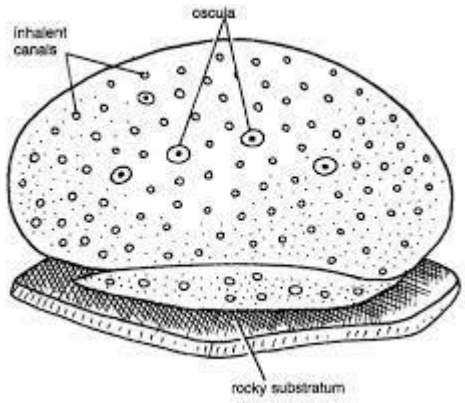
9. Habit and habitat: Spongilla is a colonial sponge. It is abundantly found in ponds, lakes and slow stream growing on submerged sticks and plants.

EUSPONGIA

PHYLUM :- Porifera

CLASS :- Demospongiae

ORDER :- Dictyoceratida



- Euspongia is found in shallow water on rocky bottom. It is a sedentary form attached to the rocks by horny spongin in secretion
- Commonly called as bath sponge attached to rocky substratum.
- It attains a large and massive size with globular or cup-shaped body with dark black colour. The slender spongin fibres form small network.
- Complex type of sponge, in which there is a further increase in the folding of the body wall.
- Surface of the body contains large openings called as oscula, and small opening called as inhalant canals.
- Bath sponge is of household use. It is prepared-by squeezing and bleaching or dyeing the sponge. The common bath sponge mainly consists of spongin fibres having the capacity of holding water.
- Commonly used in offices, etc. for wetting postal tickets and counting currency notes or papers, etc.

Spicules in sponges

The spicules constitute major part of skeletal system, which are secreted by special mesenchymal cells called scleroblasts.

On the basis of the material they are formed of, spicules are of two types: **Calcareous**, made of calcium carbonate and characteristic of the class Calcarea and **Siliceous**, made of silica and characteristic of the class Hexactinellida.

According to the size, spicules are classified into two major types: **Megascleres**, which are large-sized and constitute main supporting framework of sponge body and **Microscleres**, which are smaller in size and occur in the mesenchyme.

Based on the number of axis present in the rays spicules may be of three types: monoaxon, triaxon and polyaxon.

Monaxon: These spicules grow along a single axis. These may be straight needle-like or rod-like or may be curved. Their ends may be pointed, knobbed or hooked. If spicule has only one pointed end it is called **Monoactinal**. If there are two points it is called **Diactinal**. **Amphidisc** are spicules which have disc at both ends.

Triaxon: Triaxon spicule has three axes that cross one another at right angles to produce six-rays. These are found only in class Hexactinellida.

Tetraxon spicules consist of four rays radiating from a common point. **Triradiate** are also tetraxons in which one of the four rays is lost. In **Calthrops** all rays are equal.

Polyaxon: In this type of spicules, several equal rays radiate from a central point. They are common among the glass sponges.

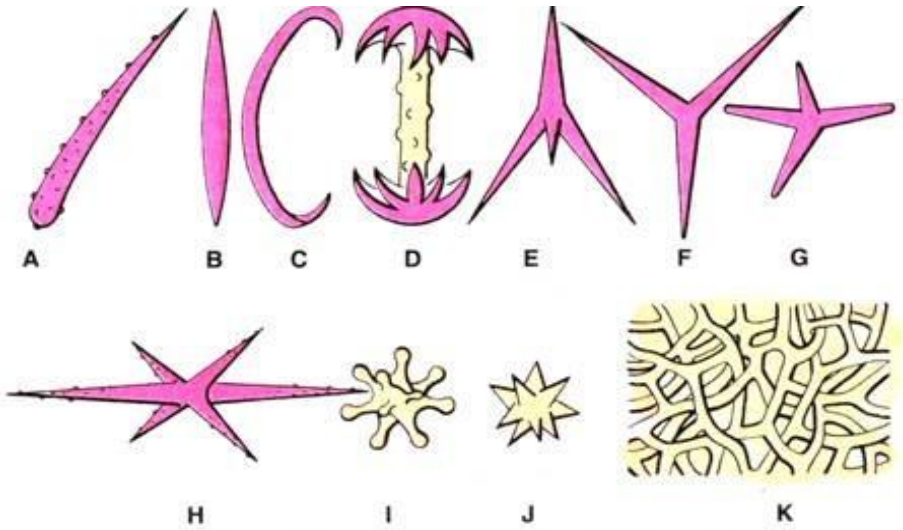


Fig. 28.9. Spicules and spongin. A—Monactinal monaxon; B—Diactinal monaxon; C—Curved monaxon; D—Monaxon with hooked ends; E—Tetraxon; F—Triradiate; G—Calthrops; H—Hexactinal triaxon; I and J—Polyaxon; K—Spongin fibres.

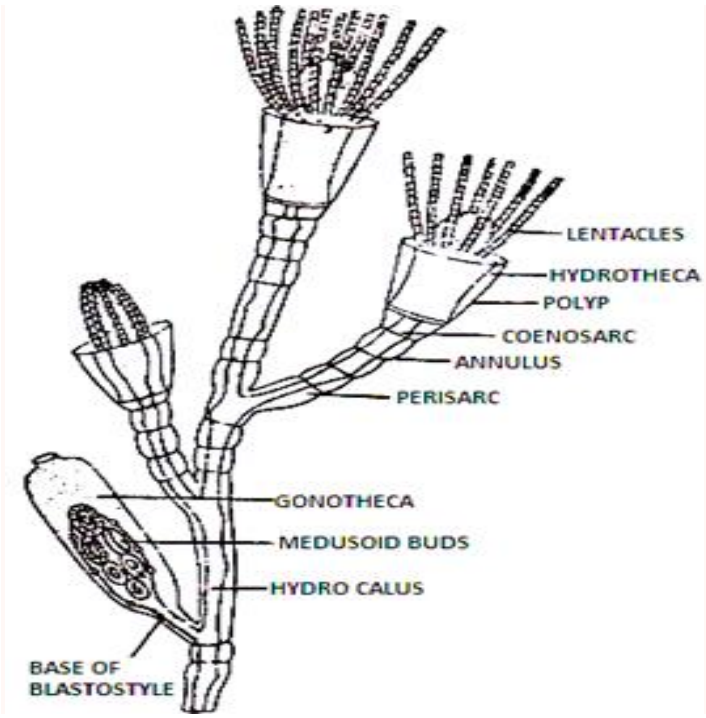
COELENTERATA

Obelia Colony

Phylum: Coelenterata

Class: Hydrozoa

Order: Leptothecata



- It is colonial hydroid.

• Its colony consists of basal horizontal portion, the hydrorhiza which is attached to the substratum and no. of vertical branches known as hydrocauli arising from hydrorhiza.

• The colony is trimorphic having three types of zooids, e.g. hydranth, blastostyle and medusa.

• Hydranth or polyp has a cylindrical body attached to the axis of the hydrocaulus by its proximal end free at its distal end.

• It is covered by cup shaped hydrotheca. It is nutritive zooid of colony.

• The hypostome is surrounded by a number of solid tentacles provided with nematocytes.

• Blastostyle or reproductive zooid is cup shaped without mouth and tentacles.

• It is enclosed by a covering, gonotheca.

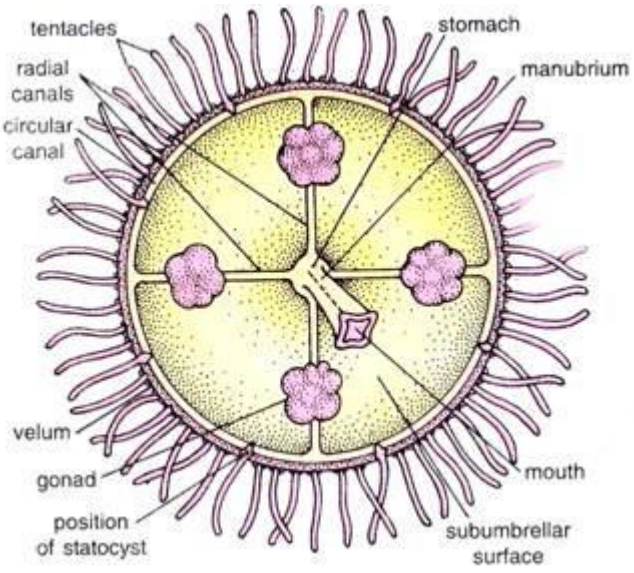
• It gives rise to buds which later become flattened and develop into new medusae.

• Medusa is bell shaped with a concave and convex side. It contains marginal tentacles, four radial canals, a ring canal, four gonads born on the radial canals and hanging central manubrium on the concave side.

• The medusae are free swimming.

• Life history of obelia exhibit an alternation of generation, called metagenesis.

Obelia Medusa



1.These are saucer-like or umbrella- shaped structures and are developed from blastostyles asexually.

2. All along the margin they bear a ring of tentacles (velum).

3. The inner surface of the dome of saucer bears 4 radial canals.

4. Each radial canal bears a distinct gonad.

5. In the centre, where the radial canals meet, there is present a tubular structure-the manubrium, bearing a rectangular mouth.

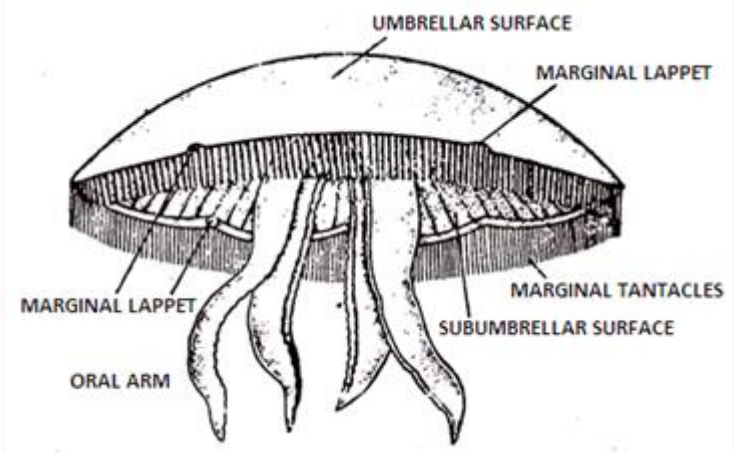
6. The medusa is free-swimming zooids.

7. On maturation these gonads release germ cells – the ova and sperms, in the sea water.

Aurelia **Phylum:** Coelenterata

Class: Scyphozoa

Order: Semaeostomeae



i) It is found in coastal waters of all seas.

ii) It has a gelatinous, transparent and coloured body.

iii) The subumbrellar margin of the umbrella is beset with tentacles and broken into 8 notches.

iv) Each notch has a tentaculocyst and a pair of marginal lappets.

v) The squarish mouth borne on a short manubrium, placed in the centre of subumbrellar surface.

vi) Angles of the mouth drawn into four long oral arms.

vii) Gonads two pairs, horse-shoe shaped and placed on the floor of the four gastric pouches.

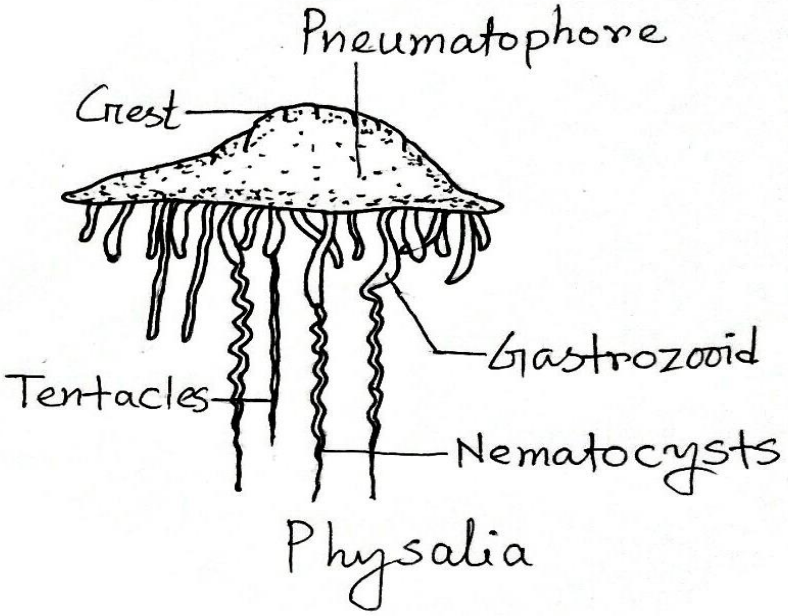
viii) Sexes are separate and life cycle presents alternation of generations.

Physalia

Phylum: Coelenterata

Class: Hydrozoa

Order: Siphonophorae



i) It is a colonial form, brightly coloured, blue or purple unichambered float – the pneumatophores, filled with gas having the composition of air.

ii) The gas is secreted by gas gland present in the underside of the pneumatophores. It is hydrostatic in function.

iii) Upper surface of the float is drawn into a sail or crest and has an opening called pneumatopore.

iv) Physalia exhibits the highest degree of polymorphism. The colony consists of: - Gastrozooids or nutritive zooids with mouth but without tentacles. Blastostyles or gonophores or reproductive zooids bear clusters of medusae. - Dactylozooids or protective zooids with tentacles and nematocysts. - Tentacles are very long and coiled and carry batteries of nematocysts. - Collection of all of the zooids forms cormidia.

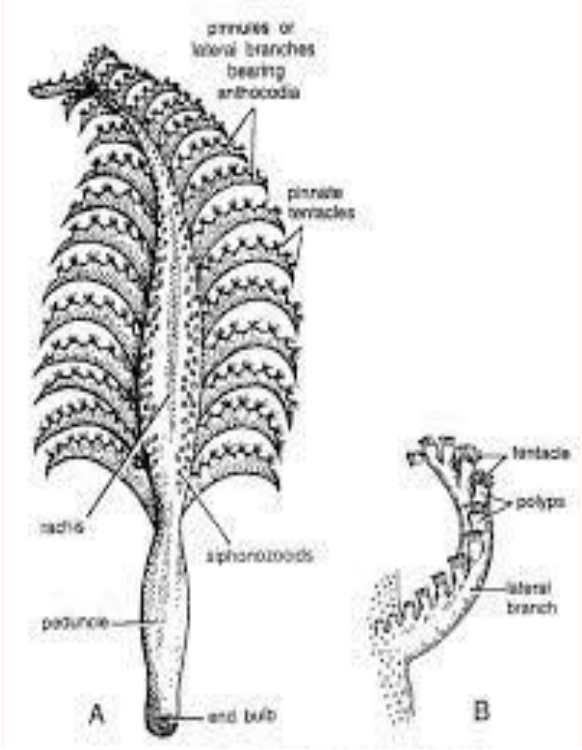
v) It is popularly known as Portuguese man-of-war ("Man-of-war" refers to a warship denoting its highly aggressive nature as a predator)

Pennatula

Phylum: Coelenterata

Class: Octocorallia

Order: Pennatulacea



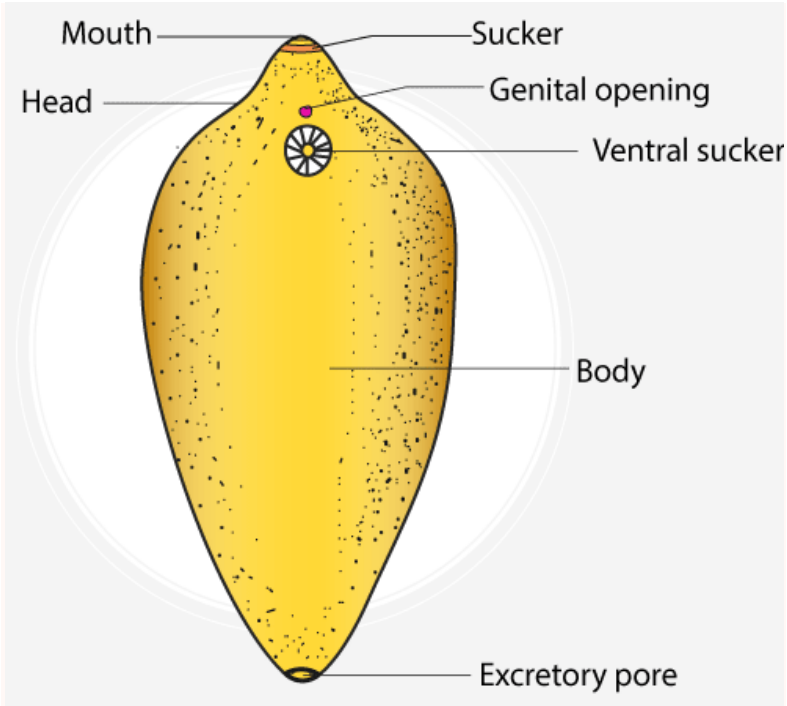
1. It is commonly known as “sea pen
2. The colour is usually red and the fully formed colony measures about 10 cm in height.
3. The colony is elongated, dimomorphic, feather-like and is differentiated into a lower peduncle or stalk and an upper rachis.
4. The peduncle is dialated at its lower tip into an end bulb, which remains burried in mud or sand at the sea bottom and is devoid of zoids.
5. The rachis is narow at two ends, dialated in the middle and bears two rows of lateral branches—the pinnules.
6. Each pinnule is a long, slightly curved, flattened and fleshy projection of the rachis and bears, along its upper margin, a row of anthocodia—the autozoids.
7. Each anthocodia (autozold) bears a ring of 8 tentacles, few gonads and mesentaries In multiples of eight (8). They serve to feed the colony and undertake the task of reproduction also.
8. The rachis, all through its length along dorsal and lateral sides, bears minute spinules—the siphonozoids.
9. The siphonozoids are without tentacles and gonads, with reduced mesentaries and are having distinct siphonoglyphs, which help in producing water currents.
10. Skeleton is a horny axis which supports only the peduncle and rachis but does not extend into pinnules.
11. Sexes are separate.

PLATYHELMINTHES

Fasiola hepatica **Phylum:** Platyhelminthes

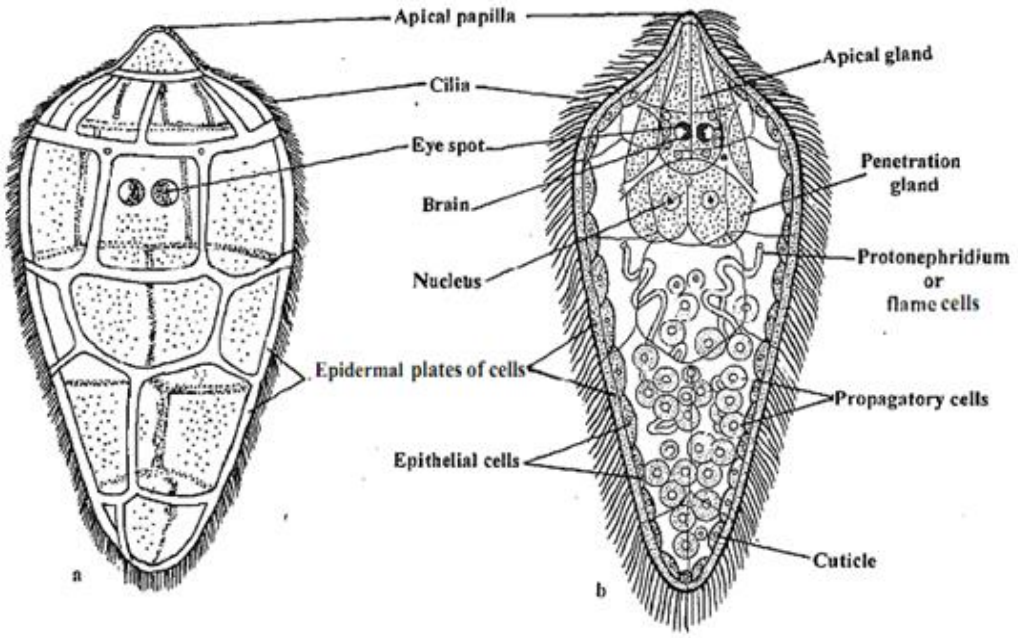
Class: Trematoda

Order: Echinostomida



- *Fasciola hepatica* is found in the bile duct of sheep's liver as an endoparasite.
- The body is dorso-ventrally flattened, leaf-like and measures about 25-30 mm in length and 4-5 mm in breadth.
- The **anterior end** is produced into a conical projection called the cephalic cone.
- The **mouth** is situated ventrally at the anterior end, and it is surrounded by **oral sucker**
- A highly muscular **ventral sucker** or acetabulum is situated a little posterior to the oral sucker.
- The **posterior end** is large and more rounded in the front than the back.
- The **digestive system** comprises oesophagus, pharynx and diverticulated intestine.
- The **excretory pore** is situated at the posterior extremity.
- They are **hermaphrodites, i.e,** they have both female and male reproductive parts.
- The eggs pass to the exterior through the median **genital pore** present between the ventral and oral suckers.

Miracidium larva



Miracidium is the first stage larva that comes out from the fertilized egg.

i) Miracidium is an oval, microscopic, flattened larva which appears conical in shape.

ii) Body is uniformly covered with epidermal plates. There are 21 plates arranged in 5 rows. First to fifth row contain 6,6,3,4,2 epidermal plates respectively.

iii) Anterior end of the larva is projected into a conical lobe called apical papilla which acts as a boring organ.

iv) Internal structures of the miracidium which can be seen include, the triangular sac called apical gland attached to the apical papilla, a pair of bag-like penetration gland located on each side of apical gland (also called cephalic glands), two eye spots, two flame cells, rudimentary gut and germ cells.

v)Miracidium larva comes out from the egg shell of the fertilized egg by eroding the operculum with the help of proteolytic enzyme.

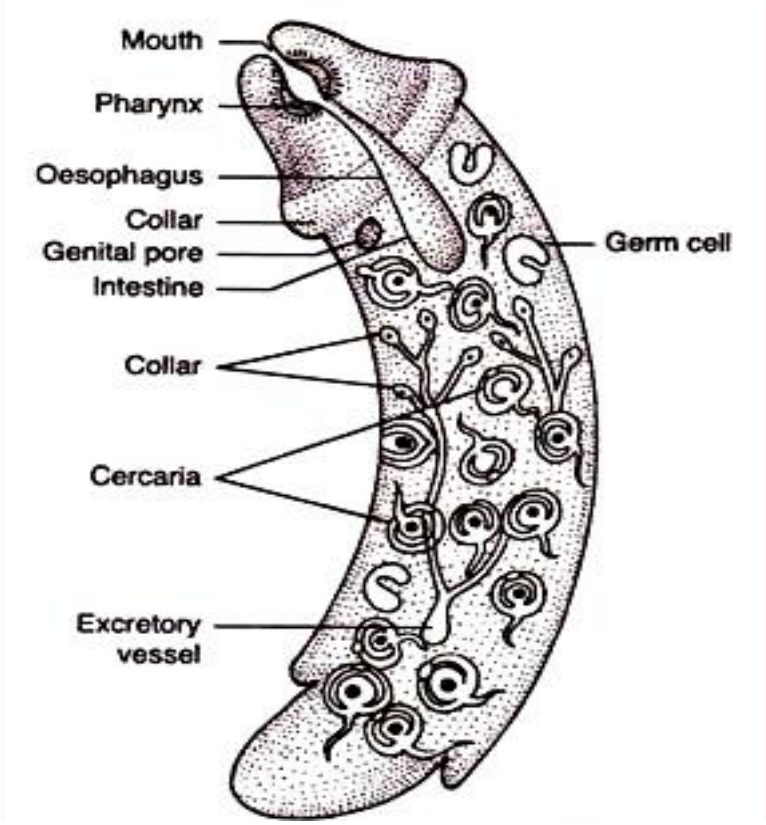
vi) It is a free swimming stage in fresh water.

vii) Miracidium larva swims freely in water for 4-30 hours in search of a suitable intermediate host which may belong to the genus Limnea or Planorbis.

viii) If the larva does not come in contact with a suitable host it dies.

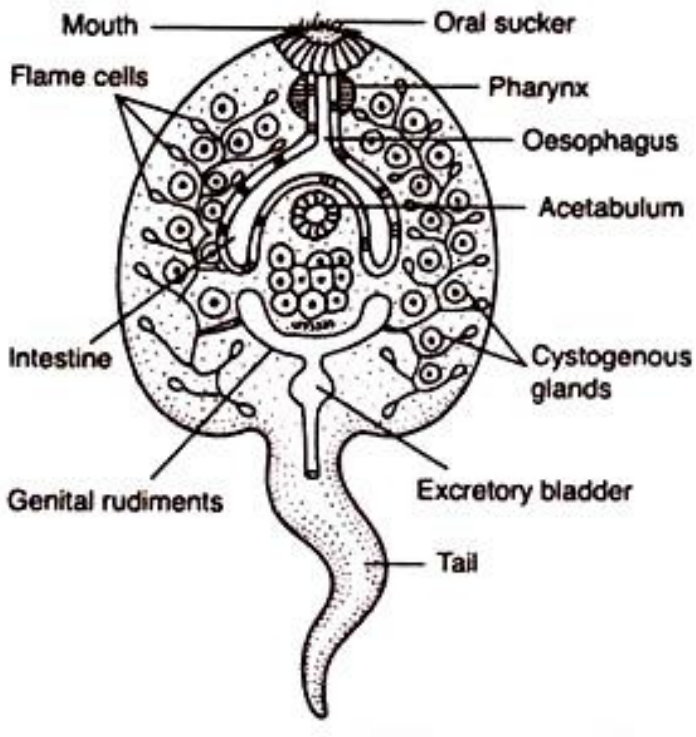
ix) Miracidium larva enters the snail and destroys its tissues. It penetrates through the pullnonary chamber; during this period it loses its cilia, epidermal plates, brain, eye spots, apical and penetration glands as well as primitive gut.

Redia larva



- Rediae emerge from the Sporocyst by rupture of its body wall.
- Each Redia is an elongated oval hollow body covered with thin cuticle.
- At the anterior end there is a muscular collar.
- The mouth is at the anterior end which opens into muscular pharynx, which in its turn opens into a small intestine. Little behind the muscular collar is the birth pore.
- Posterior part of the body has a pair of blunt conical processes called lappets.
- Above each lappet lies the excretory pore.
- The Redia larva comprises of germ cells which by division produces Cercaria larvae in autumn.
- These come out through birth-pore .

Cercaria Larva:



Each Redia produces 14 to 20 Cercaria larvae.

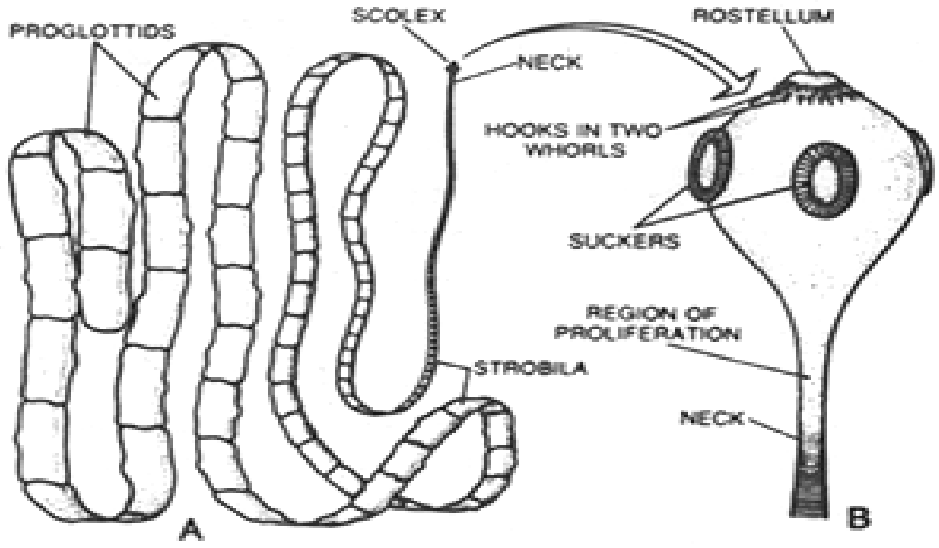
These larvae come out through the birth pore of Redia larva and enter into the snail's digestive gland.

- A fully grown Cercaria is a flattened, heart shaped body with an exceedingly contractile tail, more than double as long as the body proper.
- There is an oral sucker at the anterior end and a little behind there is a ventral sucker, placed in the middle of the lower surface of the body.
- In the centre of the oral sucker there is a mouth which leads into the pharynx.
- The pharynx finally opens into bifid intestine. The body contains flame cells (Protonephridia), germ cells and gland cells (Cystogenous gland cells)
- The Cercariae are gymnocephalous in type (i.e., they possess two almost equal suckers, no stylet, well developed pharynx, oesophagus, and intestine and simple tail) and have well developed cystogenous glands.
- When fully formed the Cercaria emerges from the snail body and anchors itself by means of its oral sucker to a suitable substrate, such as grass, loses its tail and transforms into a Metacercaria, which becomes enclosed in a meta-cercarial cyst secreted by its cystogenic gland.

Taenia solium **Phylum:** Platyhelminthes

Class: Cestoda

Order: Cyclophyllidae



Taenia solium : A. whole; B. its scolex

1. Body of Taenia Solium is ribbon-like, 2-3 meters long and consists of about 800-900 segments known as pro-glottides

2. The pear-shaped head bears 28 curved chitinoid hooks arranged in two rows, and four adhesive suckers.

3. Just behind the head there is a small un-segmented region which may be called the neck.

4. Each proglottis is a complete hermaphrodite sexual unit.

5.The reproductive organs of Taenia Solium first appear at about 200th segment; the male part of the reproductive system appears first, becomes mature at about 400th segment, and the posterior segments are filled up with greatly increased uterus, heavily loaded with developing embryos.

6. The male organs of Taenia Solium consist of a much lobed testis with efferent ducts, vas deferens and cirrus, opening in the genital atrium by the male genital aperture.

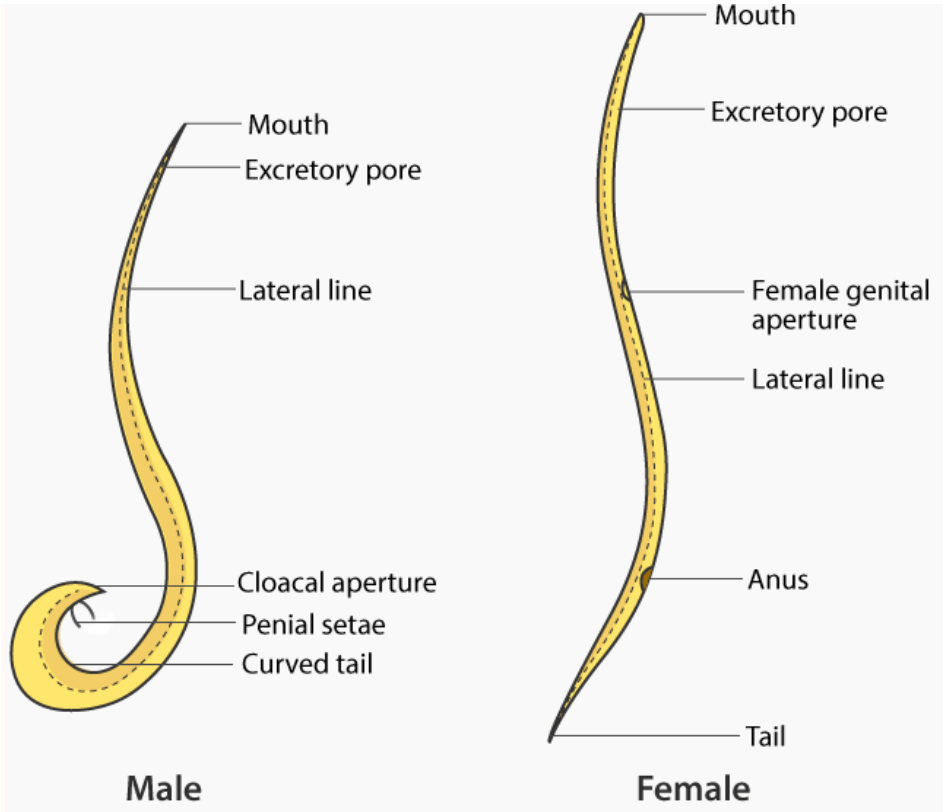
7. The female organs of Taenia Solium consist of a paired ovary with their ducts, uterus, yolk glands with ducts, shell glands with ducts, ootype, receptaculum seminis and the vagina opening in the genital atrium through the female genital aperture.

8. With the development of the uterus, the other reproductive organs are degenerated and the gravid uterus looks like a longitudinal stem with 5-10 lateral branches

Ascaris lumbricoides **Phylum:** Nematoda

Class: Chromadorea

Order: Ascaridida



- The *Ascaris* are intestinal roundworms found in pigs and humans
- Ascaris is a long, slender giant worm. The males are shorter than the females.
- The length of the female is 20 to 50 cm, and that of the males is 15 to 30 cm.
- The male worm is curved from the posterior end.
- Their body is elongated, cylindrical, smooth and unsegmented.
- Their body is tapered, and the end is round and pointed.
- Their body is covered with a noncellular, highly resistant cover called a cuticle, which helps them not get digested in the stomach of humans.
- They have a fully developed digestive system and distinctive digestive parts.
- Male and female are separated. Sexual dimorphism is present.

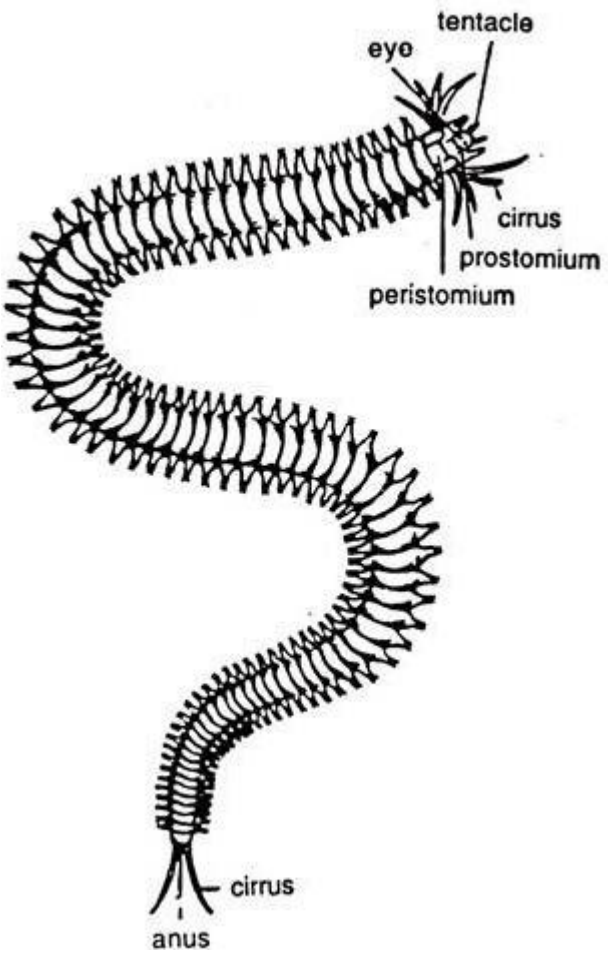
ANNELIDA

Nereis

Phylum: Annelida

Class: Polychaeta

Order: Aciculata



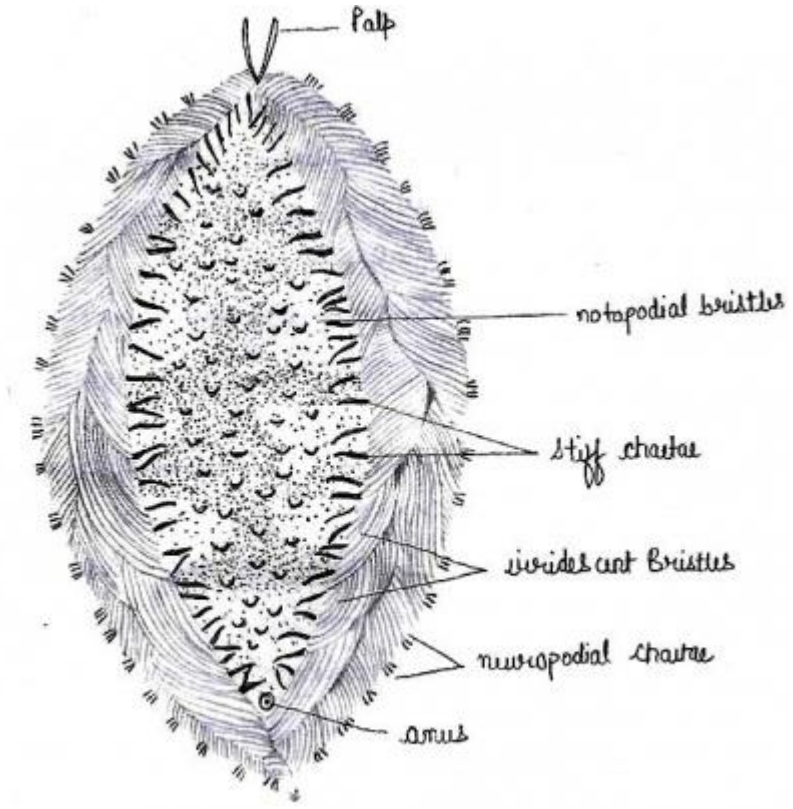
- Commonly called as Rag worm or Clam worm.
- Nereis specimen shows cylindrical and elongated body form which is divided into similar metameres or segments about 200 in number.
- Mouth is found on the anterior surface of the peristomium.
- Body segments, except head and anal segment, contain each pair of locomotory parapodia.
- Segments are also called as metameres and between two segments in intersegmental groove.
- Anal segment contains a pair or anal cirri.
- Nereis is dioecious, although male and female worms can hardly be recognized.

Aphrodite

Phylum: Annelida

Class: Polychaeta

Order: Aciculata



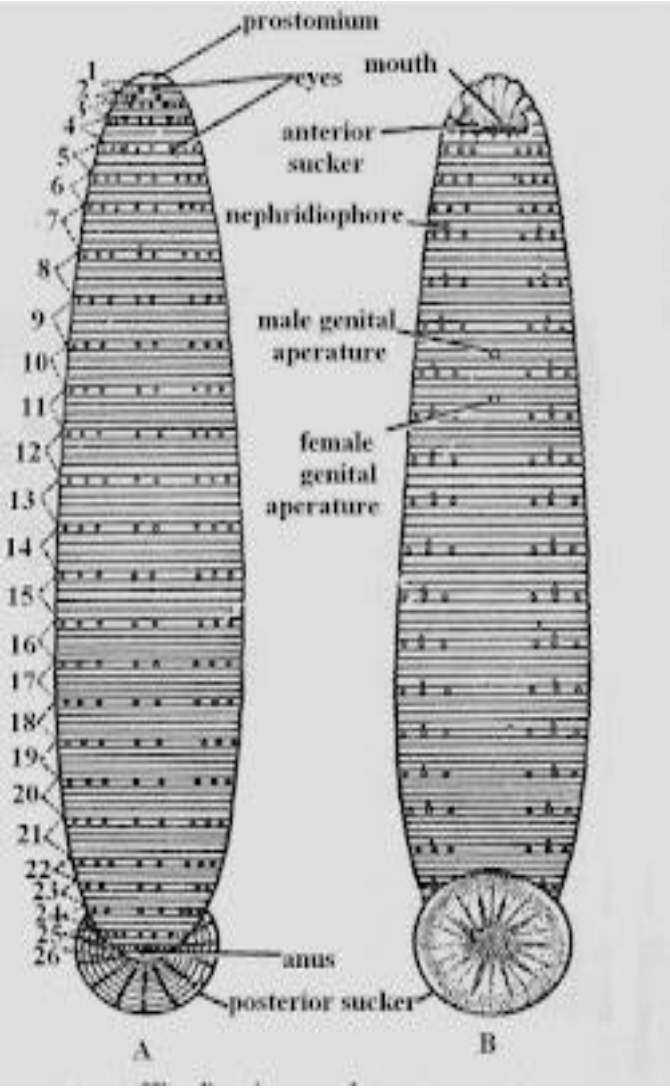
- Aphrodite is marine worm inhabiting the deep water muddy bottoms
- Commonly called as sea mouse measuring approximately 12 cm in length and made up of 30 to 35 segments.
- Shape of the animal is oval, and dorsoventrally flattened. The dorsal surface is convex and is covered with setae of different kinds.
- Body is covered dorsally by felt-like or blanketlike setae arising from the notopodium.
- Anterior end contains a small head or prostomium, bearing a small median tentacle and 2 lateral palps. Anus is dorsally situated at the more pointed posterior extremity.
- Ventral surface is flat, segmented and forming a creeping sole. Each ventral segment or metamere contains stiff setae.
- Pumping action of the dorsal body wall causes the sea water to be filtered through the dorsal felt into the space below.

Hirudinaria granulose

Phylum: Annelida

Class: Hirudinea

Order: Gnathobdellida



•Commonly called as Indian cattle leech.

• Body is soft, vermiform, elongated dorso ventrally flattened, measuring 30 to 35 cm in length.

• Skin is kept moist and slimy due to abundant mucus secretion.

• Anterior and posterior suckers are well developed.

• Dorsal surface is olive green, ventral surface orange yellow or red.

• Body is divided into cephalic, preclitellar, clitellar, middle, caudal and posterior sucker regions with 33 segments.

Each segment is superficially divided into 5 annuli.

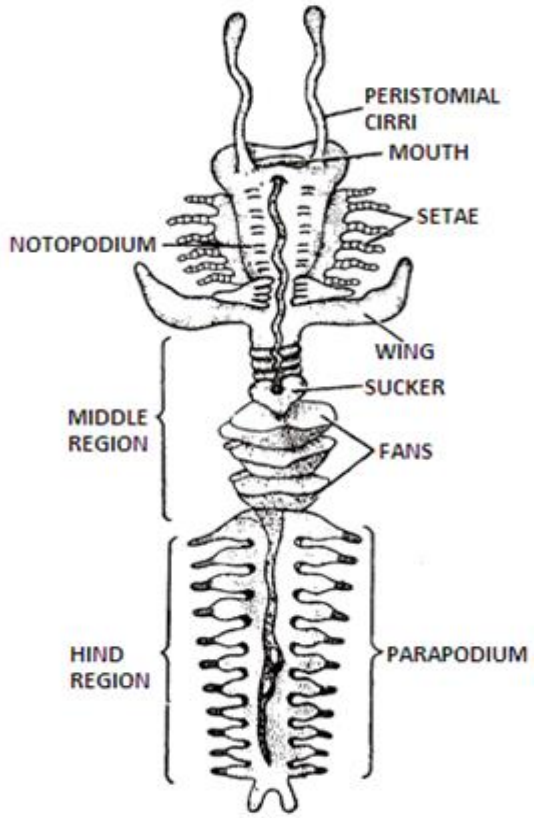
• Eyes 5 pairs dorsally. Segmental receptor organs are 4 pairs (dorsal) and 3 pairs (ventral). Anus is on 26th segment, nephridiopores on 6 to 22 segments ventrally, male-genital pore on mid-ventral, inter-segmental groove of 2nd and 3rd annuli of 10th segment and female-genital pore on 11th segment.

Chaetopterus

Phylum: Annelida

Class: Polychaeta

Order: Canalipalpata



1. They are marine, tubicolous and burrowing worms.

2. The tubes are "U" shaped and are lined with thick mucous secreted by the animal.

3. Body is about 20—30 cm in length and is divisible into an anterior, a middle and a posterior region.

4. The anterior region is comprised of 15 segments, the middle region of 3 segments and the posterior region of about 30 segments.

5. The prostomium and peristomium are reduced and tentacles and palps are absent.

6. Mouth is surrounded by funnel like peristomial collar.

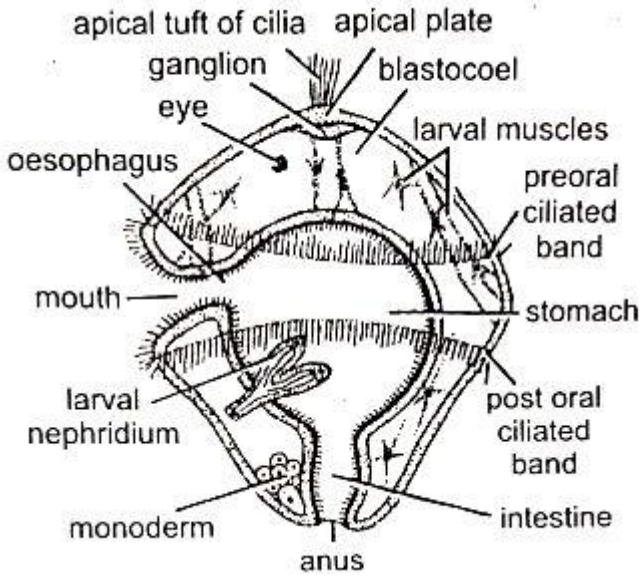
7. A pair of backwardly directed peristomial cirri are present on peristomual collar. Pharynx Is non-protusible.

8. All anterior segments bear parapodia with large notopodia.

9. The first segment of middle region bears a pair of great **"wings"** which are modified notopodium. Segments 1-15 bear five suckers which are also modified notopodia. The segments 13 to 15 bear flat and large fans (the modified notopodia).

10. The segments in posterior region are all alike and bear biramus parapodia. They are devoid of gills or branchiae.

Trochophore Larva



In the development of Nereis, trochophore larva is formed after gastrulation.

• Larva is conical in shape, microscopic and fast swimmer.

• Anterior end contains apical sensory organ, having tuft of cilia. Nerve ganglion is present below it.

• Digestive system consists of open mouth, rounded stomach, intestine and anus.

• There are two ciliated bands for swimming-(i) preoral ciliated band or prototroch and (ii) post oral ciliated band or metatroch.

• Internally, larva contains coelom, larval nephridium, mesoderm, eye spot and larval muscles.

• After metamorphosis, trochophore larva changes to adult.

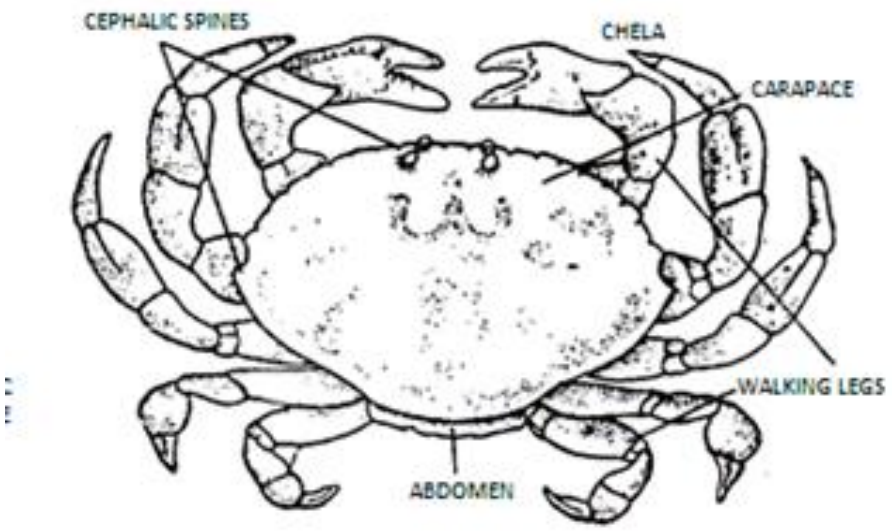
ARTHROPODA

Cancer

Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda



1. Commonly known as **"crabs"** and are found buried under rocks, wood pieces and in sand along sea shore.

2. Body is flat and covered by a carapace. It is comprised of a cephalothorax of 13 segments and abdomen is curved below the cephalothorax.

3. The cephalothorax is comprised of 13 (5 + 8) segments of cephalic and thoracic region, is much broader then its length and is covered over by a carapace.

4. Carapace in callinectes is beautifully decorated and is produced into a pair of spines laterally.

5. The cephalothorax bears a pair of stalked compound eyes, a pair each of small antennule and antennae.

6. Mouth parts and first two maxillepedes are exceedingly small and are covered over by third maxillepede which acts as operculum or cover.

7. Of the five pairs of walking legs, first pair is chelate and is largest. The second to fifth pairs are non-chelate and sufficiently developed and clawed.

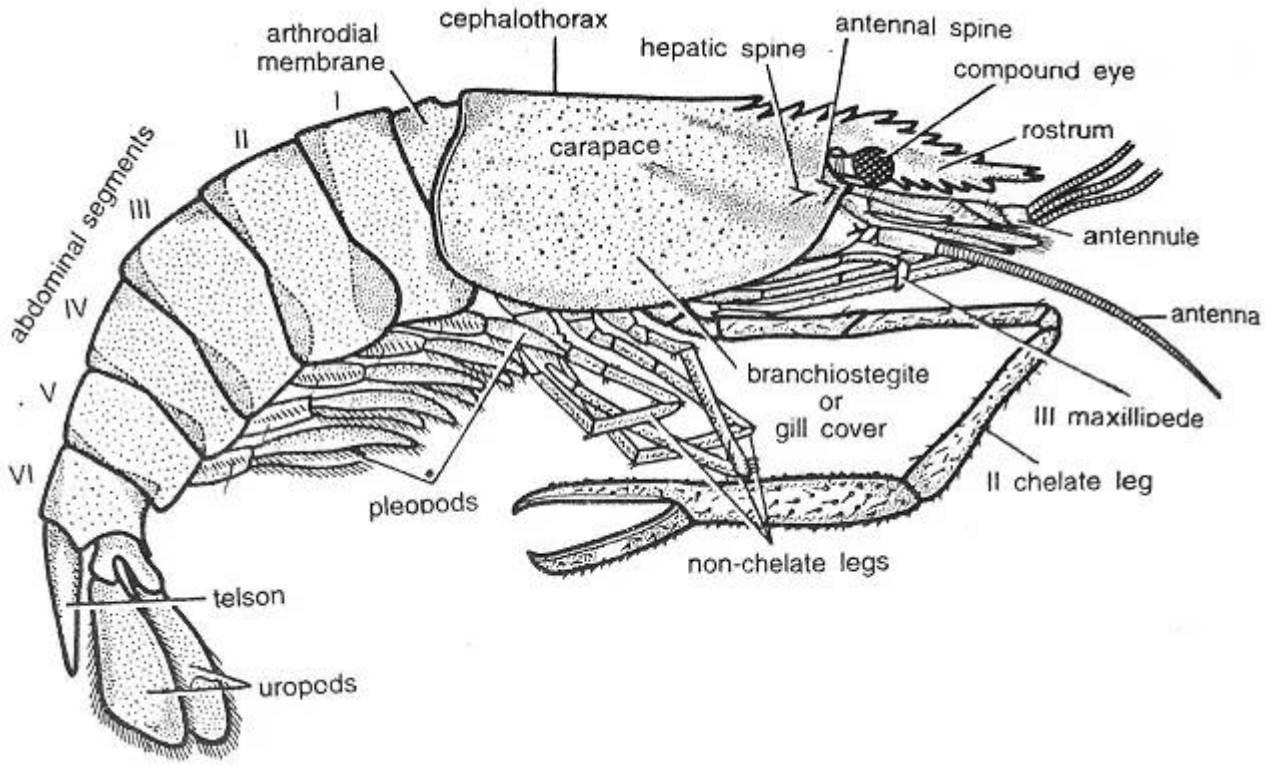
8. Abdomen is reduced, flattened, movably articulated and is curved or flaxed permanently in a groove below cephalothorax. It is comprised of six segments and a telson. Abdominal appendages are degerate.

9. In male, however, two pairs of pleopods are present modified into copulatory organs, whereas, in females four pairs are present and are modified for carrying eggs. The uropods being completely absent.

Palaemon **Phylum:** Arthropoda

Class: Malacostraca

Order: Decapoda



- The body of prawn is divided into Cephalothorax and Abdomen

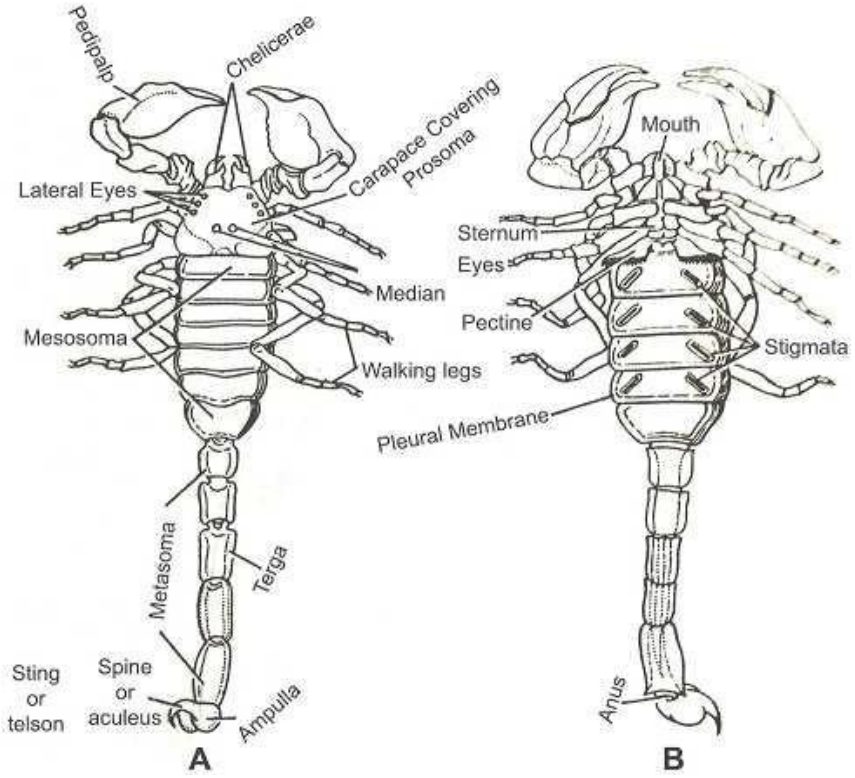
- Cephalothorax have 13 pairs of appendages on the ventral side
- First fivepairs of appendages are Antenulle, Antenna, Mandible, First maxilla and Sec maxilla
- Remaining 8 pairs appendages are 3 pairs of maxillipeds and 5 pairs of walking legs
- Cephalothorax is covered by a hard covering known as Carapace
- Abdomen consists of six segments
- Every segment of the abdomen there is a pair of appendages called Pleopods
- Pleopods used for swimming
- Gills are primary respiratory organs in prawn
- Excretory organs of Prawn are known as green glands

Palamnaes(Scorpion)

Phylum: Arthropoda

Class: Arachnida

Order: Scorpiones



Palamnaeus is commonly known as scorpion.

1. Body is bilaterally symmetrical, triploblastic, coelomate, metamerically segmented animal with jointed appendages.

2. Body is differentiated into anterior prosoma, middle mesosoma and posterior metasoma.

3. Prosoma is covered by carapace that bears a pair of median eyes and 2-5 pairs of lateral eyes. It has six segments, each with a pair of appendages, *i.e.*, one pair of chelicerae, one pair of pedipalp and four pairs of walking legs.

4. Opisthosoma consists of two parts anterior mesosoma and posterior metasoma.

5. Mesosoma is seven segmented, the first segment bears genital operculum, the second segment bears a pair of pectines and each of the third, fourth, fifth and sixth segments have a pair of stigmata. The seventh segment is without any appendages.

6. Metasoma is tail like and comprises five caudal segments and a last segment or telson bearing the sting.

7. Sexes are separate.

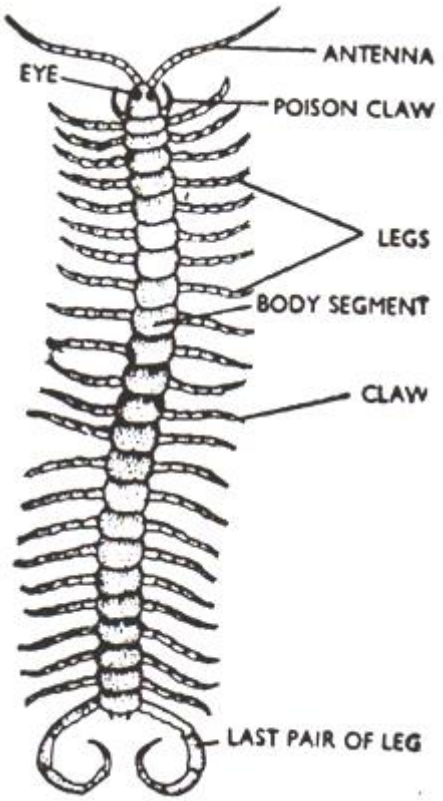
8. Viviparous.

Scolopendra

Phylum: Arthropoda

Class: Chilopoda

Order: Scolopendromorpha



1. Commonly called as **"centipedes"** and are poisonous in nature. They are swift moving, carnivorous, nocturnal and are commonly hidden in dark and damp places under logs, bricks, stones and in houses in crevices.

2. Body elongated and flattened dorsoventrally and is generally comprised of about 21-23 segments.

3. Body is divisible into a head and a trunk. The head bears a pair of 12 jointed antennae, a pair of jaws and two pairs of maxillae.

4. All the trunk segments, except the last two and one just behind the head, bear a pair of jointed appendages with each.

5. The segment just behind the head bears a pair of four jointed and curved poison claw (the maxilleped).

6. Respiration through branched tracheae and excretion through two malpighian tubules.

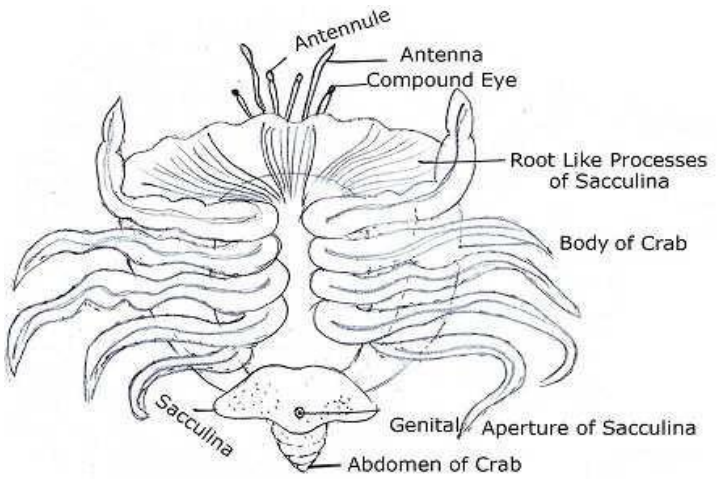
7. The sexes are separate and the genital openings are situated at the hind end of body.

Sacculina

Phylum: Arthropoda

Class: Thecostraca

Order: Cirripedia



1. Sacculina is commonly known as root-headed barnacle.

2. It lives as a parasite on crab's abdomen.

3. The body is made up of two parts- a thin sac and a peduncle. The sac appears like a fleshy tumour attached to the abdomen by a peduncle. The peduncle consists of numerous root-like filaments which protrude body of the host to derive nutrition.

4. Appendages, segmentation, alimentary canal and anus are absent.

5. Hermaphrodite, *i. e.* sexes united.

6. Larva is cirripede-nauplius.

7. The female *Sacculina*, attached to male crab, causes hormonal imbalance in the crab that makes it infertile (parasitic castration).

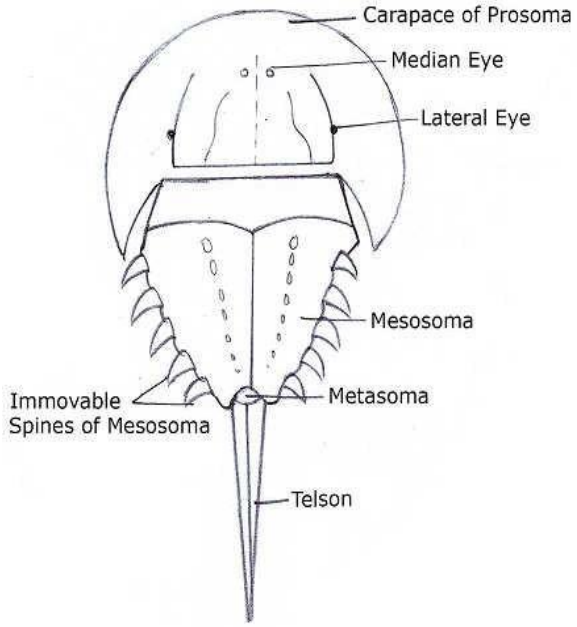
.

Limulus

Phylum: Arthropoda

Class: Merostomata

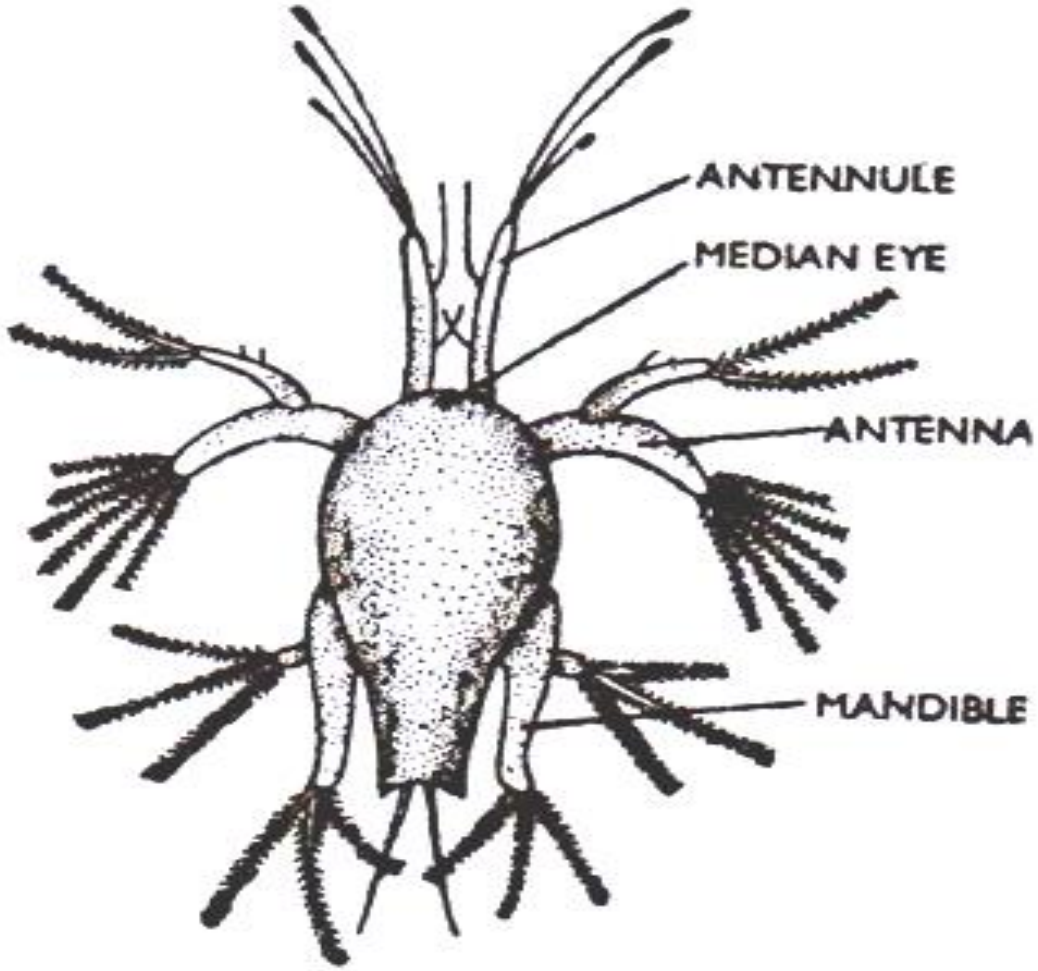
Order: Xiphosura



Limulus is commonly known as king crab.

1. It is bilaterally symmetrical, triploblastic metamerically segmented animal with jointed appendages.
2. Body is divided into anterior prosoma, posterior opisthosoma and a spine like tail or telson.
3. Prosoma is covered by a horse-shoe shaped carapace. It bears a pair of simple eyes and a pair of compound eyes. It bears 6 pair of appendages surrounding the mouth. The first pair of chelicerae is small, trisegmented and chelate. Rest of the five appendages consists of four pairs are chelate legs and a last pair of non-chelate leg.
4. Opisthosoma is hexagonal and movably articulated with prosoma. It consists of 6-segmented mesosoma and 3-segmented metasoma. It bears six pairs of appendages, the first pair is fused and forms the genital operculum and the remaining five pairs of appendages are flap like and membranous and are used for respiration.
5. The telson is used to flip itself over if stuck upside down and to steer in the water.
6. Excretion takes place through coxal glands.
7. Sexes are separate. Fertilization is external

Nauplius



1. Nauplius larva, which is the earliest free swimming stage in the development of crustaceans.

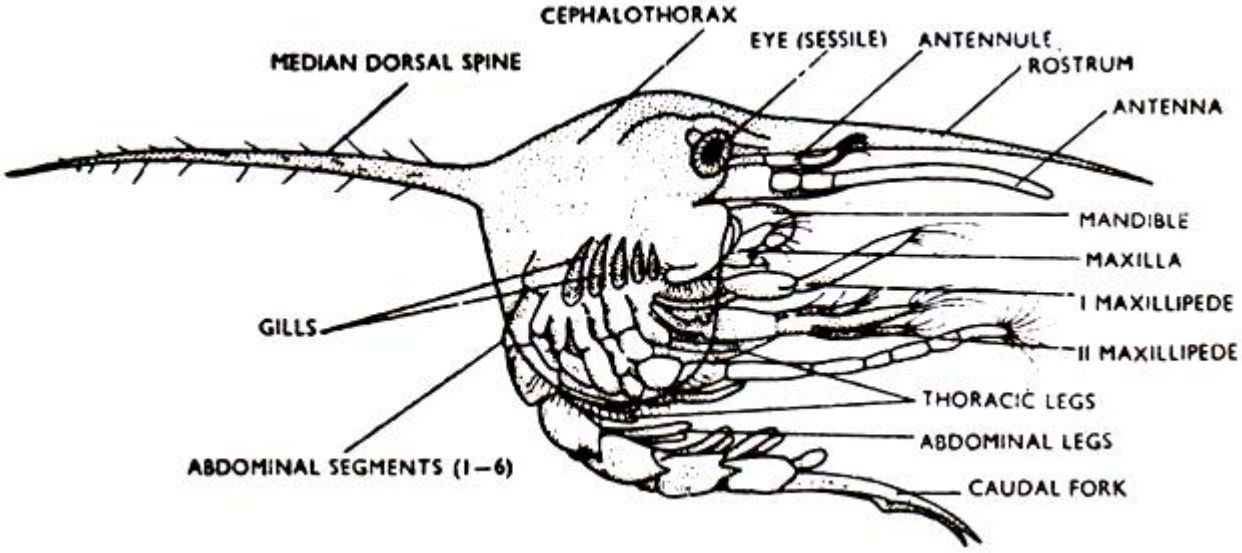
2. Body is somewhat fusiform or pear shaped and is without segmentation.

3. The head bears paired mitanous antennae and biramous antennule and mandibles and a median sessile eye.

4. All appendages bear setae.

5. This larva possesses only alimentary canal and no other organ. After spending free swimming life it metamorphoses into metanauplius.

Zoea Larva



1. Zoea larva is the fourth stage in the life cycle of crustaceans.

2. This larva develops from Protozoa.

3. The body is divisible into cephalothorax and a long segmented abdomen.

4. The cephalothorax is covered over by carapace and bears paired compound eyes and paired appendages e.g., antennules, antennae, mandibles, maxillae and maxillepedes and five pairs of gills.

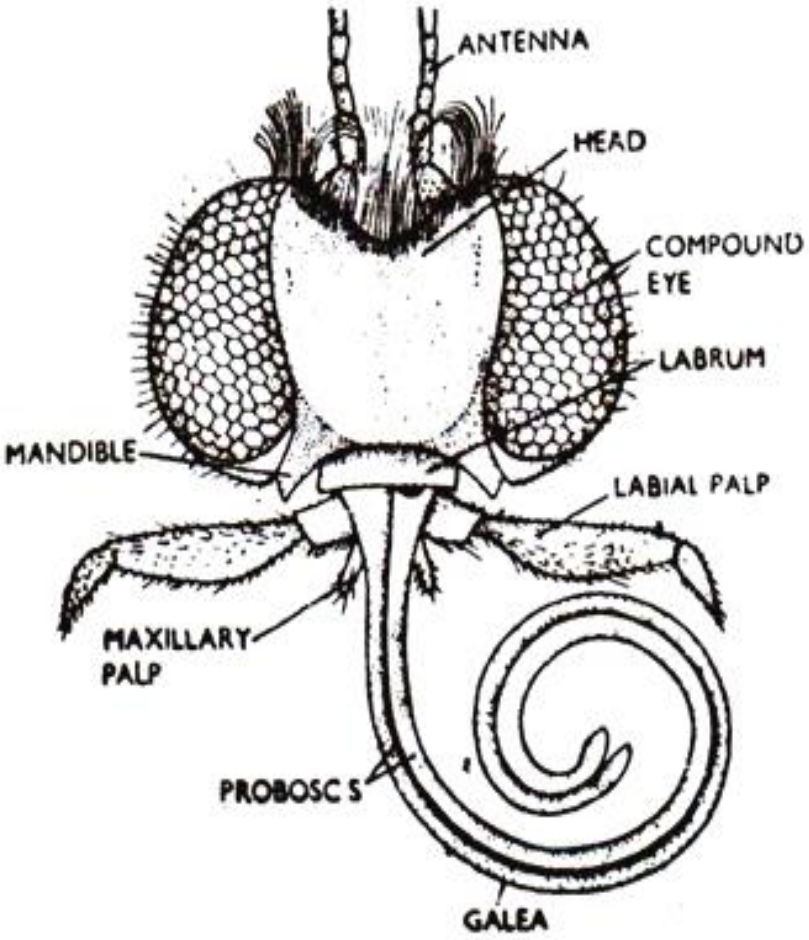
5. The carapace is produced into a long and pointed rostrum and a long median dorsal spine with many small bristles.

6. The cephalothorax also bears buds for 6 pairs of thoracic appendages.

7. The abdomen has six segments with paired rudiments of abdominal apeandages and a pair of caudal forks.

8. It metamorphoses into Metazoea and ultimately into Megalopa.

Mouth parts of butterfly



1. The mouthparts of butterfly and moths are siphoning and sucking type

2. The head bears a pair of large compound eyes and a pair of long jointed antennae.

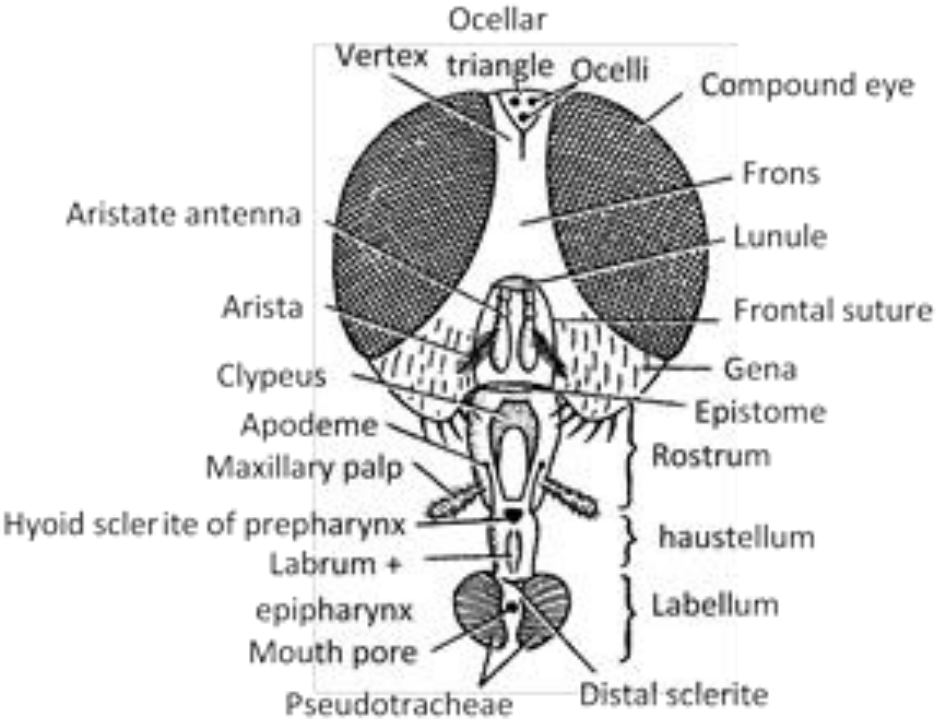
3. The mouth parts are of siphoning type and are comprised of a basal transverse and rectangular labrum, a pair of reduced mandibles, a pair of maxillae (galeae) forming a long and coiled proboscis and paired labial and maxillary palps.

4. The proboscis is hollow internally and remains coiled under head when not in use. They only open up after receiving the food stimulus.

5. The maxillary palps and labium pre greatly reduced and degenerate and labial palps are well developed and jointed. The mandibles and hypo pharynx being absent.

6. The mouthparts are used for sucking nectar from flowers.

Mouth parts of House fly



1. The mouthparts are of sponging type and are used for sucking liquid food.

2. The head is large and bears a pair of very large compound eyes and very small antennae.

3. The mouthparts include a long proboscis tube made by labrum – epipharynx, hypo-pharynx, labium and a pair of un-jointed maxillary palps on sides of proboscis.

4. The proboscis is divided into terminal disc-like label/urn a middle hausteilum and a basal rostrum.

5. Each labellum is made up of 2 oval lobes or labellar discs & each labellar disc is made up of numerous pseudo tracheal channels.

6. The rostrum is connected to head and hausteilum is the prolongation of rostrum.

7. The hausteilum is made up of labium and encloses the food channel, which is formed by labrum-epipharynx and hypo pharynx.

8. Mandibles and maxillae are absent.

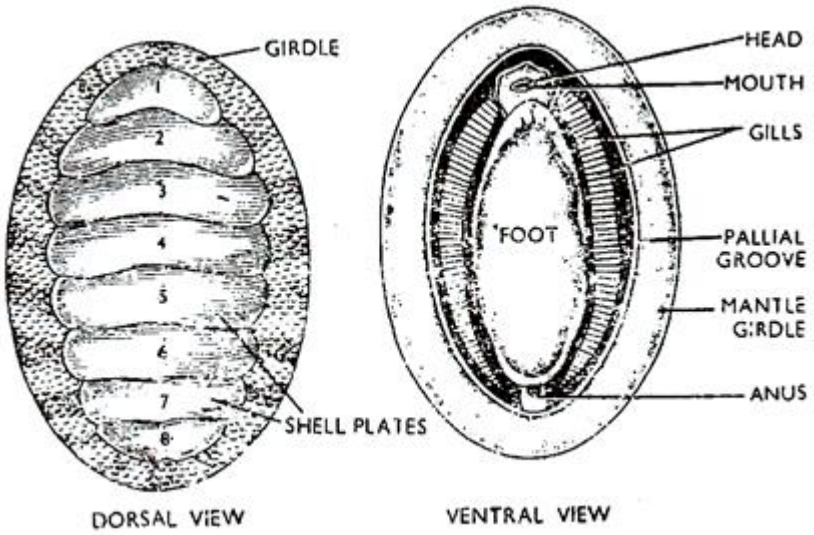
MOLLUSCA

Chiton

Phylum: Mollusca

Class: Polyplacophora

Order: Chitonida



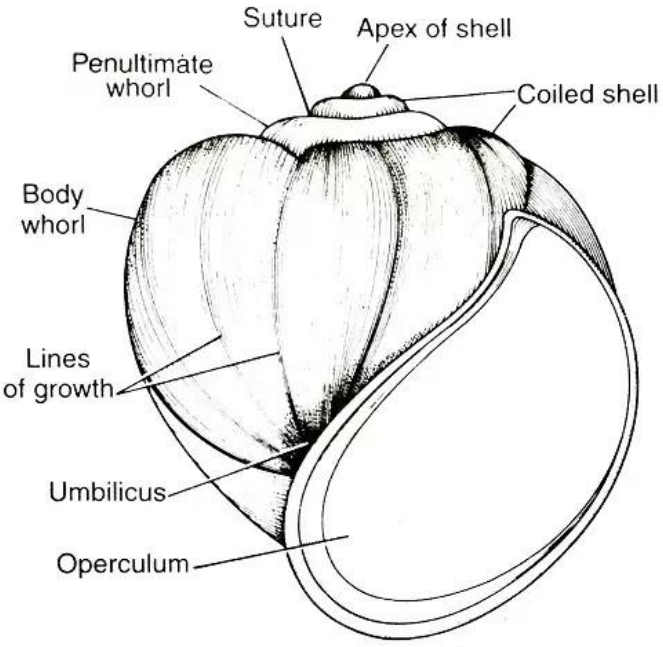
1. It is a marine animal of cosmopolitan distribution.
2. It is found attached to stones and rocks (coral reefs) between tide marks.
3. Body is elliptical and is convex on dorsal and flat on ventral surface. Shell is present on dorsal side and is made up of 8 transverse and overlapping calcareous plates arranged in linear-zones.
4. Around the plates is present the mantle which is covered thickly with spicules.
5. On the ventral surface the major portion is occupied by
6. Between foot and mantle is present the mantle groove which is having about 80 ctenidia like gills on either side of foot.
7. Behind the foot, in the middle, lies the anal pore and in front of the foot in the middle segmented lies a large head with small opening —the mouth, but there are no eye or tentacles.
8. On one side in the mantle groove is present a genital and an excretory pore.
9. Sexes are separate, gonad is single and Development through trochophore larva.
10. Nocturnal, herbivorous (feeding on algae) and are used for decoration and as food.

Pila globosa (Apple Snail)

Phylum: Mollusca

Class: Gastropoda

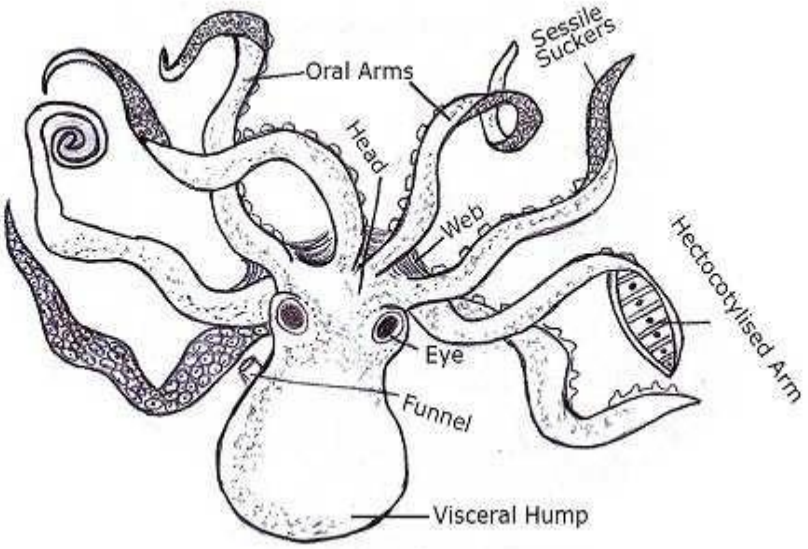
Order: Architaenioglosaa



- *Pila* is a soft, unsegmented and globose mollusc whose body can be divided into head, visceral mass and foot.
- The head consists of two pairs of tentacles, one pair of eyes and a ventral slit mouth, also known as an aperture.
- The foot is flat, broad, ventral and almost triangular in shape. It is attached to the operculum.
- A visceral mass, that is a hump-like structure, houses all the main organs of the animal.
- The mantle is a structure that covers the visceral mass. It secretes calcium carbonate and forms a shell for the organism.
- The striking feature of *Pila* is the presence of an operculum. The operculum is an anatomical calcareous structure that is attached to the upper surface of the foot. It acts as a trapdoor that closes the aperture of the shell when the soft part of the animal is withdrawn.

Octopus

Phylum: Mollusca
Class: Cephalopoda
Order: Octopoda



1. An *Octopus* is commonly called devil fish.

2. The body is unsegmented, symmetrical and soft bodied animals.

3. The head bears a pair of eyes. The mouth is surrounded by eight elongated equal arms usuallybearing suckers.

4. Shell is absent.

5. It moves around by crawling or swimming.

6. For defence it ejects ink from the ink-gland into the surrounding water, producing a smoky cloud.

7. In males one of the arms, called hectocotylized arm, bears a spoon shaped organ at its end. Thearm is used to caress the female and deposit spermatophores beneath its mantle.

8. Sexes are separate.

9. Development is direct.

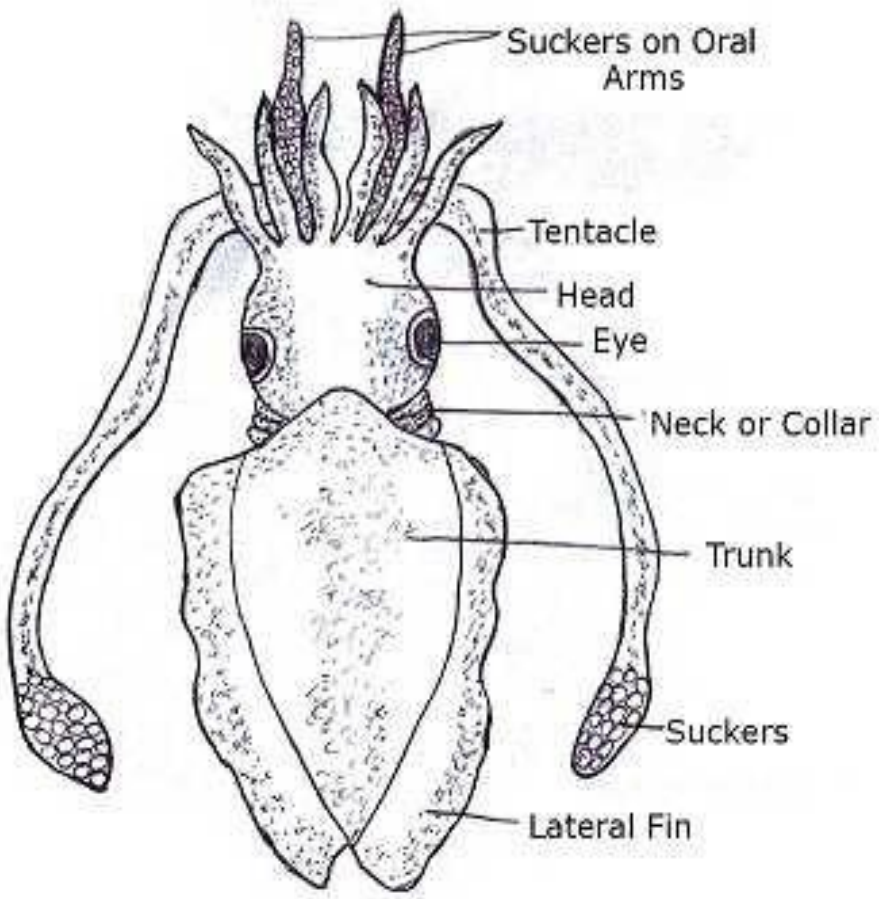
10. It feed upon crabs, bivalves and fishes etc.

SEPIA

Phylum: Mollusca

Class: Cephalopoda

Order: Sepiida



Sepia is commonly called cuttle fish

1. Body is soft, unsegmented and bilaterally symmetrical. It is divisible into a large head, a smallneck or collar and trunk.

2. The head is well developed, bears a pair of eyes and 10 oral arms which are a modification offoot. 8 oral arms are smaller while two are longer and are called tentacles.

3. Collar is constricted and connects the head with the trunk.

4. The trunk extends into flaps called lateral fins on either side that help the animal in swimming.

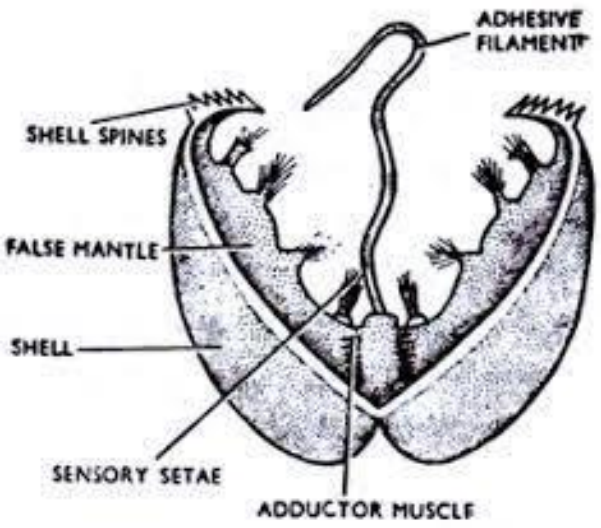
5. It is covered by a thick muscular mantle, enclosing a large mantle cavity, on the ventral sidewhich contains viscera.

6. It has a life expectancy of 1-2 years.

7. The Sexes are separate and reproduction is sexual.

8. Ornament makers use cuttle bones as moulds for casting small objects.

Glochidium larva:



1. It comprises a bivalve shell and a false mantle lining the shell.

2. Each shell valve is triangular, convex externally and concave internally and is attached to the other valve on the dorsal side only.

3. The free ventral ends of each valve are slightly curved inwards and bear few hooks or spines.

4. The mantle is projected into numerous protuberances bearing sensory bristles.

5. Between the two valves at the dorsal side is present a median adductor muscle which helps in closure of the valves.

6. Below the adductor is present a small median byssus gland horn which arises a long provisional byssus thread or adhesive filament.

7. The larva, prior to metamorphosis, leads a parasitic life where it is attached to a fish through hooked ventral ends.

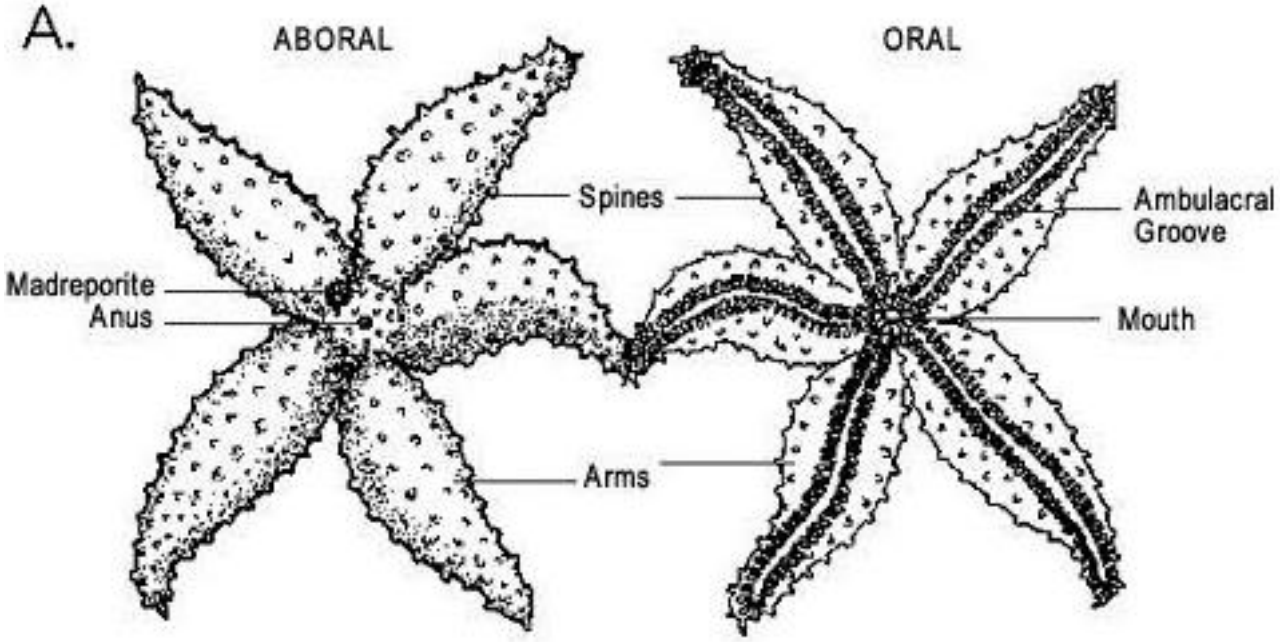
ECHINODERMATA

Asterias

Phylum: Echinodermata

Class: Asteroidea

Order: Forcipulatida



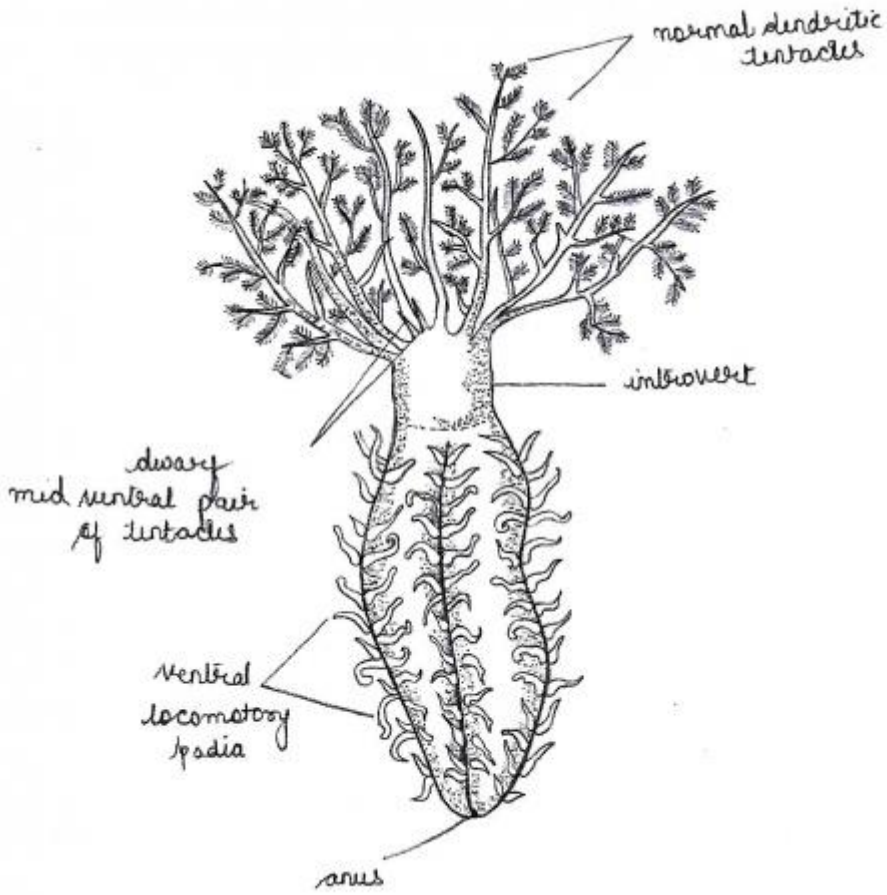
- They have five arms that are broad at the base and taper at the end and curl up a little too.
- The tube feet present on the lower surfaces of their arms are tubular projections that are a part of the vascular system. These projections help in locomotion and feeding.
- The aboral (upper) surface is usually orange to brick red in colour and the oral (lower) surface is of paler shades.
- The madreporite is a pressure-equalising valve like structure that is used to filter water into the vascular systems of the sea stars.
- It is a calcareous opening that looks like a wart or button-like structure on the aboral surface of the organism.
- Ampulla are small sac-like structures that are connected to stone canals. The stone canals together form a circular ring canal.
- The ampulla are also connected to sucker-like podia. As the ampulla contracts, the podia is stretched, water is moved in and the whole process helps in their movement.
- The starfishes can grow up to a maximum diameter of 20 inches but are commonly found in the range of 4 – 12 inches.
- It feeds on molluscs and other benthic invertebrates.

Cucumaria

Phylum: Echinodermata

Class: Holothuroidea

Order: Dendrochirotida



1. It is commonly known as **"sea cucumber"**, is marine and is found in shallow waters.
2. Body elongated, cylindrical, five sided, swollen in the middle and narrow at two ends.

3. The mouth and anus (cloaca) are situated at opposite ends.

4. Body surface is traversed by five longitudinal ridges -the ambulacral ridges each of which is bordered by double rows of tube feets.

5. The spines, pedicillariae, branchiae or plates are all absent but small calcareous particles are found embedded in the body wall.

6. Mouth is surrounded with a small ring-like peristome and a collar-like introvert. The introvert bears long, highly branched and dedritic tentacles.

7. Madreporite is internal and so also the respiratory organs, which are in the form of 3 well developed respiratory tree.

8. Sexes are separate and development through auricularia larva.

Bipinnaria Larva

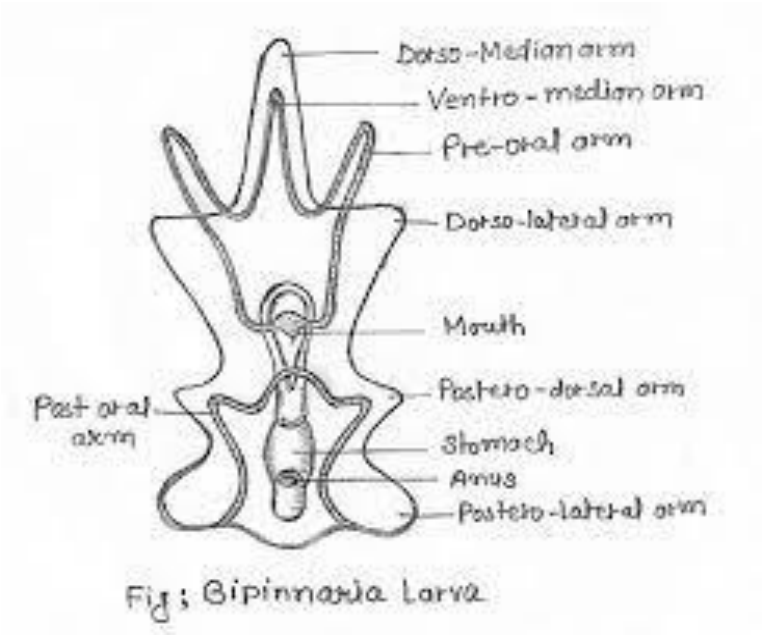


Fig: Bipinnaria Larva

It is the first larval form of Asteroidea.

It is a bilaterally symmertrical, free swimming, pelagic larva.

The pre oral region is elongated, postoral region is broad.

It possesses two ciliated bands, the pre oral and post oral bands

The anterior end of the archenteron develop as mouth whereas the blastopore becomes the anus.

The pre oral and post oral ciliated bands are′ continued over a series of prolongation called arms.

The following are the names and the number of arms developing from pre oral and post oral ciliated bands :

Postero lateral arm - two

Post oral arm - two

Postero dorsal arm - two

Antero dorsal arm - two

Pre oral arm - two

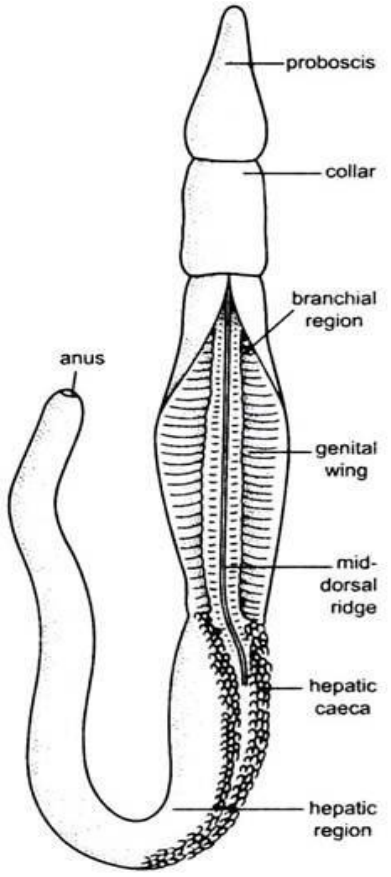
Ventero median arm - one

Dorso median arm - one

HEMI CHORDATA

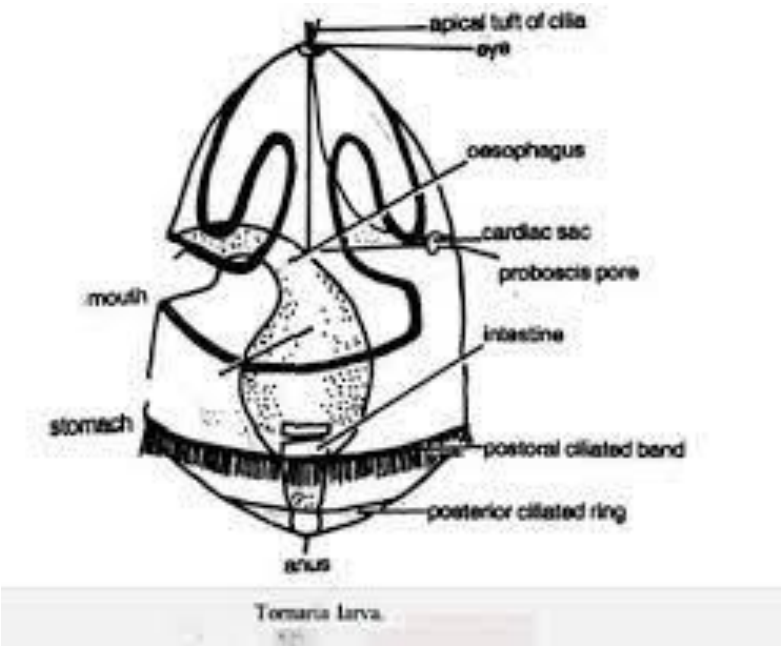
Balanoglossus **Phylum:** Hemichordata

Class: Enteropneusta



(1) Balanoglossus is commonly called as 'Acorn worm.' It lives in a U-shaped burrows.
(2) It measures 10 cm to 2.5 meters, depending on the species.
(3) It is bilaterally symmetrical, triploblastic deuterostome with worm-shaped body divisible into three regions-anterior proboscis or prosoma, middle collar or mesosoma and posterior trunk or metasoma.
(4) Proboscis is conical, collar is funnel like, while trunk is cylindrical.
(5) Proboscis contains heart vesicle, central sinus and buccal diverticulum. It has thick muscular body wall and its cavity or coelom opens to the exterior by the proboscis pore.
(6) Collar contains the mouth and collar coelom which opens by a pair of collar pores on dorsal surface.
(7) Trunk region contains most of the internal organs, such as pharynx, gonads or hepatic region. Pharynx and gonads constitute branchiogenital region. Posteriormost part is abdomen.
(8) Branchio-genital region is composed off : (i) genital wing having gonad (ii) branchial region containing paired gills and (iii) hepatic region having hepatic caecae.
(9) Alimentation is complete and circulatory system usually contains contractile sac of heart.
(10) Sexual dimorphism. Fertilization external and development includes tornaria larva.
(11) It possesses power of regeneration.

Tornaria Larva



Tornaria larva

I. The tornaria larva usually has an ovoid bell-shaped body which is extremely transparent. It swims freely in water.

2. The body of tornaria larva is variously folded into lobes.

3. The margin of lobes is bordered by cilia:

4. There are two circlets of cilia. (i) an oral circlet of cilia surrounding the mouth or circun~oral ciliary band (often not clearly visible in slides). (ii) a posterior ciliated band or telotroeh that occurs as a ring in front of the anus.

5. The alimentary canal is very simple having a mouth, oesophagus, stomach and intestine.

6. The mouth is ventral and anus is posterior and terminal.

7. Water sac is also found in the body of larva which opens outside through the dorsal pore, the hydropore.

8. An apical sensory plate with two eye spots and a of tuft of sensory hairs occurs at the centre of the narrow anterior end.

DISSECTIONS

Prawn- Nervous system