

## UNIT-II

**Protozoa-Euglena, Porifera-Hyalonema, Coelenterata-Aurelia, Ctenophora- Plerobranchia, Platyhelminthes-Fasciola-Liver Fluke, Aschelminthes-Wuchereria bancrofti and Annelida-Earth worm, General characteristics, classification up to order –type studies.**

*Presented by*

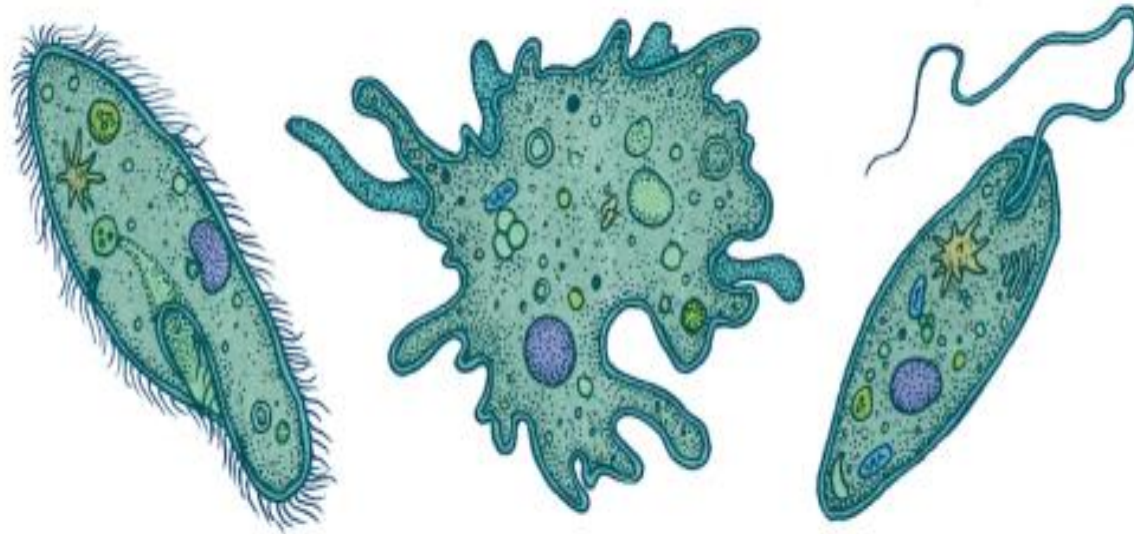
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# Phylum Protozoa: General characteristic and Classification



# Phylum Protozoa

- The animals included in phylum Protozoa can be defined as microscopic and acellular animalcules without tissues and organs.
- It have one or more nuclei.
- Protozoa exist either singly or in colonies.
- Almost about 50,000 species are known till date.
- According to five-kingdom classification system, protozoans belong to the phylum Protozoa of kingdom Protista.



- *Anton Van Leeuwenhoek* was the first to observe protozoa (Vorticella convellaria) under a microscope. He called them animalcules.
- *Gold fuss* coined the term Protozoa which in Greek means first animals (Proto= first; zoans=animals).
- *Hyman* and other zoologists preferred to call them as acellular animals.
- The body of protozoans is **unicellular**.
- They are generally referred to as acellular rather than unicellular as the so called single cell performs all the life activities.
- Though it is structurally equivalent to a single cell of the metazoan body.
- It is functionally equivalent to the whole metazoan animals.



# General Characteristics of phylum Protozoa

- Protozoans are usually microscopic and unicellular individuals.
- They exhibit all types of symmetry.
- Most species occur as single but many are colonial.
- Body is bounded by a cell membrane or plasmalemma.
- Body may be naked or is covered by a pellicle or a test, made of silica or calcium carbonate.
- A filamentous network of the cytoskeleton may form a dense supportive structure, called the epiplasm.
- Usually uninucleate, but may be more than single nucleus in some forms.



- Locomotor organelles may be flagella (e.g., Euglena), cilia (e.g., Paramecium), pseudopodium (e.g., Amoeba) or absent in parasitic forms (contractile myonemes are present in the body).
- Nutrition may be holozoic, e.g., Amoeba (animal-like), holophytic (e.g., Euglena), saprophytic, mixotrophic or parasitic.
- Intracellular type of digestion occurs within the food vacuoles.
- Respiration performs generally through the outer surface of the body, but may be few obligatory or facultative anaerobes.
- Excretion performs generally through the body surface, and water regulation of the body is accomplished by contractile vacuole.



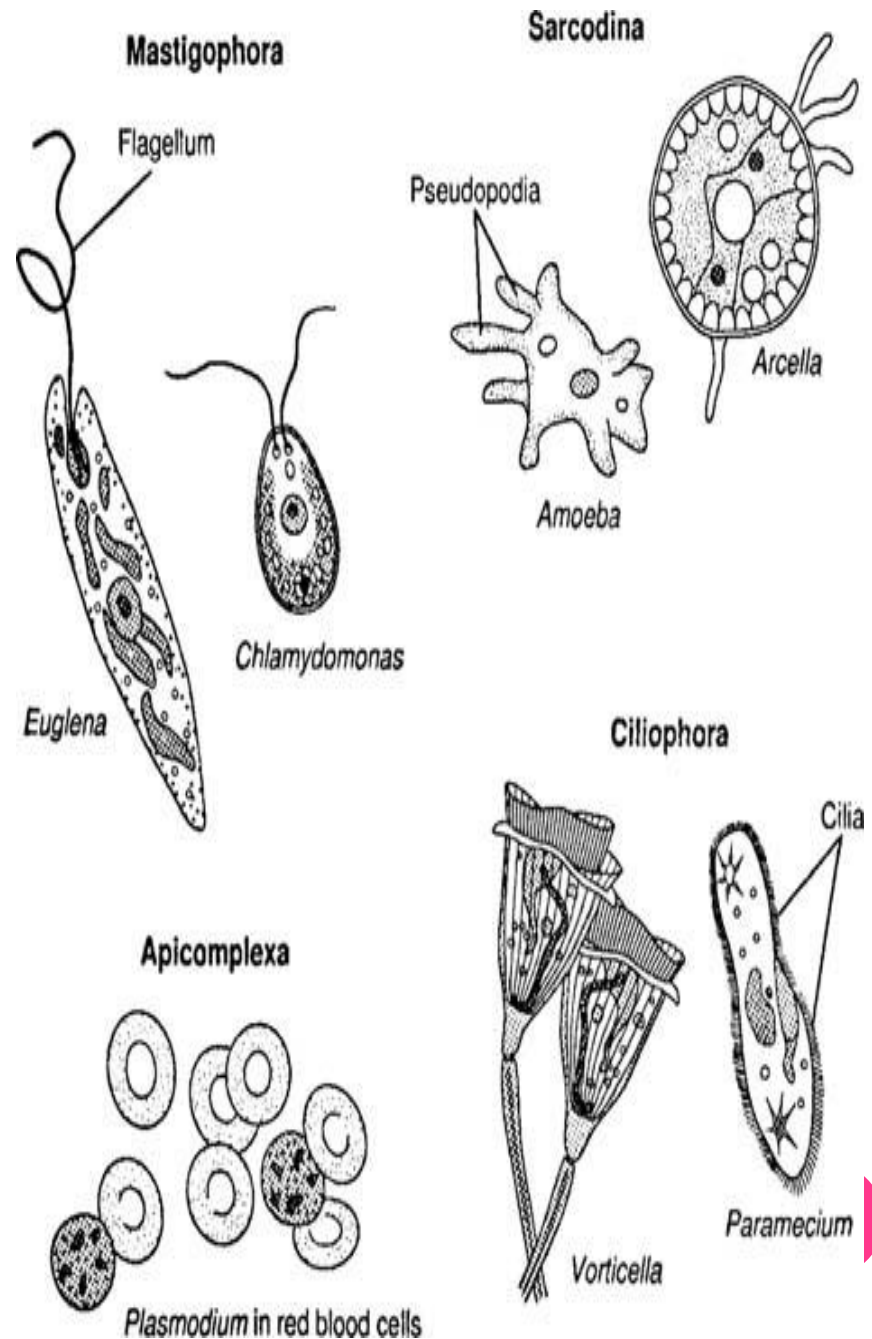
- Asexual reproduction occurs by fission (mitosis), plasmotomy or budding.
- In certain forms sexual reproduction may occur either by conjugation or fusion by gametes (syngamy).
- They never develop from blastula stage during development.
- Mainly aquatic but many are parasitic, commensal or mutualistic



## Classification of Protozoa:

Phylum protozoa is classified into four classes on the basis of locomotory organs

- ✓ **Class : Flagellata or Mastigophora**
- ✓ **Class : Rhizopoda or Sarcodina**
- ✓ **Class : Sporozoa**
- ✓ **Class : Ciliata**





## **Class: Flagellata or Mastigophora**

- Usually free living but few are parasitic forms.
- One or more **flagella** usually present for locomotion or food capturing or attachment or protection.
- Body is covered with a pellicle which provides a definite shape.
- Some forms are green due to the presence of **chloroplasts** (*e.g. Euglena*).
- Asexual reproduction occurs by longitudinal binary fission.
- Single nucleus present in a cell.

*e.g. Volvox, Noctiluca, Trichomonas, Trypanosoma, Giardia, Leishmania etc.*



## **Class: Rhizopoda or Sarcodina**

- Free living or endoparasite.
- Contractile vacuole may be present or absent.
- Locomotory organelles are pseudopodia which also help in food capturing.
- Body is without a pellicle, and has no fixed shape.
- Protoplasm is differentiated into ectoplasm and endoplasm.
- Single nucleus is found in the endoplasm.
- Nutrition is holozoic and parasitic in few forms.
- Reproduction takes place by fission

*e.g. Amoeba, Entamoeba etc.*



## **Class: Spoprozoa**

- They are exclusively **endoparasites**.
- Locomotory organelles are **absent**.
- Body is covered by a thick pellicle.
- Nutrition is **saprophytic** and contractile vacuole is **absent**.
- Sexual reproduction takes place by **gamete** or **spore formation**.

*e.g. Monocystis, Plasmodium etc.*



## **Class: Ciliata**

- They may be either free living or **endoparasite**.
- Nucleus may be one, two or many in number.
- Body organization is complex.
- Body shape and size is definite and is covered with a pellicle.
- **Cilia** are the locomotory organelles.
- They have a holozoic mode of nutrition.
- Small **micronucleus** is **reproductive** in function whereas large **macronucleus** is **vegetative** in function.
- Asexual reproduction occurs by transverse fission and sexual by **conjugation**.

*e.g. Opalina, Nyctotherus, Balantidium, Paramecium etc.*



# Euglena

***Phylum – Protozoa*** (Acellular or unicellular)

***Subphylum – Sarcomastigophora*** (Flagella or pseudopodia or both present)

***Superclass – Mastigophora*** (One or more flagella present)

***Class – Phytomastigophorea*** (Chloroplasts present)

***Order – Euglenoidida*** (Flagella arise from the bottom of a pit called reservoir, many chloroplasts, gullet present.)

***Genus – Euglena***



## Habits and Habitat of euglena

- It is a free living flagellate.
- It is found in great numbers in stagnant freshwater pond, ditches, etc.,
- It containing nitrogenous organic matter like urine and faeces of animals.
- Under favourable environmental conditions it multiplies rapidly and forms green scum on the water surface (like algal blooms).
- *E. viridis*, *E. agilis*, *E.fusiformis* and *E. orientalis* are common Indian species.

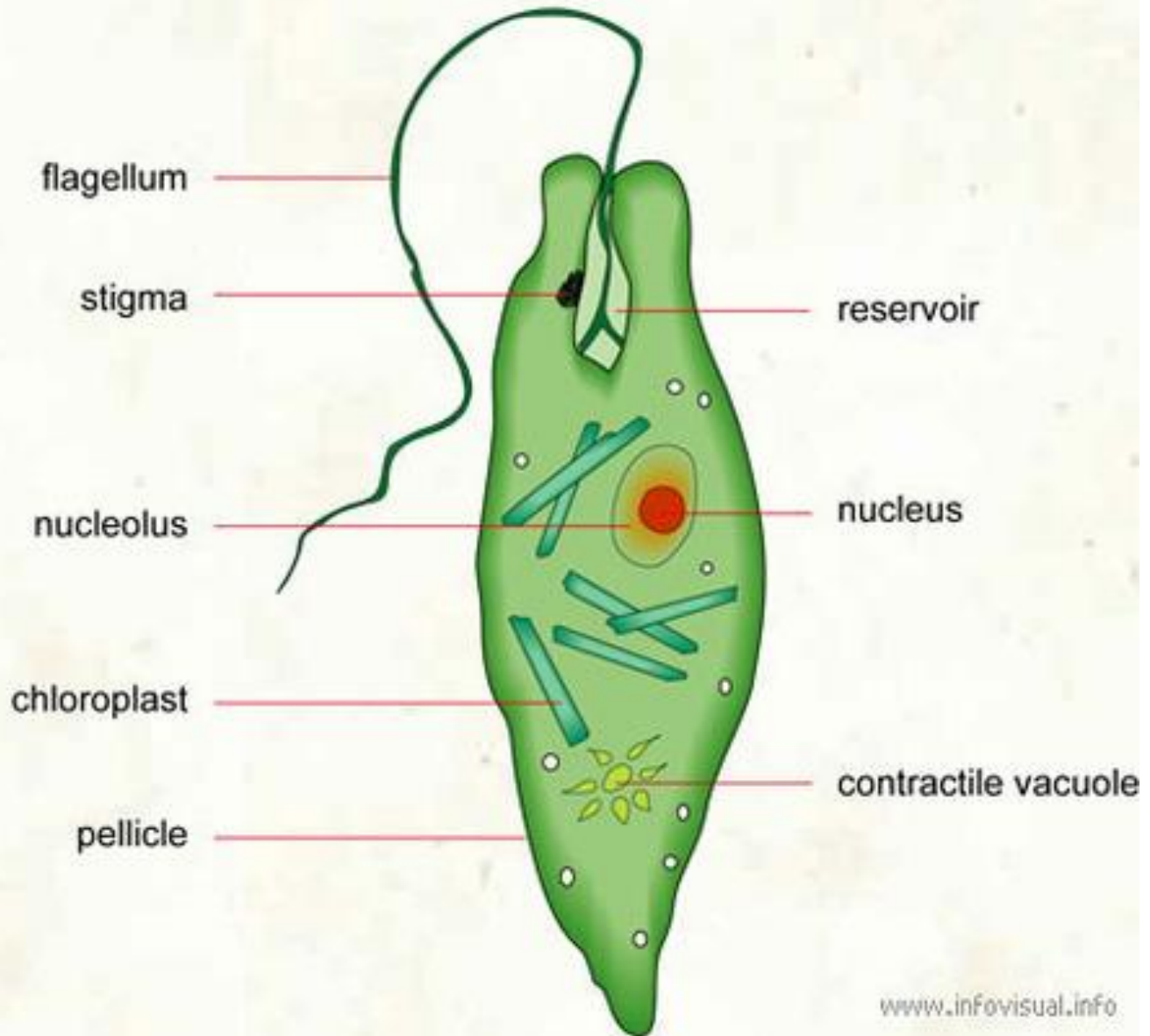


## Structure of euglena

- Euglena is a eukaryotic unicellular organism, it contains the major organelles found in more complex life.
- This protist is both an autotroph, meaning it can carry out photosynthesis and make its own food like plants, as well as a heterotroph, it can also capture and ingest its food.
- When acting as an autotroph, the Euglena utilizes its chloroplasts (which gives it the green colour) to produce sugars by photosynthesis.
- When acting as a heterotroph, the Euglena surrounds the particle of food and consumes it by phagocytosis, or in other words, engulfing the food through its cell membrane.



# STRUCTURE OF A EUGLENA





- Due to this adaptation, many Euglena are considered mixotrophs: autotrophs in the light and heterotrophs in the dark.
- Locomotion comes in the form of either the rotating flagellums, or the flexible pellicle membrane.

Euglena displaying its Organelles, which include:

- **Flagellum**- A long, mobile filament that the Euglena uses to propel itself in its environment
- **Reservoir**- The part used for storage of nutrients
- **Stigma**- A light sensitive-spot that allows the Euglena to detect light, so that it may move towards it in order to conduct photosynthesis



- *Chloroplast*- Organelle that allows the organism to conduct photosynthesis
- *Contractile Vacuole*- Expels excess water into the reservoir, or else the cell would burst
- *Pellicle*- Stiff membrane made of proteins and somewhat flexible, can also be used for locomotion when crunching up and down or wriggling
- *Nucleus*- The central organelle which contains DNA and controls the cell's activity, contained within the **Nucleolus**



# **Phylum Porifera:** **General characteristic and Classification**



# Phylum Porifera

- Porifera animals are also called as Sponges.
- Sponges have managed to conceal their true animal nature for several centuries.
- They are sessile, profusely branched, have no clear way of capturing or eliminating food.
- They also show very little response to external stimuli.
- Some of the sponges are even green in color due to presence of symbiotic algae and hence were regarded as plants by many early researchers.
- Later they were proved as animals after the discovery of their feeding system and life cycle.



- It was **Robert Grant** who coined the term Porifera which in Latin means pore bearing animals (**L. Porus**=pore; **ferre**=to bear).
- **Huxley and Sollas** first proposed the separation of sponges from eumetazoans.
- It is believed that sponges might have evolved from the colonial choanoflagellate protozoans.
- Sponges represent an evolutionary blind offshoot.



## General Characteristics of porifera

- Their body possesses numerous, minute pores called ostia.
- They are aquatic, mostly marine and few are fresh water.
- They are sedentary and sessile except the free swimming, larval form.
- They are multicellular animals having cellular grade of body organization.
- They have cell aggregated body plan.
- They are diploblastic having two body layers – outer ectoderm (also called as pinnacoderm) and inner endoderm (also called as conoderm).
- They are usually asymmetrical but few are radially symmetrical (sycon).
- They are acoelomates.



- They have well developed canal systems where water enters through ostia into the body, circulates inside the body and goes out through osculum.
- Water canal system helps in respiration, nutrition, excretion etc.
- Their body is supported by skeleton called spicules which are made up of Calcium carbonate, Silica or Spongyn fibre.
- Nutririon is holozoic.
- Digestion is intacellular.
- Excretion and respiration takes place by general body surface.
- Reproduction is sexual as well as asexual. The sexual reproduction occurs by gametic fusion whereas asexual reproduction takes place by external budding as well as internal budding (gemmule formation) and regeneration.
- It has indirect development with free swimming larvae “amphibulastula”.
- They are hermaphrodite but fertilization is cross.



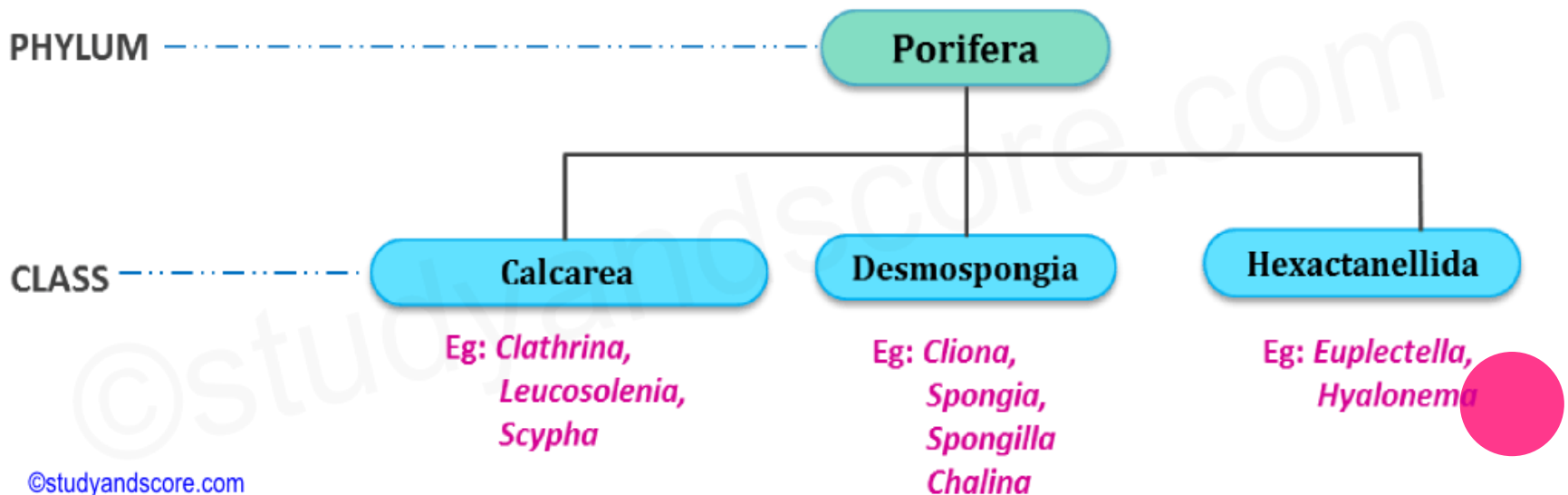
## Classification of Phylum Porifera

On the basis of the chemical nature of spicules types of the skeleton they possess, phylum porifera has been further divided into the following classes

***Class 1: Calcarea or Calcispongiae***

***Class 2: Hexactinellida or Hyalospongiae.***

***Class 3: Demospongiae***





## **Class 1: Calcarea or Calcispongiae (L. Calcarius=limy)**

- The sponges of this class are small.
- They all are exclusively marine forms living in shallow waters.
- Their skeleton is made up of calcareous spicules.
- Body many be cylindrical or vase like
- They may either live in colonies or solitarily
- Body organization may be asconoid, syconoid or leuconoid type.
- Development includes coeloblastula or amphiblastula larva

**Ex: *Clathrina*, *Sycon*, *Leucosolenia***



## **Class 2: Hexactinellida or hyalospongiae (*Gr. Hex=six; Actin=ray*)**

- This class includes glass sponges.
- The sponges of this class are of moderate size.
- They all are exclusively marine forms living in deep waters.
- Their skeleton is made up of six-rayed siliceous spicules.
- Body may be cup, urn or vase like
- They may either live in colonies or solitarily.
- Development includes trichemella larva

**Examples: *Euplectella*, *Hyalonemma***



### **Class 3: Demospongiae (*Gr. Demas=frame; Spongos=sponges*)**

- The sponges of this class are large sized.
- They include marine water or brackish water or fresh water forms
- Their skeleton is made up of siliceous spicules or sponging fibers or both or none.
- Body is vase or cup or cushion shaped
- They may either live solitarily or in colonies
- Body organization is leuconoid type
- Development includes parenchymula larva

***Ex: Cliona, Spongia, Chalina, Spongilla.***



# *Hyalonema*

*Phylum - Porifera*

*Class - Hexactinellida*

*Order - Amphidiscophora*

*Genus - Hyalonema*

- **Common Name:** Glass rope sponge
- **Distribution:** It is found along new England coast
- **Habitat:** Hyalonema is a marine form found 10-15 meters deep in sea.



## General Characters of *Hyalonema*

- It has a rounded or oval body with a spirally twisted root tuft.
- Spicules of root tuft continue through the sponge body as an axis or **collumella** and projects above as a **gastral cone**.
- Root spicules are compact, stalk-like and twisted giving the appearance of a rope.
- Middle part of collumella has symbiotic polyps.
- Skeleton consists of small **amphidisc spicules** which are siliceous in nature.
- Extending from all over the surface are small, branching, **five-rayed spicules**.



# Structure of Hyalonema

- It is a marine and free living sponge found at considerable depths around New England coast and America.
- Commonly called glass-rope sponge.
- Body comprised of a ball-like apical part and a long rope-like stalk.
- The body looks-like a Ball of shining glass wool-like fibres of silica and the stalk is a highly twisted structure.
- The body is perforated with numerous ostia and an apical large osculum.
- The canal system is of complicated type because spongocoel is usually absent.
- At the base of body where it attaches with the stalk are present numerous symbiotic anemones- *Epizoanthus*.

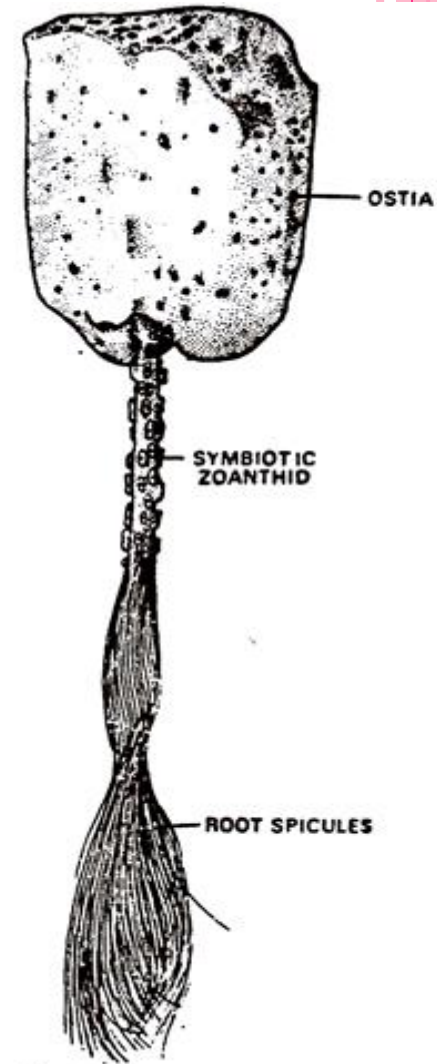


Fig. 161 HYALONEMA

# **Phylum Coelenterata :** **General characteristic and Classification**



## Phylum Coelenterata :

- The term “Coelenterata” signifies the presence of a single internal cavity called coelenteron, or gastrovascular cavity, combining functions of both digestive and body cavities.
- The term “Cnidaria” indicates the presence of stinging cells (*Gr., knide = nittle or stinging cells*). About 9,000 species known.
- *Peyssonel (1723)* and *Trembley (1744)* proved these to be animals.
- Hence, *Linnaeus (1758)*, *Cuvier (1796)* and *Lamarck (1801)* included these under '*Zoophyta*' together with sponges.
- *Leuckart (1847)* included sponges and cnidarians under his phylum Coelenterata.
- Finally, *Hatschek (1888)* divided “*Coelenterata*” into three phyla—Spongiaria (= Porifera), Cnidaria and Ctenophora.





## **General characteristics**

- Coelenterates are multicellular organisms
- They have tissue-grade of organization
- The body is radially symmetrical.
- Radial symmetry is the symmetry of a wheel.
- All the members of this phylum are aquatic
- They are solitary or colonial
- Two types of individuals occur in the life cycle. They are polyps and medusa
- The body wall is diploblastic.
- It is made up of two layers of cells, namely the ectoderm and the endoderm with a non-cellular layer called mesogloea in between.



- Nematocysts or stinging cells are present
- Coelom is absent. Hence coelenterates are acoelomate animals
- A gastrovascular cavity or coelenteron is present. It can be compared to the gut of higher animals.
- Mouth is present; but anus is absent
- Digestion is extracellular as well as intracellular
- Respiratory, excretory and circulatory system are absent
- Nervous system is diffuse-type, formed of nerve-nets.
- Reproduction is by asexual and sexual methods
- Development is indirect as there are one or two larval forms
- Life history has alternation of generations or metagenesis.



## **Classification of Phylum Cnidaria/Coelenterata**

The phylum coelenterate is divided into three classes on the basis of development of zooids:

*Class1: Hydrozoa*

*Class2: Scyphozoon or Scyphomedusae*

*Class3: Anthozoa or Actinozoa*



## **Class: Hydrozoa**

- They are mostly marine but few are fresh water species.
- Body wall consists of two layers of cells, i.e diploblastic.
- Asexual polyp stage and sexual medusa stage are present
- Medusa stage is with velum.
- Polyp is the dominant stage.
- Mesoglea is simple and acellular and the gonads are ectodermal in origin.
- They have **statocysts** to maintain equilibrium.

*e.g. Hydra, Obelia, Physalia etc.*



## **Class: Scyphozoa**

- They are exclusively marine and triploblastic animals.
- They are free swimming and are solitary.
- Mesoglea is cellular and thick (jelly like) hence commonly called jelly fish.
- Polyp stage is rudimentary or absent.
- Medusa is dominant, bell or umbrella shaped and lacks a velum.
- Larva is called Ephyra.
- Gonads are endodermal in origin.
- They have **tentaculocytes** to maintain equilibrium.

***e.g. Aurelia, Pilema etc.***



## **Class: Anthozoa**

- They are exclusively marine and are colonial forms.
- Body is triploblastic with mesoglea consisting of fibrous connective tissue and amoeboid cells.
- Polyp stage is present but medusa is absent.
- Gonads are endodermal in origin.
- Reef forming true stony corals belong to this class.

*e.g. Tubipora, Alcyonium, Heliopora, Gorgeonia, Pennatula etc.*



# *Aurelia*

## **Classification**

*Phylum - Cnidaria*

*Class - Scyphozoa*

*Order - Semaestomae*

*Genus - Aurelia*

- **Common name:** Jelly fish
- **Habit and Habitat:** It is a medusoid Jelly fish which is solitary and marine in habit. It mostly lives in warm and temperate latitudes. It feeds on diatoms, protozoans, molluscs, crustaceans and copepodes.
- **Distribution:** It is found along the entire Atlantic coast and Pacific coast.

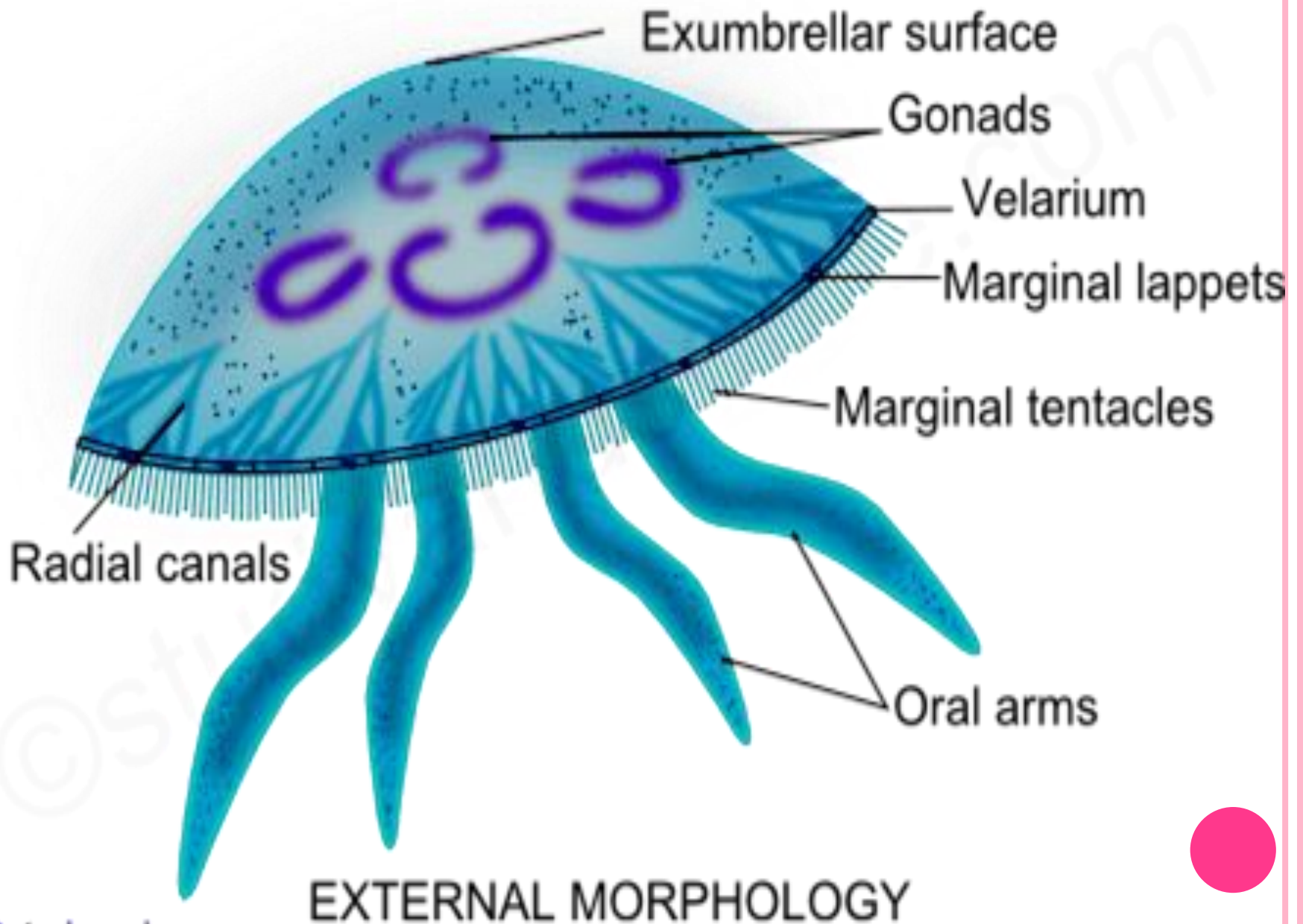



## General Characteristics

- Body is totally transparent and gelatinous. **Mesoglea** reflects light rays with crystal-like clearness.
- Body is made up of about 98% water.
- **Body colour** is bluish-white or pinkish.
- It is about 30 cm in diameter.
- Body is composed of **saucer-shaped umbrella** which can be divided into **ex-umbrellar** and **sub-umbrellar** surfaces.
- Subumbrellar surface consists of marginal tentacles, marginal lappet and manubrium.
- **Marginal tentacles** contain stinging cells.
- **Marginal lappets** are eight in number and contain sense organs namely **tentaculocysts** in eight lobes.







- **Manubrium** hangs down from the centre of subumbrellar surface.
  - It is surrounded by four, frilled and long **oral arms** disposed along four perradii.
  - There are four rounded apertures called **subgenital pits** found in between oral arms.
  - **Mouth** leads to a short gullet which directly opens into the stomach.
  - **Stomach** consists of four interradial gastric pouches. Each gastric pouch gives rise to branched radial canals communicating with circular canal.
  - There are three kinds of radial canals: Interradial, Adradial and Perradial
  - **Locomotion** occurs with the help of rhythmic contractions of umbrellar surfaces.
  - *Aurelia* is dimorphic having male and female sexes separately.
  - Development is indirect and include **planula**, **scyphistoma** and **ephyra larva**.
  - Life cycle exhibits schyphistoma larva as the only polypoid stage. Rest all stages are medusoid.
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# **Phylum Ctenophora:** **General characteristic and Classification**



## Phylum-Ctenophora (Coelenterata)

- Ctenophora is a small phylum.
- It contains only about 80 species.
- It includes a set of marine animals commonly called comb jellies or sea walnuts.
- These animals exhibit the characters of Coelenterata and platyhelminthes.
- Formerly this phylum was placed under Coelenterata. Hatschek (1889) placed it under a separate phylum called Ctenophora.
- The important Ctenophore animals are *Pleurobachia*, *Coeloplana*, *Ctenoplana*, *Velamen*, *hemiphora*, *Beroe*, etc.



## General Characteristics of ctenophora

- All the ctenophores are marine.
- They are solitary and pelagic.
- They are transparent.
- They have tissue-grade
- They have tissue-grade of organization
- They have biradial symmetry.
- They are acoelomate animals.
- They are unsegmented.
- They body-wall is diploblastic.



- The mesogloea contains cells.
- Nematocysts are absent.
- Special adhesive cells called colloblasts are present in all ctenophores.
- The gastrovascular system is well developed.
- Two anal openings are present.
- Skeletal system is absent.
- Excretion and respiration are carried out by diffusion.
- The nervous system is in the form of nerve net.
- An aboral sense organ is present in the form of statocyst.
- Cilia are used for locomotion.
- They are hermaphrodites.
- Development is indirect. It includes a cydippid larva.



## **Classification of Ctenophora**

### **Class 1. Tentaculata or Micropharyngea:**

The body in section is either circular or slightly compressed in lateral plane.

Adults with two long aboral tentacles, retractile in sheaths and un-branched meridional and stomodaeal vessel; in certain cases only larva has tentacles, while the adult has oral lobes.

*Examples: Hormiphora, Pleurobrachia, Bolinopsis, Velamen, Ctenoplana, etc.*

### **Class 2. Nuda or Macropharyngea:**

1. Tentacles absent.

2. Mouth very wide, gullet occupies the greater part of the interior body.

3. The meridional vessels are produced into a complex system of anastomosing branches. *Example: Beroe.*

# *Pleurobrachia*

*Phylum: Ctenophora*

*Class: Tentaculata*

*Order: Cydippida*

*Family: Pleurobrachiidae*

*Scientific Name: Pleurobrachia bachei*

*Common Name: Sea Gooseberry*



## **Characteristics:**

- The transparent body is spherical or slightly oval with a maximum diameter of 25 mm.
- It has eight rows of ciliary plates, used for propulsion.





- These "comb rows" are generating the beautiful color reflections often associated with the comb jellies.
- Despite its delicate and perhaps innocent appearance, the sea gooseberry is a voracious predator.
- Two tentacles, sometimes reaching a length of 20 times the body diameter, are used to catch prey floating by.
- It feeds on eggs, and larvae, small mollusks, arthropods and almost anything else, it can get hold of.
- They can be retracted into pockets inside its body, but the sea gooseberry is often seen spinning around its own center, twirling the tentacles around its body.

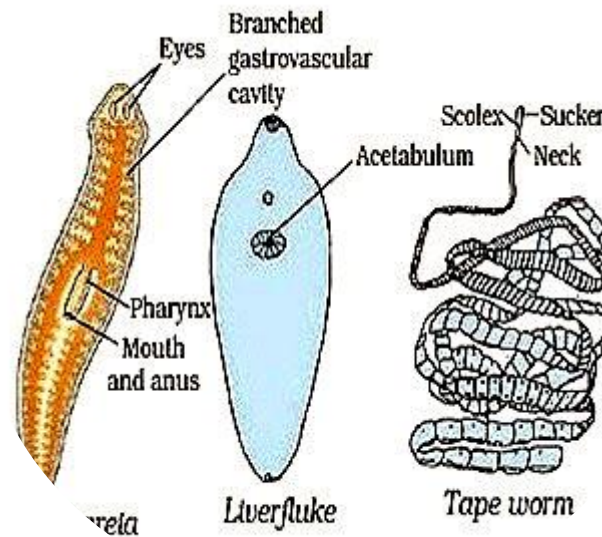


- On each tentacle there is a lateral row of fine filaments with a sticky substance, to make sure the prey is not getting loose.
- In contrast to the jelly fish, the comb jellies have no poison to paralyze their victims.
- The sea gooseberry is a hermaphrodite, it possesses both male and female genitalia.
- Eggs and sperms are released into the water, where the fertilization occurs.
- **Habitat:** It inhabits shallow waters, from the surface to a rare maximum of 200 meters.
- **Distribution:** The sea gooseberry is a cosmopolitan, found in almost every ocean in the world.



# Phylum Platyhelminthes:

## General characteristic and Classification



## Phylum Platyhelminthes

- The phylum Platyhelminthes includes flatworms like Planarians, Flukes and Tapeworms.
- The animals of this phylum are triploblastic acoelomate bilaterians.
- The evolution of triploblastic condition and bilateral symmetry coincide with the evolution of organs and organ systems, cephalization and centralization of the nervous system.
- With these features and unidirectional movement, bilaterians have a more active life-style than radially symmetrical animals.



- Platyhelminthes is a Greek term. (*Gr. Platy=flat, helminth=worm*).
- This term was coined by Gegenbaur.
- This name indicated the dorso ventrally flattened nature of the body.
- They have a solid body plan with parenchyma between the gut and the body wall.
- They also have a very well developed and a complex reproductive system.



# General Characters of Phylum Platyhelminthes

- Their body is dorsoventrally flattened.
- They exhibit bilateral symmetry.
- Also, they are triploblastic, with three germ layers.
- They do not have a body cavity and are acoelomate.
- Body is soft and unsegmented.
- They are mostly parasitic with a few free-living
- They exhibit an organ system grade of organization.
- The digestive system is incomplete or absent. There is a single opening which leads to a well-developed gastro-vascular cavity.



- The anus is absent. There is no true stomach structure. In a few species, the digestive system is completely absent.
- Respiratory and circulatory systems are absent.
- Respiration generally occurs through diffusion through the general body surface.
- The excretory system has protonephridia with the flame
- There is primitive nervous system present.
- These animals are hermaphrodites.
- Sexual reproduction happens through gametic fusion.
- Asexual reproduction also happens in a few species through regeneration and fission.
- Fertilization is internal.
- The life cycle of these organisms can be complex, especially if they are parasitic, as this may involve one or more host animals



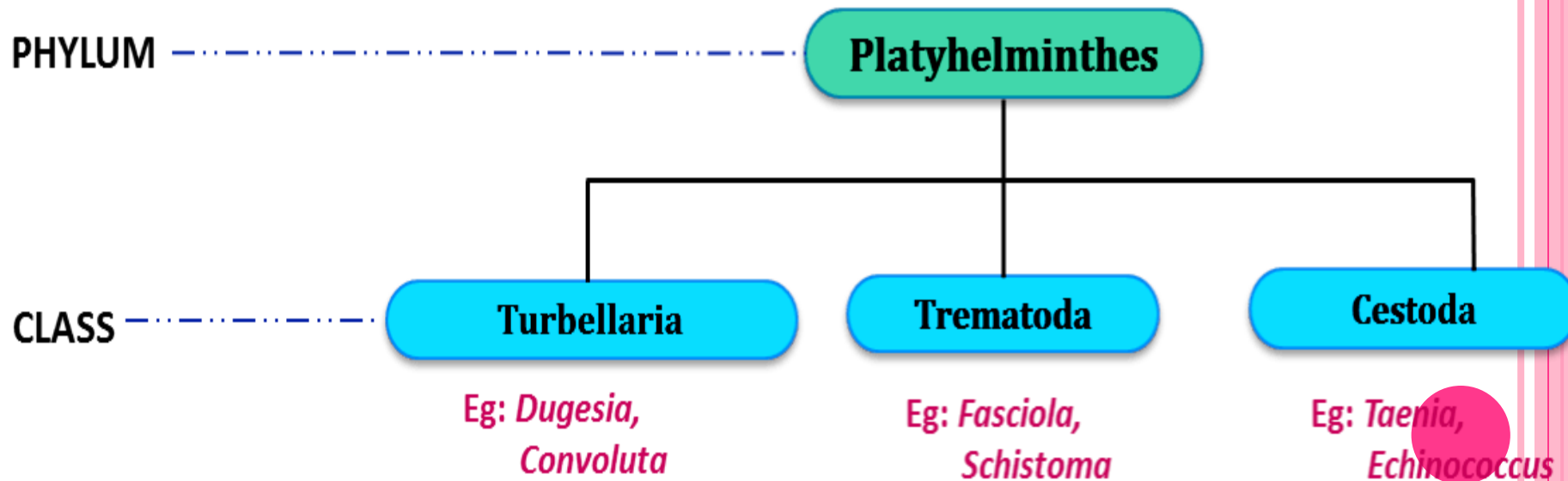
## Classification of Phylum Platyhelminthes

The phylum Platyhelminthes includes about 20,000 species. This phylum is classified into three classes namely

*Class 1: Turbellaria*

*Class 2: Trematoda*

*Class 3: Cestoda*





## **Class I: Turbellaria** (L. turbella=stirring)

- This class includes planarians, acoels etc.
- They are usually free living and some forms are also commensals or parasites
- The body of these animals is unsegmented and covered by ciliated epidermis.
- Epidermal glands cells secrete rod-shaped inclusions called rhabdoids. When these inclusions are released to the surface of epidermis they form mucus.
- Adhesive glands help in temporary adhesion to the substratum.
- Mouth is ventral and the pharynx is protrusible.
- The branched gut facilitates the transport of nutrients to all parts of the body. So gut performs the functions as a gastro vascular system
- Planarians have remarkable ability of regeneration. Totipotent cells called as neoblast cells are important in this phenomenon of regeneration.
- Development is direct but larvae like Muller's larva or Goette's larva are present in some forms. ***Examples: Planaria, Bipalium, Otoplana, Notoplana***



## **Class II: Trematoda** (Gr. Trema=hole, eidos=form)

- This class includes flukes
- Generally they live as ectoparasites or endoparasites.
- The body of these animals is segmented and covered by tegument called neodermis.
- Mouth is surrounded by oral sucker and sometimes a ventral sucker or acetabulum is also present.
- The intestine of these animals is bifid
- Life cycle includes miracidium larva, sporocyst, cercaria larva, metacercaria and adult.

***Examples; Fasciola hepatica (Liverfluke), Diplozoon***



### **Class III: Cestoda** (Gr. Kestos=girdle, eidos=form)

- This class includes tapeworm.
- These are ectoparasitic in the gut of vertebrates.
- The body of these organisms is divided into scolex, neck and strobila. Body is covered by tegument. The strobila is in turn divided into proglottids.
- They exhibit pseudometamerism.
- Scolex has hooks and suckers for attachment to the gut wall of the host.
- Digestive tract is absent
- The life cycle includes zygote, oncosphere larva, extra intestinal juvenile and intestinal adult.
- Currently the two classes Cestoda and Trematoda are included under the taxon Neodermata. In these flatworms, the body is covered by a non-ciliated syncytial neodermis. *Examples: Taenia spp ( tapeworm), Convoluta, Echinobothrium*



# Fasciola-Liver Fluke

*Phylum – Platyhelminthes*

*Class – Trematoda*

*Subclass – Digenea*

*Genus – Fasciola*

*Species – hepatica*

*Common name: The liver fluke.*

➤ Liver flukes are typical digenean trematodes and are commonly called “**flatworms**” or “**flukes**” on account of their flat, leaf-like structure.

Fasciola hepatica is the common liver fluke of sheep.

➤It is the first trematode whose life history was described by *Thomas in 1883*.

It is of much importance as it causes fascioliasis-a disease that causes damage to liver- tissues and bile ducts of sheep



# General Characteristics

- The liver fluke is a species of parasitic flat worm that infects mammals.
- They are able to produce both sexually and asexually.
- Adults live in the bile ducts of a mammalian host.
- Adults are hermaphroditic and are capable of both cross-fertilization and self-fertilization depending on the ability of other liver flukes within the same host.
- Eggs enter the gut of the host and are passed out of the host through the feces.
- The eggs hatch in water into free-living larvae that must find a suitable snail host within a few hours.
- Once inside the snail, the free-living larvae develop into a sporocyst.
- The sporocysts reproduce asexually to produce cercaria larval offspring.



- The cercaria larva exit the snail host and attach themselves to some sort of object withing their environment and develop into a cyst-encased metacercaria.
- If the cystests are consumed by an animal, the metacercarium bores into the liver of the new host where it will remain until maturity.
- As they grow, liver flukes feed on liver tissue of the mammalian host while larvae feed on the digestive gland of the snail host.

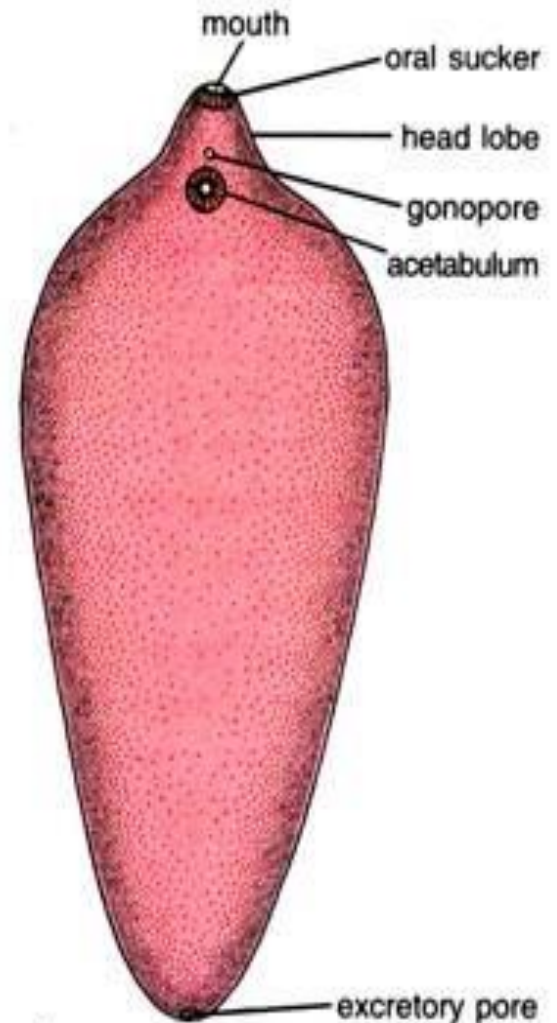


Fig. 41.1. *Fasciola hepatica*. Adult in ventral view.

## **Shape and Size:**

- Fasciola is a dorso-ventrally flattened, soft, leaf like oval shaped endoparasite.
- It is about 1.8 to 3.0 cm long, with a maximum width of 0.4 to 1.5 cm. which is a little in front of the middle region of body.
- Anterior end is somewhat broad and rounded, while posterior end is bluntly pointed.

## **Colour of the body:**

- Transparent body wall makes all the body organs to be visible. Due to this, the colour of the fluke appears pinkish.

## **Oral cone:**

- Anterior end of body is drawn out into a prominent conical projection, termed the oral cone or head lobe. At the apex of cone, a triangular mouth is found.

## **Suckers:**

There are two small suckers, anterior and ventral. Both are devoid of hooks and spines.

### **(a) Anterior Sucker:**

- Anterior or oral sucker is a cup-shaped muscular organ with enclosed mouth at the centre of its bottom. The diameter of oral sucker is 1 mm.
- Muscles of oral sucker radiate from margin of mouth to the periphery of sucker. Oral sucker serves for adhesion as well as ingestion.

### **(b) Ventral sucker:**


- Ventral sucker or acetabulum is bowl like situated mid ventrally behind the oral sucker. It is without an aperture and is of diameter 1.6 mm.



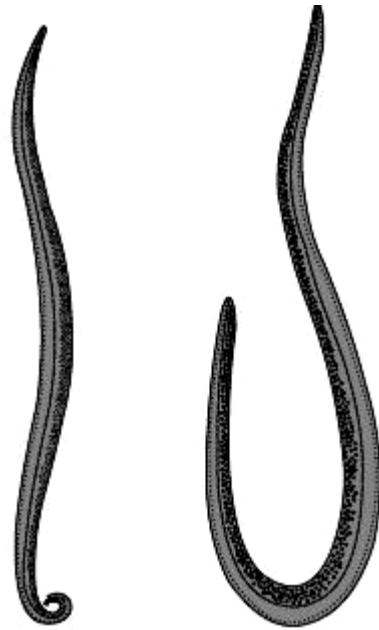
## **Apertures:**

- In front of acetabulum a small common genital aperture or gonopore is for fertilization.
- Another aperture, excretory pore lies at the posterior and slightly towards the ventral surface.
- During breeding season a temporary opening of Laurer's canal appears on dorsal surface, a little anterior to the middle of body.
- Digestive tract is incomplete without anus.

## **Scales:**

- Body covered with cuticular tegument from which numerous minute spinules or scales appear.
  - They serve for the anchoring of body to the walls of liver to protect and to help in locomotion.
- 

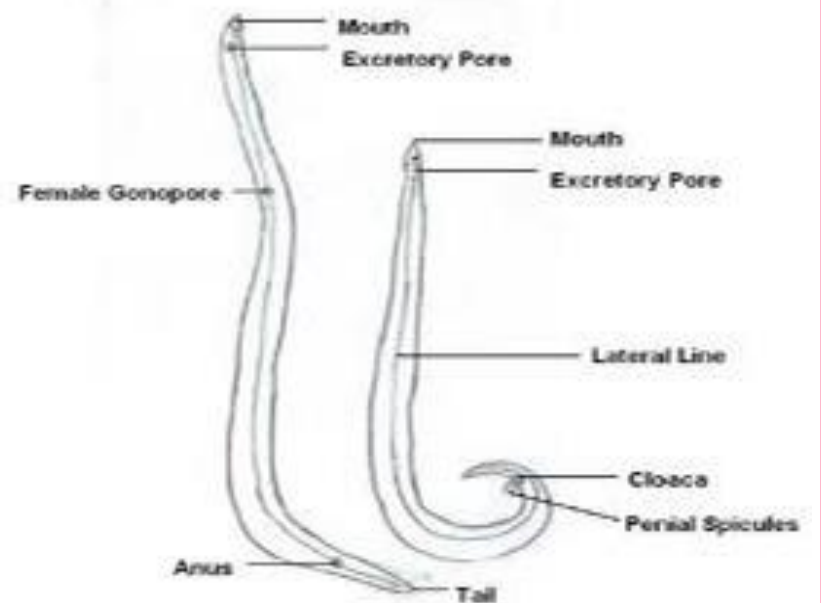
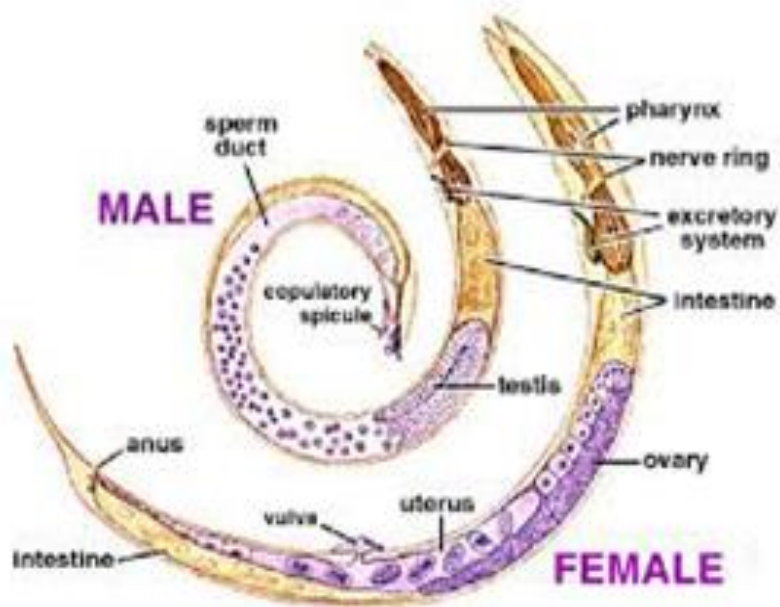
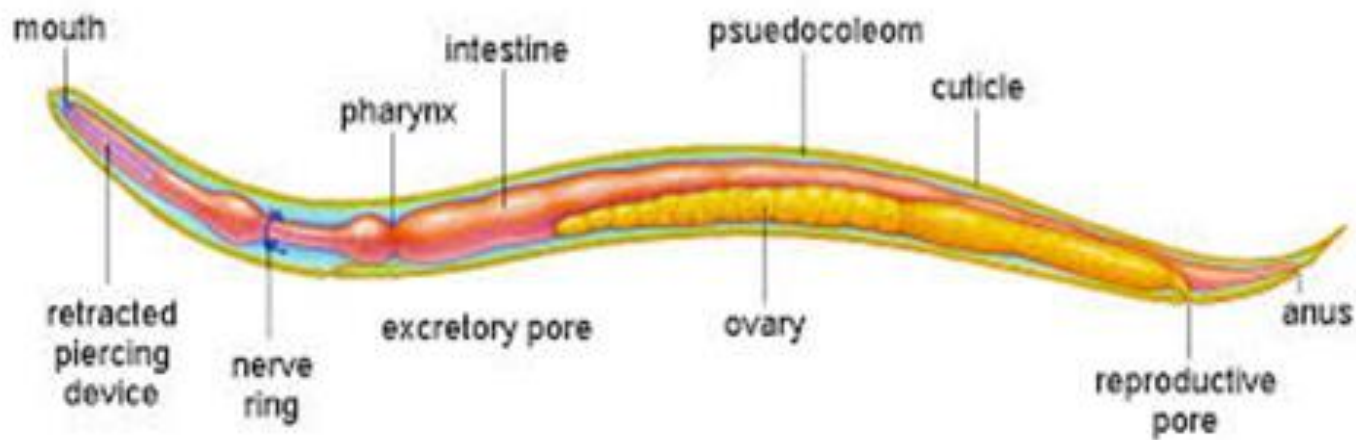
# **Phylum Aschelminthes classification and its General characteristics**



## **Phylum Aschelminthes or Nemathelminthes (*Nematos- thread/ Askos-bladder, helminthes- worm*)**

- They are commonly called thread worm or round worm.
- It is a phylum of unsegmented, triploblastic, pseudocoelomic, cylindrical or thread-like worms which are covered by a body wall having cuticle and epidermis.
- Hyman regarded Aschelminthes as a distinct phylum and the various groups included in it as classes.
- However, other zoologists consider Aschelminthes as a superphylum and its various groups as phyla (Rotifera, Gastrotricha, Kinorhynca, Nematomorph, Nematoda).
- Phylum Nematoda is its large group





## General characters

- Mostly parasitic. Few of them are free-living.
- They are cylindrical, elongated, slender worm like and tapers at both end and Triploblastic.
- Bilaterally symmetrical.
- Organ system level of organization.
- Body is unsegmented.
- Body cavity is filled with muscle. They are pseudocoelomate i.e. body cavity is not lined by mesodermal layer.
- Internal cephalization is present but externally there is little differentiation between the anterior and posterior regions.
- Distinct head is lacking. However, mouth is present in anterior region.



- Body is covered with tough and resistant cuticle.
- It is cast off periodically or which moults only during the period of growth.
- It protects the body against the action of digestive juice.
- Digestive system is complete and straight with both mouth and anus.
- Mouth is terminal and surrounded by lips bearing sense organ.
- Respiratory and circulatory organs are absent.
- Respiration occurs through general body surface.
- Respiration is aerobic in free-living forms and anaerobic in parasitic form.



- Excretory system consists of intracellular canal or lateral excretory ducts. And also protonephridia having renette cells.
- Nervous system is not much developed.
- Nervous system consists of circumpharyngeal nerve ring and longitudinal nerve cords.
- Sense organs are poorly developed in the form of papillae, which are well defined as amphids (in mouth) and phasmid (in anus).
- These are unisexual i.e. sexes are separate with sexual dimorphism.
- Fertilization is internal, may be cross or self.
- Development may be direct or indirect. Larval forms are *Rhabditiform*, *Filariform* and *Micrifilaria*.
- Various lateral lines and pores are present on the surface of body



Phylum Aschelminthes or Nemathelminthes is divided into following five classes.

### **Class: Nematoda**

- Commonly known as **roundworms**, they are aquatic or terrestrial.
- They may be free-living or parasitic.
- Body wall is with **syncytial cuticle** and **longitudinal muscles** in four bands.
- Digestive system is complete, with muscular pharynx and glands.
- They lack respiratory and circulatory system.

*e.g. Ascaris, Rhabditis, Oxyrius etc.*





## **Class: Rotifera**

- They are **microscopic** and aquatic animals.
- **Eye spots** and **antennae** act as sensory organs.
- They are commonly called **wheel animalcules** having a trunk and a tail.
- Body wall is thickened into plates or **lorica**.
- Anteriorly, they have a ciliated **trochial disc**.

*e.g. Limnias, Rotara (Rotifera) etc.*



## **Class: Nematomorpha**

- They are commonly known as **hair worms**, found in spring (aquatic).
- Body is unsegmented and covered with a thick cuticle.
- **Pseudocoel** is present which is filled with **parenchyma**.
- They lack circulatory, respiratory and excretory system.
- Digestive system is complete.

***e.g. Paragprdius, Nectonema etc.***



## **Class: Gastrotricha**

- They are microscopic and may be fresh water forms or marine.
- Body is covered by cuticle which bears **spines**.
- Excretory system consists of two **protonephridia**.
- Pharynx is tri-radiate and muscular.
- The posterior end of the body is forked.

*e.g. Macrodasya, Chaetonotus etc.*



## **Class: Kinorhyncha**

- They are marine, microscopic and worm like forms.
- Body is superficially segmented.
- Body surface is spherical and consists of spiny cuticle.

*e.g. Trachydemus, Echinoderes etc.*



# **Wuchereria Bancrofti**

*Domain: Eukaryota*

*Kingdom: Metazoa*

*Phylum: Nematoda*

*Class: Secernentea*

*Order: Spirurida*

*Family: Filariidae*

*Genus: Wuchereria*

*Species: Wuchereria bancrofti*

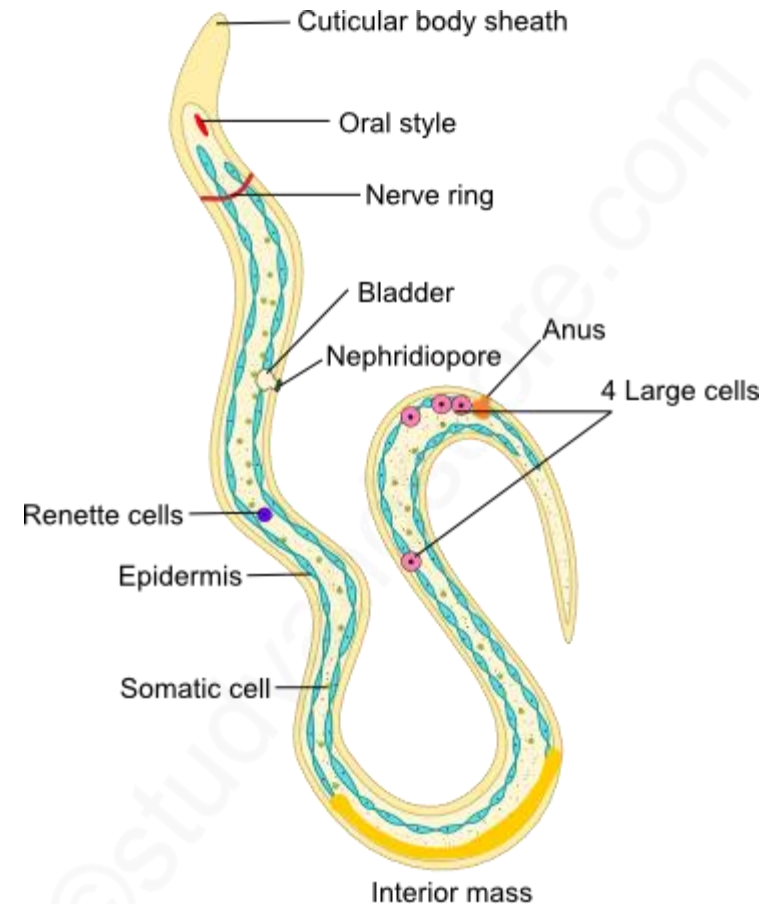


- *Wuchereria bancrofti* is commonly known as filarial worm.
  - This worm causes filariasis in humans.
  - **Demarquay** first discovered the larval form of this worm; later Wucherer found these larvae in the chylorous urine.
  - **Lewis** found them in human blood and **Bancroft** found the adult females.
- The name of this worm is given *Wuchereria bancrofti* in honor of the two scientists **Wucherer** and **Bancroft** who made considerable contribution in studying the disease caused by these worms.



## Structure of *Wuchereria Bancrofti*:

- The body of adult filarial worm is elongated, narrow, filiform and cylindrical in shape.
- These worms are creamy white in color. Anterior ends terminate bluntly whereas the posterior end is a little pointed.
- The male and female worms are found coiled round each other in the lymph vessels.



WUCHERERIA - MICROFILARIA

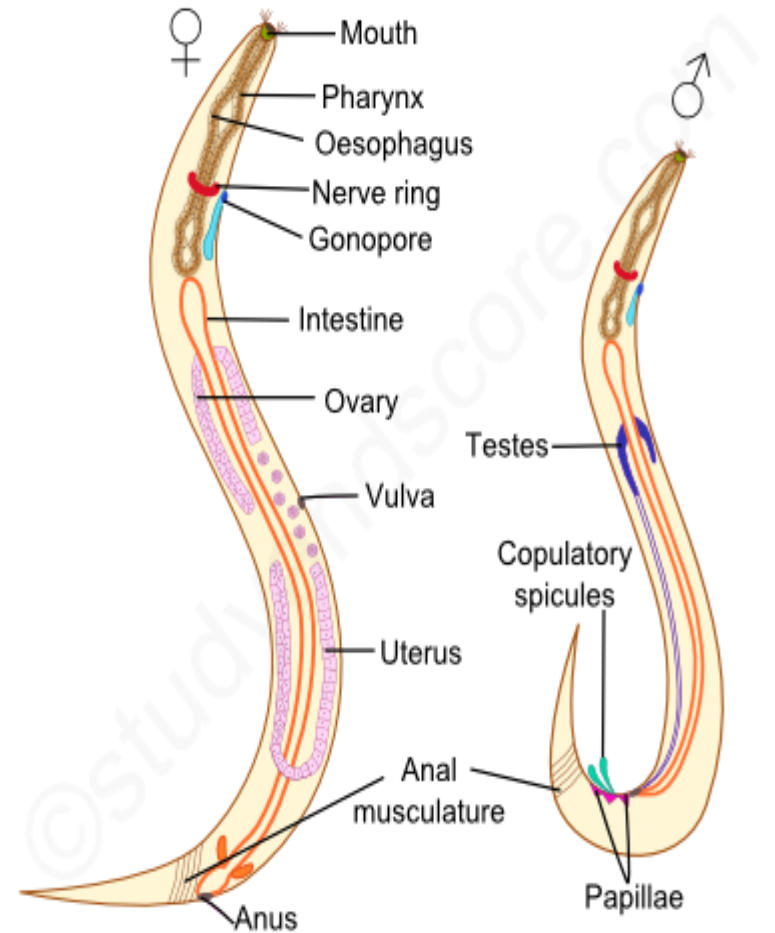


- A mouth with no oral lips is present at the anterior end.
- The alimentary canal of this worm includes mouth, pharynx, oesophagus, intestine and anus.
- The anterior part of the pharynx is muscular and the posterior part is glandular.
- *Wuchereria bancrofti* is a unisexual worm exhibiting sexual dimorphism.
- The female worms are slightly longer and thicker than that of their male counterparts.
- Each female worm measures around 65-100mm in length and 0.25 mm in diameter.
- The posterior end of the female is straight and bears anus.
- The female genital pore also called as vulva is present ventrally at about one third length of the body from the anterior tip.





- Male worms are comparatively smaller and thinner than the females.
- Each male filarial worm measures around 40 mm in length and 0.1 mm in diameter.
- The posterior end of the male worm is curved bearing cloaca in this region.
- A pair of unequal penial setae or copulatory spicules is present in cloacal or curved region.
- Many copulatory papillae are present in the posterior region.



WUCHERERIA - ADULT FEMALE AND MALE



# **Phylum Annelida classification and its General characteristics**



## Phylum Annelida

- Phylum **Annelida** includes segmented worms.
- These animals are found in marine, terrestrial, and freshwater habitats, but a presence of water or humidity is a critical factor for their survival, especially in terrestrial habitats.
- The name of the phylum is derived from the Latin word *annellus*, which means a small ring.
- Animals in this phylum show parasitic and commensal symbioses with other species in their habitat.
- Approximately 16,500 species have been described in phylum Annelida.
- The phylum includes earthworms, polychaete worms, and leeches.
- Annelids show protostomic development in embryonic stages and are often called “segmented worms” due to their key characteristic of **metamerism**, or true segmentation.

## **Characteristics of Phylum Annelida**

- They have a long and segmented body.
- Annelids are bilaterally symmetrical.
- They are triploblastic.
- Also, they exhibit organ system grade of organisation, showing organ differentiation.
- The body is covered with a thin cuticle.
- They are coelomate. A body cavity or coelom is present.
- Annelids live in moist environments, moist soil, freshwater and marine water.
- They have parapodia and chitinous setae, used for locomotion.



- Their body appears red due to the presence of haemoglobin.
- Excretory and nervous systems are present.
- The digestive system is complete and developed.
- Respiration happens through the general body surface.
- These invertebrates have a true closed circulatory system.
- Sexes may be separate or united, wherein they are called hermaphrodites.
- Fertilization can be internal or external.

***Examples of Annelids: Earthworm, Leeches, Lugworms, Polychaetes***



## Classification of Phylum Annelida

➤ Phylum Annelida is divided into four main classes, primarily on the basis of setae, parapodia, metameres and other morphological features.

➤ *Parker and Haswell* classified phylum annelida into 4 classes as-

*Class-I : Polychaeta*

*Class-II: Oligochaeta*

*Class-III: Hirudinea*

*Class- IV: Archiannelida*



## **Class-I : Polychaeta**

- Most of them are marine, 5-10 cm. in length and variously coloured.
- External segmentation and internal septum distinct.
- Each segment bears a lateral fleshy outgrowth help in swimming.
- These appendages are known as parapodia and parapodium bears many setae.
- Body is with a distinct head, head with eyes, pulp and tentacles.
- Clitellum is absent.
- Generally unisexual, fertilization external.
- Development through trochophore larva.

The Class Polychaeta has been divided into two subclasses

***Sub Class I- Errantia***

***Sub Class I- Sedentaria***



## ***Sub Class I- Errantia***

- Body is divided into many segments, except head and anal segment.
- All segments are equal.
- Parapodium is with an endoskeleton known as aciculum.
- Presence of mandible with teeth.
- Most of them are free swimmers, some may live in the tube.

***Examples- Nereis, Aphrodite, Polynoe, Glycera, Syllus.***





## ***Sub Class I- Sedentaria***

- Sedentary, tubicolous worms, living in calcareous or chitinous tubes secreted by epidermal glands.
- Head poorly developed with tentacles, pulps and feeding appendages.
- Trunk segments differentiated into or three regions due to dissimilarity in the forms of segments parapodia and setae.
- Pharynx not protrusible and devoid of jaws and teeth.

***Examples- Chaetopterus, Arenicola, Amphitrite, Terebella, Sabella etc.***



## **Class-II: Oligochaeta**

- Either freshwater or terrestrial forms.
- Head indistinct and without head appendages.
- Parapodia and bristles absent and setae remain embedded in the skin.
- Clitellum present.
- Sexes united, gonads few, permanent, development direct

***Examples- Tubifex, Dero, Pheretima, Megascolex etc.***



## **Class-III : Hirudinea**

- Mostly aquatic forms, either fresh water or marine, but a few may be terrestrial.
- Body dorsoventrally flattened, divides into definite number of segments which may be divided externally into segments.
- Head distinct, without head appendages, may bear eyes.
- Parapodia, Setae, tentacles absent.
- Usually with two sucker, posterior one large and used for adhesion anterior one suctorial.
- Coelom filled with vacuolated parenchyma and botryoidal tissue.
- Blood vascular system haemocoelomic type.
- Fertilization internal, development direct, and are hermaphrodite.

***Examples- Acanthobdella, Pontobdella, Hirudo.***



## **Class-IV : Archiannelida**

- Body simple, elongated vermiform and threadlike.
- Setae, parapodia absent.
- External segmentation indistinct, internal septum present.
- Hermaphrodite, gonads develop during reproductive season only.

***Examples- Polygordius, Protodrilus etc.***



# Earthworm

*Phylum: Annelida*

*Class: Oligocheata*

*Genus: Pheretima*

*Species: posthuma*

*Common Name: earthworm*

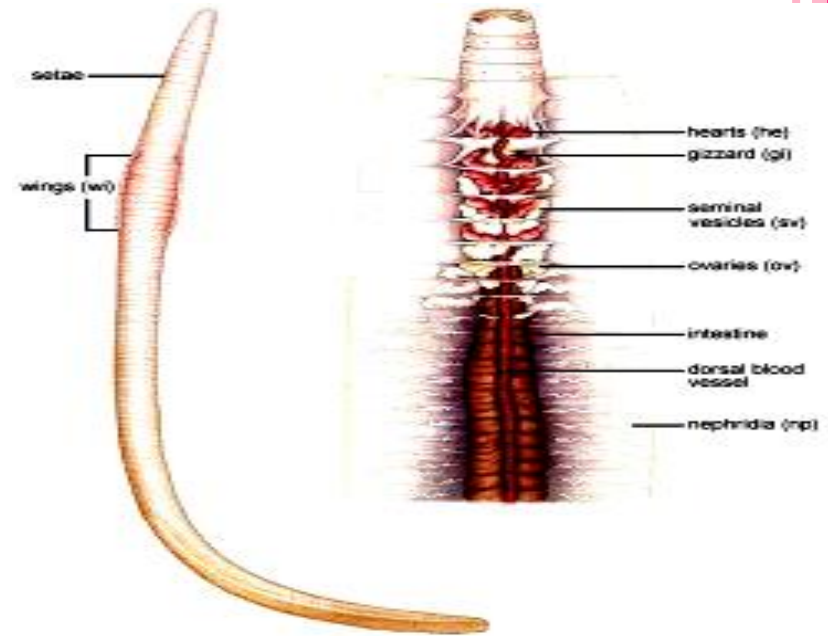
- Earthworm is a segmented worm; a terrestrial invertebrate belonging to the phylum Annelida.
- They are the common inhabitants of moist soil and feed on organic matter.
- This is worm casting (fecal deposit) increases the fertility and burrowing help in proper aeration of the soil.
- The earthworms found in India are *Pheretima and Lumbricus*.



- Earthworms have a tube-like arrangement or cylindrical shaped and reddish-brown segmented body.
- The body is divided into small segments.
- The dorsal side is characterized by a dark line of blood vessels and ventral side is characterized by the genital openings.
- The mouth and the prostomium (an organ helps in burrowing) distinguish the anterior end.
- The segments 14-16 of a matured earthworm consist of a glandular tissue called clitellum which helps us to distinguish the mouth and tail ends.
- The body is divided into three segments with respect to clitellum- preclitellar, clitellar and postclitellar.



- Earthworms are hermaphrodites i.e., they carry both male and female sex organs. Segments 5-9 accommodate four pairs of spermathecal apertures.
- The female genital pore is situated at the 14<sup>th</sup> segment and a pair of male genital pores is situated at the 18<sup>th</sup> segment.
- The body consists of S-shaped setae, which help in locomotion in the earthworm.
- Setae are present in each segment except in the first, last and clitellum segments.



- The alimentary canal is a long tube running from first to the last segment of the body. The food of earthworms is the leaves and decaying organic matters which are mixed with soil.
- According to the diet, the parts of the alimentary canal and their secretion differ from other organisms. The alimentary canal begins at the mouth passes through the pharynx, esophagus, muscular gizzards, stomach, intestines, and finally ends at the anus.
- The food particles get digested gradually as they travel through various compartments of the alimentary canal.
- The muscular gizzards grind the soil particles and other matters and at the stomach, the humic acid of the hummus gets neutralized by the calciferous glands present in them.
- The typhlosole present in the intestine increases the surface area for absorption.



- Earthworms have a closed circulatory system, constituting a heart, blood vessels, and capillaries.
- The segments 4-6 consist of blood glands that help in the production of blood cells and hemoglobin.
- Earthworms lack a well-developed structure for respiration. They respire through their moist skin by diffusion.
- Nephridium is coiled tubules that regulate the volume and composition of the body fluids and thus, act as the excretory organ in earthworms. Nephridia are arranged in three segments- septal, integumentary and pharyngeal nephridia .
- A funnel that is connected to nephridia delivers wastes and excess fluid and is excreted out via the digestive tube.



- The sensory input and muscular responses are controlled by the ganglia which are arranged segment-wise in the organism.
- These ganglia, on the paired nerve cord, make up the nervous system of the earthworms.
- Although earthworms lack eyes they have specialized receptor cells to recognize the changes around them.
- Specialised sensory organs and chemoreceptors help them to respond to stimuli perfectly.
- The sensory system of the earthworms is present in the anterior portion of the body.
- Earthworms are bisexual. Hence, each individual carries both male and female reproductive systems in them.



Thank  
you

