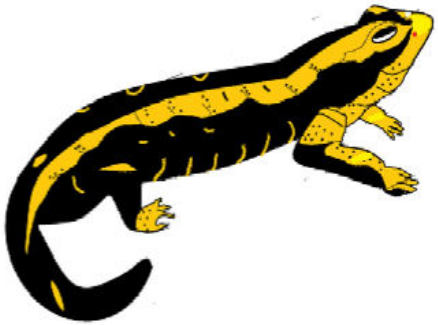
# V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

## VIRUDHUNAGAR

## LAB MANUAL on INVERTEBRATA & CHORDATA

## (UNDER DBT STAR COLLEGE SCHEME)

Department of Biotechnology,Ministry of Science and Technology, MHRD,New Delhi



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V.V.Vanniaperumal College for Women, Virudhunagar,Tamilnadu
VVVC/DBT-SCS/2020-2021/Zoology /Practicals procedure /Invertebrata & Chordata

# V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University
*Re-accredited with 'A' Grade (3rd cycle) by NAAC*
**VIRUDHUNAGAR – 626 001** (TAMIL NADU)

## DBT STAR COLLEGE SCHEME

**Department of Biotechnology, Ministry of Science and Technology**
**Government of India, New Delhi**

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### FOREWORD

This Lab Manual on" **INVERTEBRATAAND CHORDATA**" is prepared inaccordance with the updated syllabus under DBT Star College Scheme sponsored by the Department of Biotechnology, Ministry of Science and Technology, MHRD, New Delhi to fulfil the needs of students. The colourful diagrams with labelled parts , key points for the identification of organisms and their ecological as well as economic importance will help to develop the cognitive skill of the students. It also promotes better understanding of concepts and identification of animals using key characters.

We thank the **Department of Biotechnology, The Ministry of Science and Technology, MHRD, New Delhi** for providing a good opportunity under Star College Scheme (No.HRD11011/163/2020-HRD-DBT Dt. 24.08.2020). Under this scheme, we have purchased multiple pieces of microscopes, slides, charts, and specimens. This kind of support motivates the students for quick understanding of the concepts of animal science and to create interest on their core subject.

We hope this manual will definitely meet out the student's thirst for knowledge to enhance their research attitude in the classification of fauna and motivate them to become a good taxonomist in future.

**MEMBER SECRETARY / COORDINATOR** **CHAIRMAN / PRINCIPAL**


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## ANATOMICAL OBSERVATION



## MOUNTING



## FIELDWORK/IDENTIFICATION

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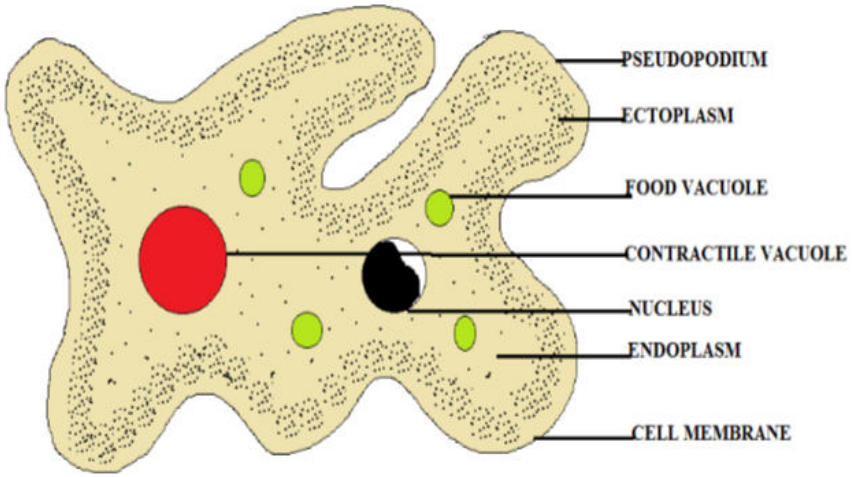
# PHYLUM :PROTOZOA

# AMOEBA

| | |
|---|---|
| PHYLUM | PROTOZOA |
| CLASS | RHIZOPODA |





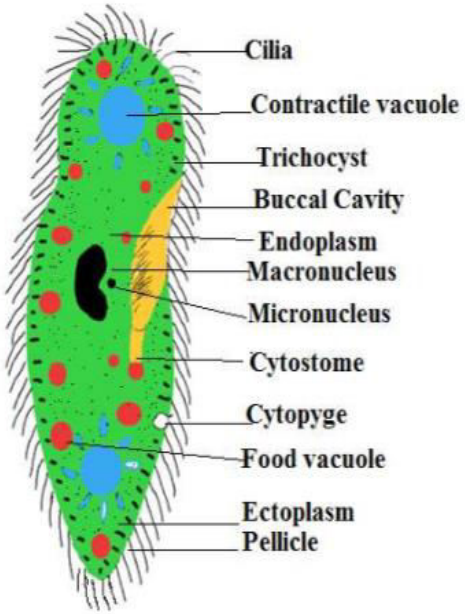

# AMOEBA

## COMMENTS:

- *Amoeba proteus* is an unicellular,microscopic,freshwater organism, included in the Phylum Protozoa
- Since **pseudopodia** helps in locomotion, it is placed under the class Rhizopoda
- It is irregular in shape
- The **plasmamembrane**, the covering membrane helps in respiration.
- The cytoplasm is divisible into a peripheral **ectoplasm** and central **endoplasm**
- The **nucleus** in the endoplasm controls growth and reproduction
- The **contractile vacuole** carries out osmoregulation by pumping out the excess water
- The **food vacuoles** help in digestion.
- **Nutrition** is holozoic.
- Encystment helps in protection during unfavourable seasons.
- It reproduces only by asexual methods such as binary fission and multiple fission

# PARAMECIUM

| | | |
|---|---|---|
| **PHYLUM** | **:** | **PROTOZOA** |
| **CLASS** | **:** | **CILIATA** |





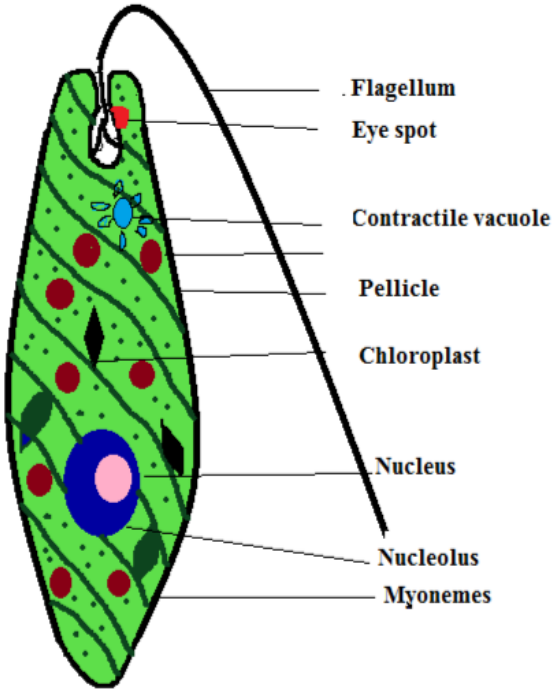

# PARAMECIUM

## COMMENTS:

- *Paramecium* is a free swimming fresh water organism.
- It is an unicellular organism observed under microscope.So, it belongs to the **phylum Protozoa**
- Cilia covers the entire body and helpS in locomotion and feeding. Hence it is placed in the **Class Ciliata**.
- It looks like a slipper and so called as **slipper animalcule**.
- Definite symmetry is seen in *Paramecium*
- The **pellicle** covering the organism gives protection
- The cytoplasm has a peripheral **ectoplasm** and central **endoplasm**.
- The **trichocysts** in the ectoplasm helps in offense and defence.
- The **two contractile vacuoles** in the endoplasm expels out the excess water
- There are **two nuclei**, namely a **macronucleus** that controls all the essential metabolic activities and a **micronucleus** that helps in reproduction.
- The **oral apparatus** in the ventral side helps in digestion..
- Nutrition is Holozoic
- Binary fission is the **asexual** mode of reproduction and conjugation, endomixis, automixis and hemixis are the **sexual** methods.

# EUGLENA

| | | |
|---|---|---|
| PHYLUM | : | PROTOZOA |
| CLASS | : | FLAGELLATA |





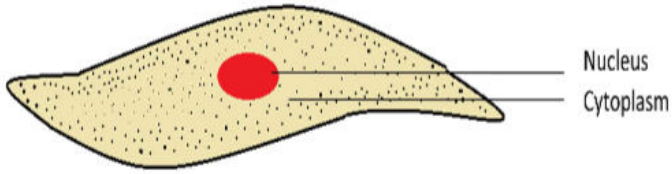

# EUGLENA

## COMMENTS:

- *Euglena* is a green coloured **protozoan** inhabits on the surface of freshwater
- It is an **unicellular** organism,hence it is placed in the phylum Protozoa
- It moves with the help of **flagella** and so included in the class Flagellata
- Numerous **chloroplasts** are arranged in star-shape. So,Euglena is an **intermediate link** between plant kingdom and animal kingdom
- Its body is spindle shaped
- It is covered by a **pellicle**
- It has a single nucleus
- It absorbs dissolved oxygen from the surrounding water by diffusion.
- Both holophytic and saprozoic modes of nutrition are seen
- The **contractile** vacuole discharges the excess of water
- An **eye spot** helps in photosensitivity
- Euglena produces two daughter individuals by longitudinal **binary fission**

# PLASMODIUM

| | | |
|---|---|---|
| PHYLUM | : | PROTOZOA |
| CLASS | : | SPOROZOA |





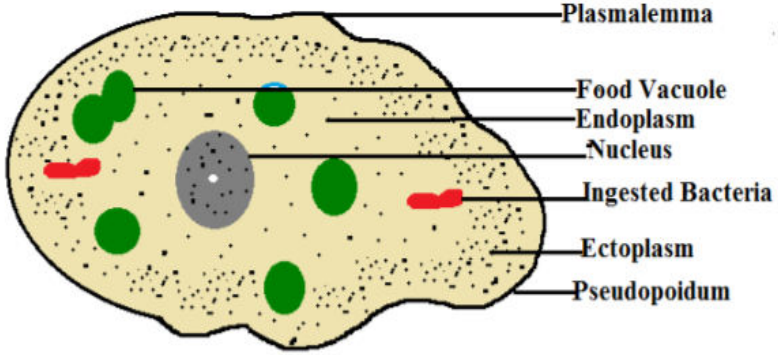

# PLASMODIUM

**COMMENTS:**

- *Plasmodium* is an unicellular organism. Hence it is included in the phylum Protozoa
- It is a parasite reproducing by the formation of spores. Hence it is included in the class Sporozoa.
- . It is an endoparasite living in the blood of man.It causes malaria in man.
- *Plasmodium* completes its life cycle in two hosts,namely man and female anopheles mosquito
- It is a digenic parasite.Man is the intermediate host and the mosquito is the primary host.
- The lifecycle includes three important stages namely Gametocytes, Sporozoites and Merozoites.
- When a mosquito bites a man, The male and female gametocytes of *Plasmodium* enter the gut of mosquito along with the blood meal.
- The gametocytes then develop into sporozoites in the gut of mosquito
- These infective sporozoites are transmitted through the saliva of mosquito into the bloodstream of man again through mosquito bite. They mature into schizonts in the liver and released as merozoites
- These merozoites the enter the blood of man and develop into gametocytes, which then enters the blood of a man through a mosquito bite and the whole cycle starts again

# ENTAMOEBA

| | |
|---|---|
| PHYLUM | PROTOZOA |
| CLASS | RHIZOPODA |



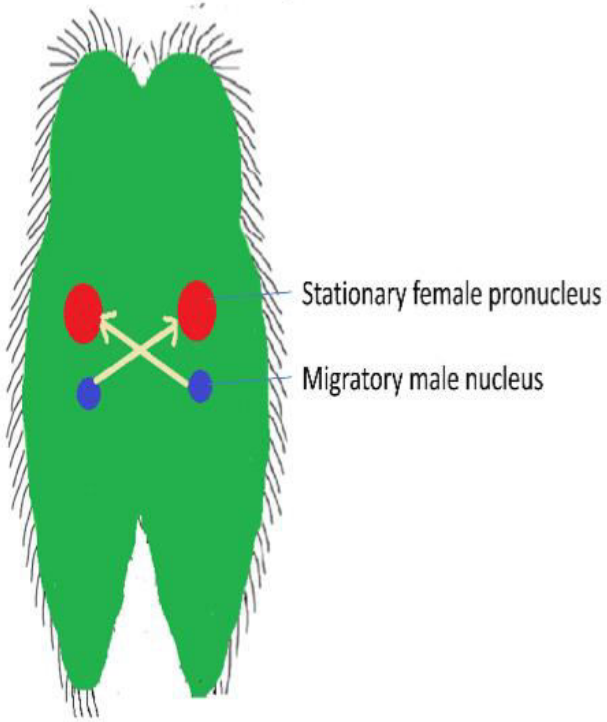



# ENTAMOEBA

**COMMENTS:**

- Entamoeba histolytica is an **endoparasite** living in the **large intestine of man**
- It is an unicellular organism observed under microscope. So, it belongs to the phylum Protozoa
- It is irregular in shape with a pseudopodium and included under the class Rhizopoda
- It is a **monogenic parasite**.It causes the lysis of the intestinal tissue of the man and hence the name 'histolytica'.
- The body is covered by a plasmalemma
- The cytoplasm contains nucleus and food vacuoles
- Nutrition is **holozoic**
- It feeds on bacteria, RBC, WBC and intestinal cells
- It reproduces by binary fission
- The infection occurs when the **mature cysts** enter the small intestine of man through faecally contaminated water or food.
- Cysts are then transformed into **trophozoites** and migrate into the **large intestine**
- These tropozoites produce cysts that are excreted out with the faeces
- It causes **dysentery** by invading the mucosa and submucosa layers of the large intestine in man.
- This parasite can be prevented by keeping the households clean

# CONJUGATION IN PARAMECIA






# CONJUGATION IN PARAMECIA

**COMMENTS:**

- Conjugation is a **temporary union** two paramecia for exchanging their genetic material mutually.
- It occurs during **unfavourable** lving conditions.
- In conjugation, two paramecia of the **opposite mating types** come closer with their ventral surfaces and unite by their oral grooves. They stop feeding and their oral apparatus disappears.
- The pellicle and ectoplasm at the point of contact, break down and a protoplasmic bridge is formed between the two parameica. Now , these individuals are called conjugants.
- The **macronucleus** bigins to disintegrate and absorbed in the cytoplasm.
- The **micronucleus** of each conjugant divides twice . Three of these four nuclei degenerate in each. The remaining micronucleus of each conjugant divides mitotically and **unequally produces** stationary female pronucleus and migratory male pronucleus.
- A diploid synkaryon is formed by fusing male and female pronucleus . Now the conjugant separate and are called exconjugation.
- The **synkaryon** divides thrice to form eight micronuclei in each **exconjugant**.
- Four of the eight micronuclei enlarge and become macronuclei and three of the other four micronuclei disappear. The remaining micronucleus divides into two with the binary fission of each exconjugant into two daughters.
- Now each daughter carries one micronucleus and two macronuclei. Then the micronucleus again divides into two with the binary fission of the daughter paramecium. Thus, each exconjugant produces 4 daughter paramecia. As there are tww exconjugants, **8 daughter paramecia are prouduced.**
- In conjugation, **old micronucleus is replaced** by a new micronucleus.
- It **brings** about the **recombination** of genetic materials and the origin of genetic **variations**

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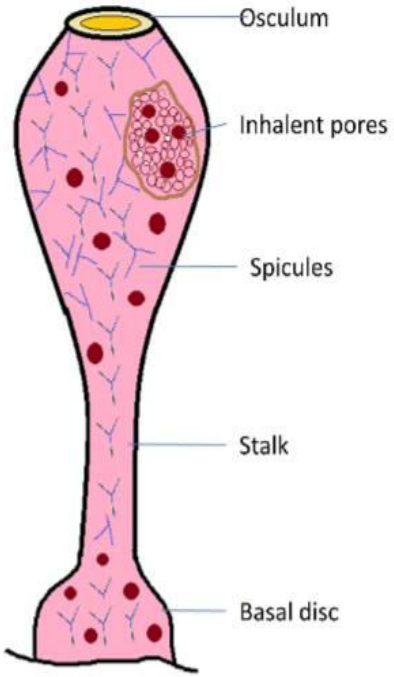
# PHYLUM :PORIFERA

# OLYNTHUS

| | | |
|---|---|---|
| PHYLUM | : | PORIFERA |
| CLASS | : | CALCAREA |



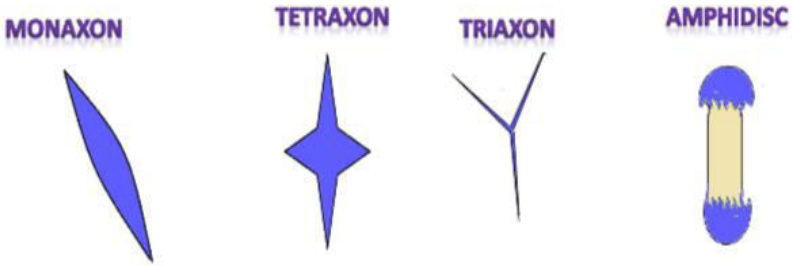



# OLYNTHUS

## COMMENTS:

- Olynthus is a simple sponge with numerous pores and channels for the circulation of water in its body. Hence it is included in the Phylum Porifera.
- It has spicules made of calcium carbonate. Hence it is included in the Class Calcarea.
- It is a very simple type of sponge with Ascon type of canal system
- It is also called *Clathrina*. It is the temporary stage in the life history of all syconoid sponges
- The free swimming gastrula in this sponge settles on a rock, grows and develops an Olynthus stage .This stage resembles a little sponge
- Its body is cylindrical and vase- like. It has the symmetry of awheel.
- It is attached to the substratum by a stalk and a basal disc on the one end
- The other free end has a large opening called osculum.
- The body encloses a large cavity called spongocoel
- The canal system helps in collecting food, respiration, excretion and reproduction.

# SPICULES OF SPONGES






# SPICULES OF SPONGES

**COMMENTS:**

- **Spicules** are needle-like **crystalline** bodies found in sponges.
- They provide structural support and **protection** to the sponges
- They are secreted by the mesenchyme cells called **scleroblasts**
- The spicules have different shapes.They are in the form of **needles, rods, bows, arrows, pickaxes, stars, etc.**
- Spicules are classified into two types based on the material they are made of namely **calcareous** and **siliceous**
- Spicules are classified into **megascleres** and **microscleres** based on their **size**
- The spicules are also **classified** into according to the number of **axes and rays**. They are monaxon, triaxon, tetraxon,polyaxon etc
- Monaxon spicules grow along a single axis. Amphidisc are spicules which have disc at both ends.
- Triaxon spicule has three axes that cross one another at right angles to produce six-rays. These are seen only in class Hexactinellida.
- Tetraxon spicules consist of four rays radiating from a common point.
- Sponges with **calcareous spicules** are incuded in the class **Calcarea**
- The sponges with **six-rayed siliceous** spicules are placed in the class **Hexactinellida**
- The **Class Demospongiae** has sponges with **siliceous** spicules and **spongin fibres**
- Thus Spicules provide the basis of classification of sponges in the Phylum Porifera.

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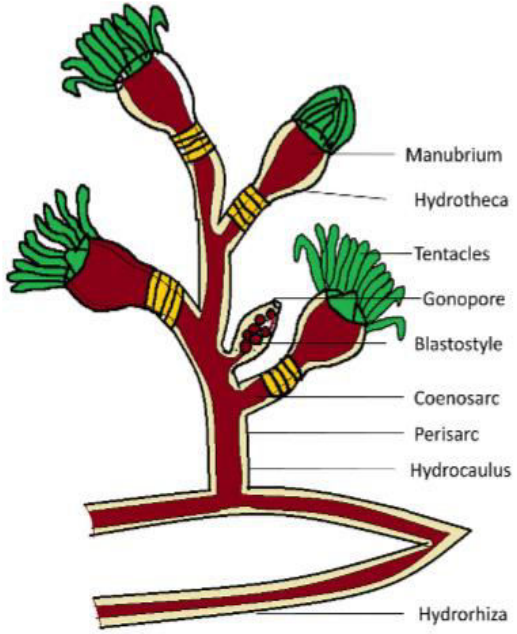
# PHYLUM :COELENTERATA

# OBELIA COLONY

| | | |
|---|---|---|
| PHYLUM | : | COELENTERATA |
| CLASS | : | HYDROZOA |





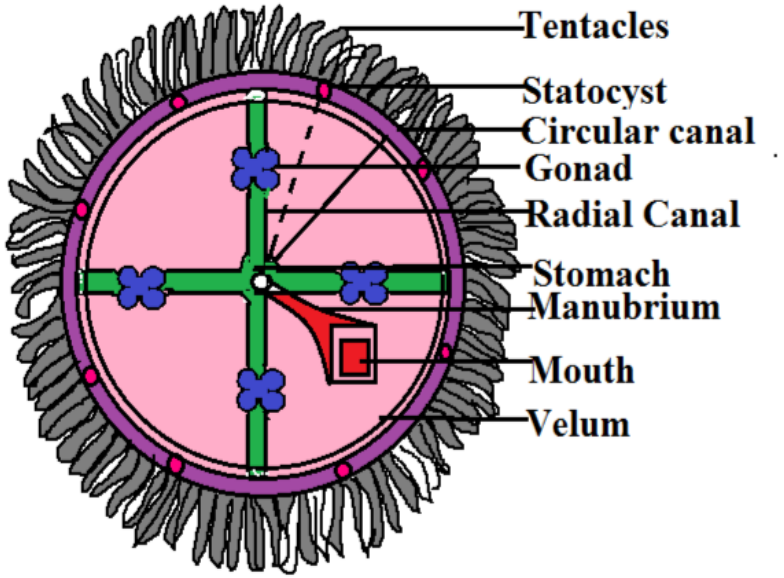

# OBELIA COLONY

**COMMENTS:**

- It is a colonial form of coelenterate found in sea water. It is also called **sea fur**
- It has **coelenteron**.So, it is included in the phylum Coelenterata. This phylum is also called Cnidaria as it has cnidoblasts or stinging cells for protection
- It is included under the class Hydrozoa since it has hydra like stage in its life history
- It is a sedentary form attached with the substratum by the basal horizontal **hydrorhiza.** Many vertical branches known as **hydrocauli** arise from hydrorhiza.
- It is found to be attached on the surface of sea weeds, molluscan shells, rocks and wooden piles in shallow water up to 80 metres in depth.
- The colony is trimorphic having three types of zooids ,namely **polyps,blastostyles** and **medusa**.
- The polyp is a nutritive zooid .It has a number of tentacles that helps in feeding
- The blastostyle or the budding zooid has no mouth and tentacles.It is enclosed by a covering called **gonotheca**. It gives rise to buds which develop into **medusa**.
- The **blatostyle** also helps in asexual reproduction.
- The bell-shaped medusa, the reproductive zooid helps in sexual reproduction
- The life history of obelia exhibits an **alternation of generation** or **metagenesis**

# OBELIA MEDUSA

| | | |
|---|---|---|
| PHYLUM | : | COELENTERATA |
| CLASS | : | HYDROZOA |





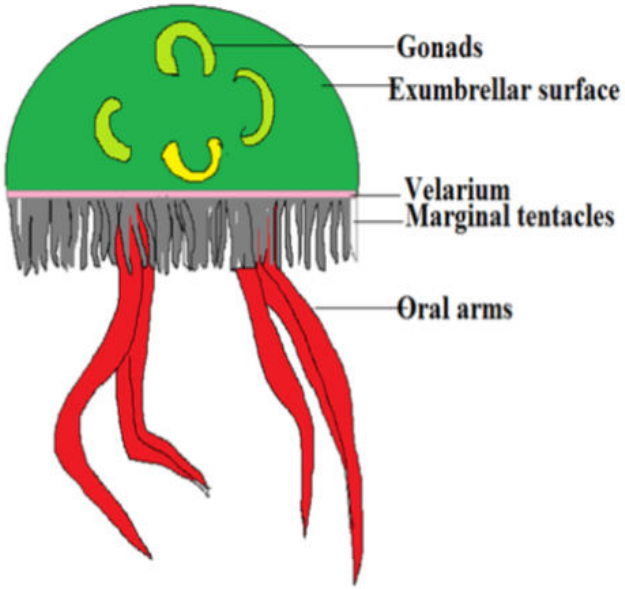

# OBELIA MEDUSA

**COMMENTS:**

- Medusa is a free swimming , **sexual zooid** of *Obelia* colony
- It develops from the **blastostyle** of *Obelia* colony
- It has a well defined **radial symmetry**
- There is a concave sub-umbrellar surface and convex ex- umbrella surface
- The centre of sub-umbrellar surface has the handle-like **manubrium** with a mouth at its end.
- On the sub-umbrellar side,there are four **radial canals** and a **circular canal**
- The margins of the medusa contains **tentacles** and **eight statocysts**
- The margins of the umbrella is folded inwards as a velum
- **Four gonads** are situated beneath the radial canals
- In medusa ,**sexes are separate**
- The gametes are released into the water and external fertilization takes place
- Medusa helps in the dispersal of the colony.

# AURELIA

| | |
|---|---|
| **PHYLUM** | **COELENTERATA** |
| **CLASS** | **SCYPHOZOA** |





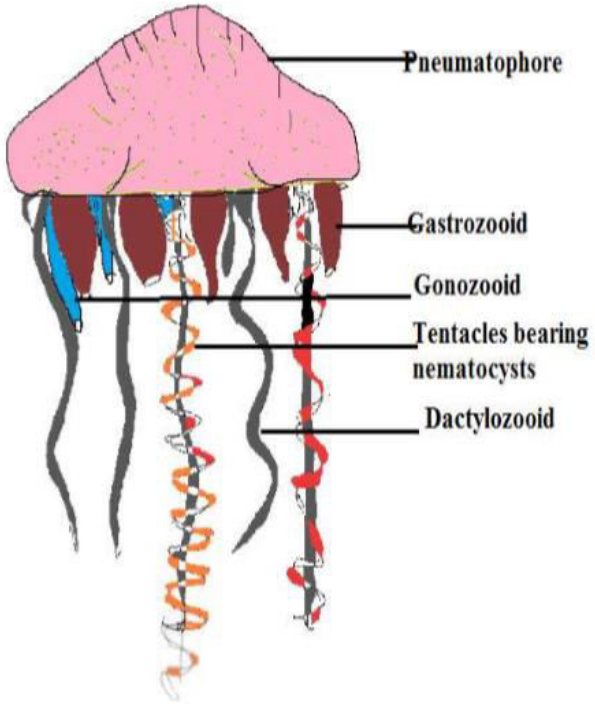

# AURELIA

**COMMENTS:**

- Aurelia is a **marine coelenterate**. It is the common jelly fish in coastal waters of tropical and temperate oceans of the world.
- It has **coelenteron**. So, it is included in the phylum Coelenterata. This phylum is also called Cnidaria as it has **cnidoblasts** or stinging cells for protection
- It is included under the class Scyphozoa since it has many **tentacles**
- It has a convex upper surface known as **exumbrellar surface** and a lower concave, the **subumbrellar surface**.
- The margin of the umbrella is divided into eight lobes by notches. Each notch contains a **tentaculocyst**.
- The margin of the subumbrellar surface bearing lappets and tentacles forms a thin flexible flap called **velarium**.
- Along the margins of the umbrella, there are many tentacles
- The four-cornered mouth is seen on the short manubrium hanging down in the centre of subumbrellar surface.
- Four corners of the mouth are drawn out into **four oral arms**.
- The oral arms are provided with **nematocysts**.
- **Four horse-shoe-shaped** pinkish **gonads**, are situated between oral arms
- Mouth leads into a short gullet which opens into stomach.The stomach gives rise to four inter-radial **gastric pouches**.
- Each gastric pouch gives off radial canals which open into a **circular canal**.
- **Sexual** reproduction takes place .Development is **indirect**

# PHYSALIA

| | |
|---|---|
| PHYLUM | COELENTERATA |
| CLASS | HYDROZOA |





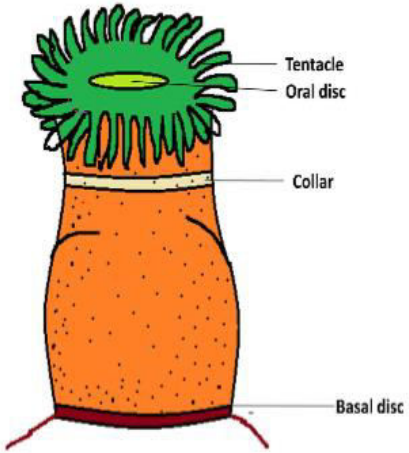

# PHYSALIA

**COMMENTS:**

- Physalia is a colonial marine pelagic form. It is commonly called **Portuguese man-of-war.** It is so named because of its sudden appearance and disappearance like Portuguese war ships during war.
- The species reaches large size ,10 to 30cm long and tentacles measuring several meters
- The colony bears a transparent balloon-like **pneumatophore** floating above the surface and the whole colony remains inside water.It has a crest or sail on its upper surface.
- The short stem,consists of budding coenosarcs on the ventral surface of the pneumatophore.
- The zooids are hanging from the under surface of the float.They are of the following four types:
  - a.Large **dactylozooid** with long fishing tentacles,
  - b.Small dactylozooids with tentacles,
  - c.Bunches of **gastrozooid** without tentacles and
  - d.Several branched **gonozooid** bearing gonopalpons.
- The swimming bells or **nectocalyces** are absent.
- The pneumatophore contains gas glands ,which secrete air.
- The gas fills the float to swim and when the animal has to sink,gas is forced out.
- Physalia is dangerous because its long tentacles inflict severe burning , pain,skin lesions,eruption,fever etc

# SEA ANEMONE

| | |
|---|---|
| PHYLUM | COELENTERATA |
| CLASS | ANTHOZOA |






# SEA ANEMONE

**COMMENTS:**

- It is a marine flower-like, filter feeding, solitary and sedentary form, including in the class Anthozoa of the phylum Cnidaria/Coelenterata.
- The body is short ,cylindrical and **radially symmetrical**.
- There are three distinct regions in its body namely **pedal disc, column** and **oral disc.**
- Pedal disc helps in attaching to the substratum.
- Oral disc has a slit like mouth in the centre which is surrounded by numerous tentacles.
- Mouth leads into a short gullet which finally opens into the gastrovascular cavity.
- Sexes are separate. Gonads are borne on the mesenteries
- Asexual reproduction takes place by fragmentation and budding
- It exhibits commensalism with hermit crab

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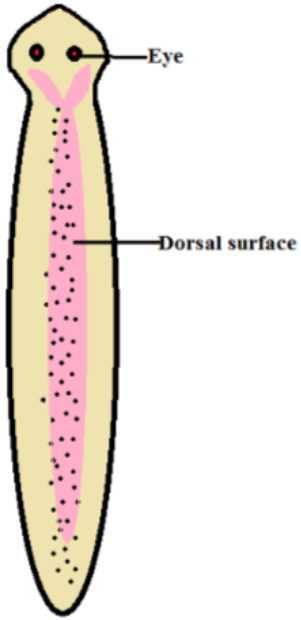
# PHYLUM :PLATYHELMINTHES

# PLANARIA

| | |
|---|---|
| PHYLUM | PLATYHELMINTHES |
| CLASS | TURBELLARIA |





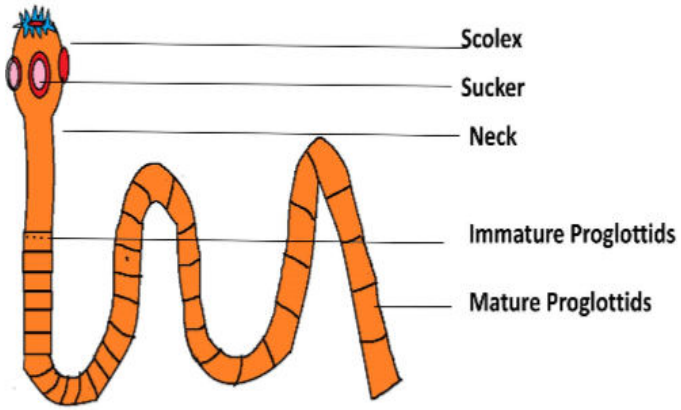

PLANARIA

**COMMENTS:**

- It is a free living **un-segmented worm** found in **fresh water**
- It is a flat worm belonging to the phylum Platyhelminthes and the class Turbellaria
- Its body is flattened like leaf with **bilateral symmetry**
- The head is triangular containing two ear like auricles and two semicircular ocelli or eyes.
- The alimentary canal consist of mouth,pharynx,oesophagus and intestine
- It has no anus.
- The pharynx is protruded out as proboscis
- Planaria is **carnivorous** and feeds upon small crustaceans, insect's larvae and also dead or living large animals.
- The **protonephridial** system helps in excretion
- **Gonopore** is found a little behind the proboscispore.
- It reproduces sexually and asexually.

# TAENIA SOLIUM

| | |
|---|---|
| PHYLUM | PLATYHELMINTHES |
| CLASS | CESTODA |






# TAENIA SOLIUM

**COMMENTS:**

- *Taenia solium* is a **parasite** found in the **intestine of man**.
- The body of this parasitic worm is flat and hence placed in the phylum Platyhelminthes and in the class Cestoda.
- It is commonly called **tape worm**.
- The body consists of the **scolex**, **neck**, and **strobila**.
- The scolex has 4 suckers and a rounded **rostellum** which is surrounded by a double row of hooks.
- The strobila is formed of **700 to 900 proglottids**.
- It is **hermaphrodite** with a set of male and female reproductive organs in the same worm.
- The life cycle is completed in two hosts, the man and the pig.
- Pig acquires bladder worm infection by consuming contaminated human faeces.
- The tapeworm infection occurs in men when he consumes pork not cooked properly.
- It causes the various diseases like anaemia, eosinophilia, Diarrhea, haemorrhage, abdominal pain, nausea, insomnia etc.

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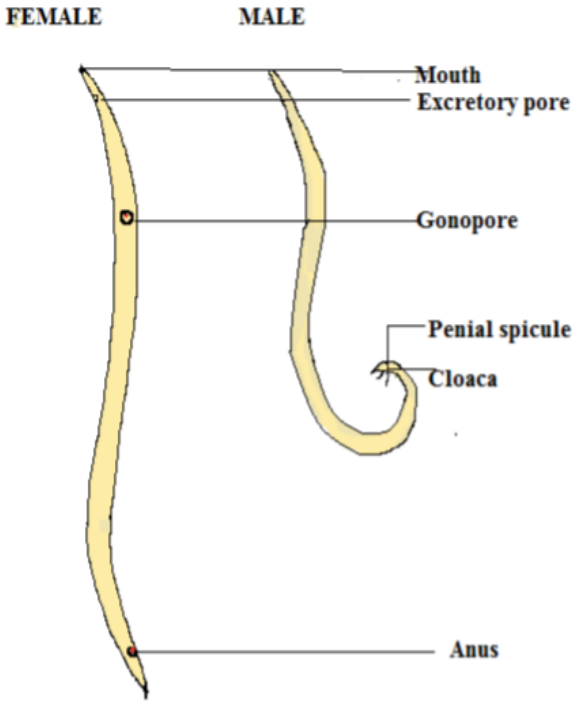
# PHYLUM :ASCHELMINTHES

# ASCARIS

| | |
|---|---|
| PHYLUM | ASCHELMINTHES |
| CLASS | NEMATODA |





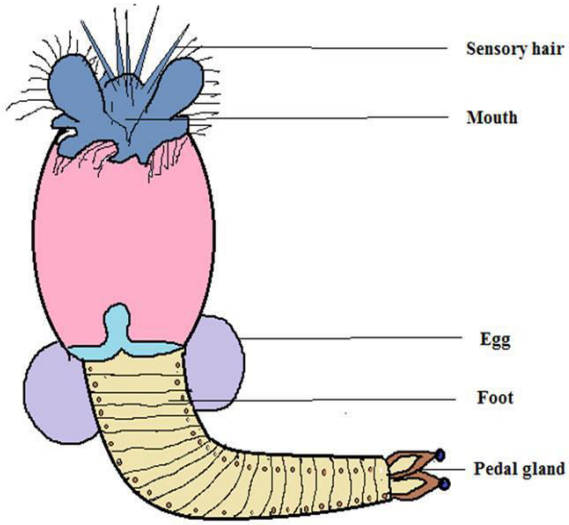

# ASCARIS

**COMMENTS:**

- *Ascaris lumbricoides* is a **monogenic parasite,** lives in the **intestine of man.**
- It is a round worm included under the Phylum Aschelminthes and the Class Nematoda
- Its body is elongated and cylindrical.
- Sexual dimorphism is seen. The male measures 15-30cm.in length and the female is longer with the length of 20-35cm.
- The tail end of the male is ventrally curved containing **cloacal aperture** ,through which **two spicules** project.
- The female worm has the **straight tail end**.
- Mouth is situated at the anterior end it is guarded by **three lips** .
- Four longitudinal chords extend from the anterior to the posterior end.
- Excretory pore lies at a distance of 1mm from anterior end.
- Life cycle includes a **rhabditiform** larva and the larva exhibits an **extra intestinal migration.**
- Human beings are infected by these worms when they consume food or water that is contaminated by eggs of Ascaris.
- Ascaris causes a disease called **ascariasis**.

# BRACHIONUS

| PHYLUM | ROTIFERA |
|---|---|
| CLASS | MONOGONONTA |






# BRACHIONUS

**COMMENTS:**

- Brachionus is a **microscopic**, **planktonic** rotifers inhabiting in **freshwater** ecosystem
- It is commonly known as rotifers, ranging from 0,04to 2mm in length.
- It is a **pseudocoelomate** showing **bilateral** symmetry
- Its body is divisible into a lobed anterior end provided with a ciliary apparatus, **elonged trunk** and a **tail**
- The anterior end bearig the mouth corona and various projections. Mouth is located in the corona in the mid-ventral line of the head
- The presence of **corona,**a ciliated structure on the head is the **distinctive feature** of brachinus, facilitates feeding
- It feeds on protozoans, bacteria and algae.
- **Excretion** is carried out by a pair of **protonephridial** tubules
- The **foot** is modified into a **long stalk**.
- The **pedal gland** commonly opens at the tips of the toes, **secretes adhesive material**
- Rotifers are **dioecious**
- Rotifers such as *Brachionuscalyciflorus* are favored test animals in aquatic toxicology because of their sensitivity to most toxicants.
- They also are used as model organisms in various other biological fields e.g. due to their higher reproductive mode in evolutionary ecology. They are dominant forms in thezooplanktonic communities.They play a key role in food chain.
- Brachionus sp., are easily reared in large numbers and are used as substitute for wild zooplankton for feeding hatchery reared larval fish.

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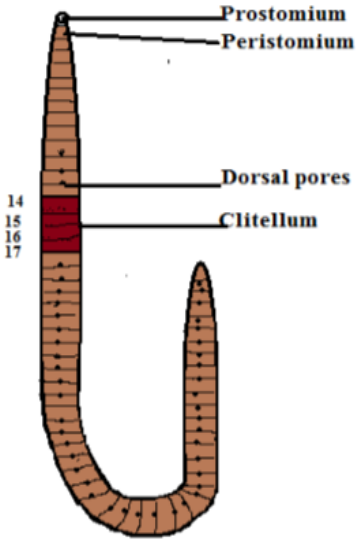
# PHYLUM :ANNELIDA

# EARTHWORM

| | |
|---|---|
| PHYLUM | ANNELIDA |
| CLASS | OLIGOCHAETA |





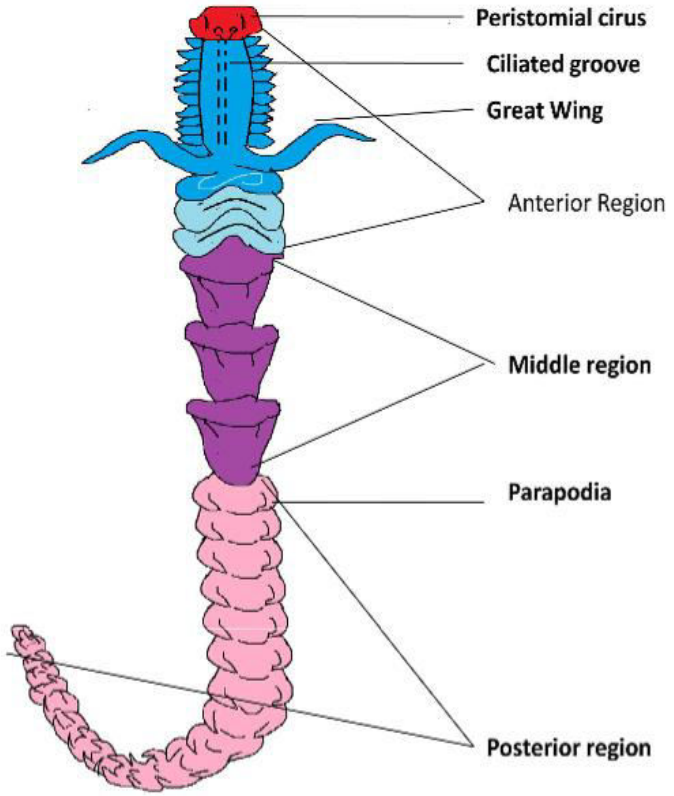

# EARTHWORM

**COMMENTS:**

- An earthworm is **a segmented worm** belonging to the phylum Annelida and the class
- Oligochaeta
- They are **burrowing animals**commonly found in moist soil and feed on organic matter
- The mouth and the **prostomium** are seen in the anterior end. The prostomiumhelps
- in burrowing.
- The **clitellum** extends between $14^{th}$ and $17^{th}$segments.This region helps us to differentiate the mouth and tail ends. The body is divided into **preclitellar, clitellar and postclitellar regions.**
- Earthworms are **hermaphrodites** as they carry both male and female sex organs. Segments 5-9 contain the four pairs of spermathecal apertures.
- The female genital pore is situated at the $14^{th}$ segment and a pair of male genital pores is situated at the $18^{th}$ segment
- They **respire** through their moist skin by diffusion.
- The **excretory** organs are the **nephridia**
- The **setae**, help in **locomotion** in the earthworm. They are present in each segment except in the first, last and clitellum segments.

# CHAETOPTERUS

| | |
|---|---|
| PHYLUM | ANNELIDA |
| CLASS | POLYCHAETA |





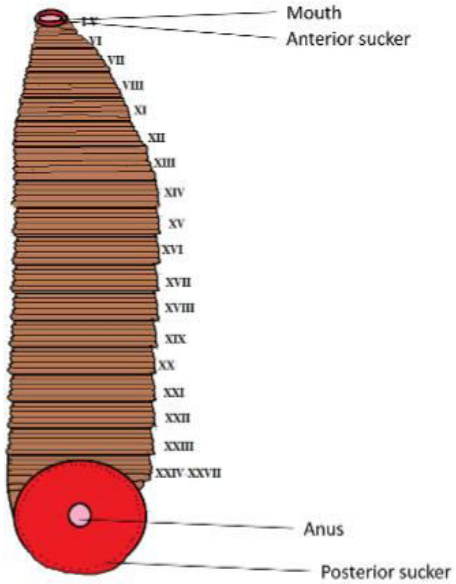

# CHAETOPTERUS

**. COMMENTS:**

- It is commonly knows as **paddle worm**. It is a tubicolous marine annelid worm placed under the Phylum Annelida and the Class Polychaeta
- It lives in an U' shaped tube which opens at both ends.
- The body is divisible into three regions.
- The **anterior region** is flat and has *9 pairs of flat* projections called parapodia on both sides of each segment. The parapodia are used for locomotion and gas exchange.
- The **prostomium** is small and the peristomium is funnel shaped with a pair of cirri.
- The **middle region** consists of **five segments**. Of these ,the first segment is modified into great wings.
- The next segment bears a pair of suckers . the remaining segments possess fans.
- Beating of these fans maintains water currents and the food particles are trapped by mucus secreted by anterior region.Thus they help in feeding.
- The **third region** has 30 segments without setae.
- It is a filter feeder.
- It can emit light,hence it is knows as phosphorescent.
- It plays an essential role in marine food chain

# LEECH

| | |
|---|---|
| PHYLUM | ANNELIDA |
| CLASS | HIRUDINEA |






# LEECH

**. COMMENTS:**

- *Hirudinea* is commonly called **cattle leech**. It is multicellular, metamerically segmented worm classified under the Phylum Annelida and the Class Hirudinea
- It is a coelomate, triploblastic and **bilaterally symmetrical** annelid .
- It lives in ponds,tanks,lakes and river
- It is an **ectoparasite** feeding on the blood of cattle and man.
- It feeds an **blood** it is said to be **sanguivorous** in habit.
- Leech has a anteroposterioly elongated body and is elastic in nature.
- Leech has **two suckers** suitated in the anterior and posterior end.
- The suckers help in attaching to the host .
- Leech has five pairs of eyes . They are suitated in the anterior five segments one pair in each segments
- Leech is used for medicinal purposes. *Hirudinea medicinalis* is the species of leech mostly used in plastic and reconstructive surgery by extracting the anti-clotting serum from the leech.

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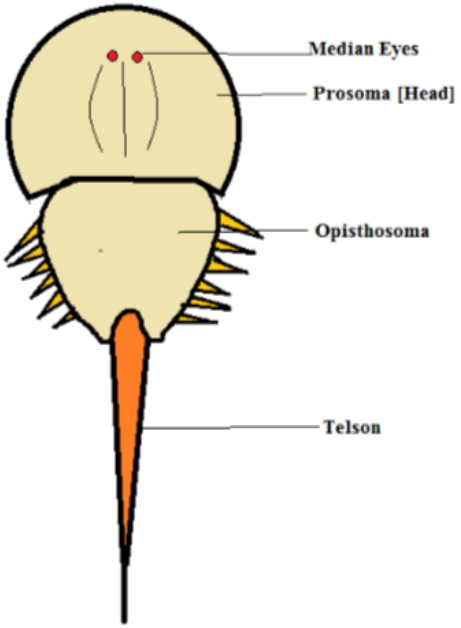
# PHYLUM :ARTHROPODA

# LIMULUS

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | MEROSTOMATA |





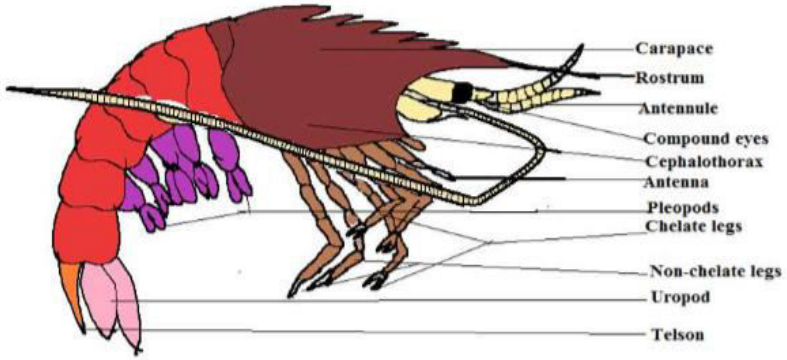

# LIMULUS

**COMMENTS:**

- These crabs are **marine arthropods** and the living fossils.
- It is classified under the phylum Arthropoda and the class Merostomata
- The body is divisible into **prosoma**, **opisthosoma** and **metasoma** (telson). Prosoma is covered dorsally with a broad horseshoe-shaped carapace
- **Two median eyes** and two lateral eyes are present on the carapace.
- Opisthosoma with serrated border has six pairs of movable spines.
- Carapace and opisthosoma are joined by a transverse hinge.
- Postoral caudal spine (telson)is hinged and movable.
- There are **six pairs of cephalothoracic appendages**—chelicerae, pedipalpi and four pairs of walking legs.
- Mesosoma bears **six pairs of flattened appendages**. The first pair are without gills and united at the middle to form genital operculum. The rest five pairs are free and each carries a gill-book.
- Heart is tubular, long and with eight pairs of Ostia.
- Limulus has similarities and dissimilarities with several groups of both extinct ( Trilobites, Eurypterida (fossil Merostomata), Hemiaspidae (fossil Crustacea) and living invertebrates(Crustaceans, Arachnids)

# PENAEUS

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | CRUSTACEA |





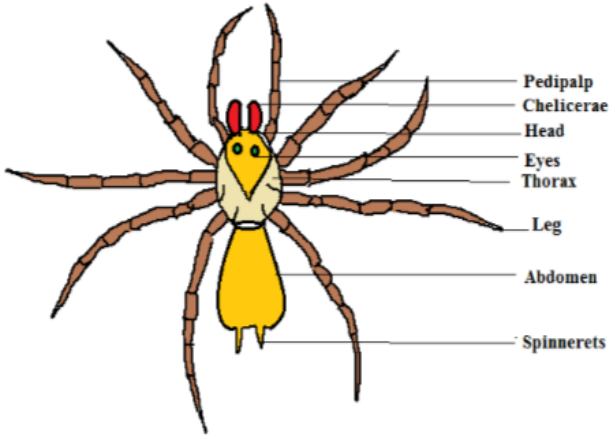

# PENAEUS

**COMMENTS:**

- It is popularly called as **prawn**.
- It is classified under the phylum Arthropoda and the Class Crustacea.
- It lives in the **sea**.
- The body is covered with a **cuticle**.
- The body is divisible into **cephalothorax** with 13 segments and **abdomen** with 6 segments..
- The cephalic region bears a pair of stalked compound eyes and five pairs of cephalic appendages namely antennae (sensory), antennules (carries out excretion), mandibles, (crushes food) I maxillae (carries food to the mouth) and II maxillae (produces constant water current within the gill chambers).
- The thoracic region has three pairs of maxillipedes and five pairs of walking legs,of these , first three pairs of walking legs are chelate , the remaining two pairs are non chelate.
- Six pairs of abdominal appendages are called pleopods.
- The sternum of the last thoracic segment of female is modified into a structure known as thelycum.
- In male the endopodites of the first pair pleopods unite to form the petasma.
- Each appendage of prawn is modified to carry out a specific function.
- The lining of the branchiostegite, **epipodites** and gills help in **respiration**.
- The **development** is **indiecct**.Nauplius,metanauplius,protozoea,zoea and mysis are the larval stages.

# SPIDER

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | ARACHNIDA |





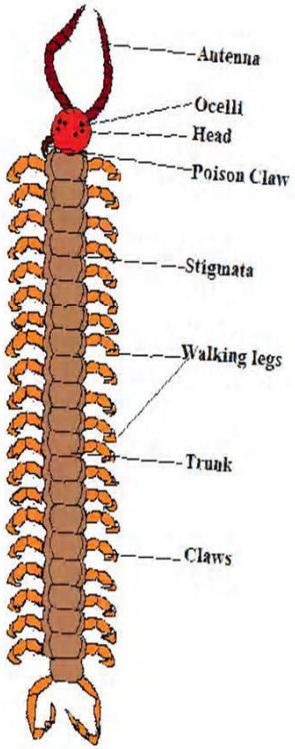

# SPIDER

**COMMENTS:**

- Spider is an arachnid .It Is an eight legged arthropod.
- It is classified under the phylum Arthropoda and the classArachnida.
- It is a terrestrial arthropod found in all places
- The body is divisible into a cephalothorax and an abdomen.
- The cephalothorax is covered by a carapace.
- A pair of simple eyes, a pair of chelicerae and a pair of pedipalpi are seen in the head.
- The chelicerae contain a poison gland.
- The thorax bears the four pairs of walking legs.
- The abdomen has spinnerets of spinning silk.
- Respiration is carried out by book lungs and trachea.
- Sexual dimorphism is seen. The males are much smaller than the females.
- The female usually eats up male after copulation.
- Spiders are predators of insects. Hence, Spiders are used in biological control of insects in apple orchards and rice fields.

# SCOLOPENDRA

| PHYLUM | ARTHROPODA |
|---|---|
| CLASS | MYRIAPODA |





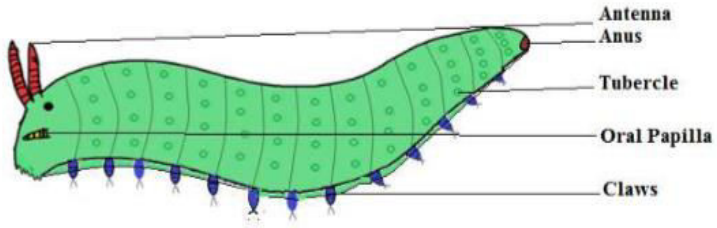

# SCOLOPENDRA

## COMMENTS:

- It is commonly called **centipede**. It is classified under the phylum Arthropoda and the class Chilopoda
- It is found in **damp places**.
- The body is long and divisible into **head and a trunk**.
- The segments of the **head** are united.
- The head consists of **antennae, ocelli, maxillae and mandibles**.
- The **trunk** has **21 segments with 21 pairs of walking legs**.
- The **poison claws** are seen on the first pair
- All the walking legs are similar. The last pair of legs are larger than the others.They are not useful in locomotion but help in sensation, defence, and offense.
- The stigmata lie on segments 4,6,9,11,13,15,17,19and 21.
- The last segment bears the anus.
- It is **nocturnal**, **carnivorus** and harmful to man.
- It is **oviparous**

# PERIPATUS

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | ONYCHOPHORA |





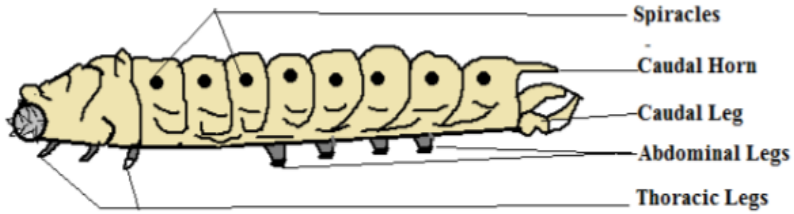

# PERIPATUS

## COMMENTS

- It is a **terrestrial** arthropod living in the moist and shady places. It exhibits discontinuous distribution
- It is classified under the class Onychophora.
- It is **nocturnal** and **predaceous** feeding on insects, other small arthropods and worms.
- The prey is captured by spurting mucus from the slime glands.
- It looks like a caterpillar
- The **unsegmented body** consists of head and trunk.
- The trunk bears paired legs which are unsegmented and each leg bears a pair of claws.
- The body is soft and wrinkled.
- The body cavity is **haemocoel**.
- There are a pair of slime glands.
- **Respiration** takes place by a network of **trachea**
- **Excretion** is carried out by **metanephridia**
- The nervous system is ladder-like.
- The sexes are separate. Males are usually smaller than females
- It has evolutionary important features as this species is a **connecting link** between the phylum annelida and arthropoda

# SILKWORM

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | INSECTA |





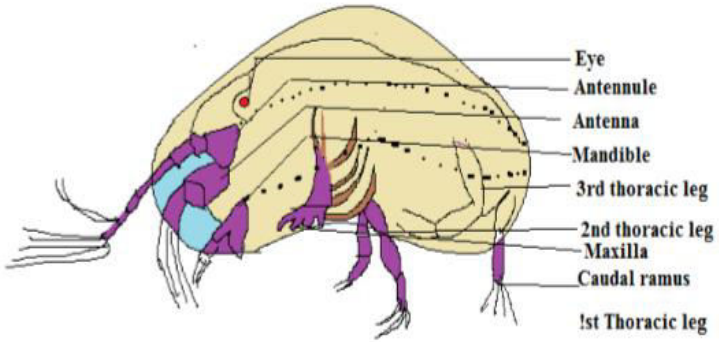

# SILKWORM

## COMMENTS

- Silkworm is the **larva** of silk moth, *Bombyx mori*.
- It is classified under the phylum Arthropoda and the class Insecta since it has
- The caterpillar or larvae are hatched from the eggs of the adult silk moth.
- The silkworms **feed** on **mulberry leaves** and give rise to pupa.
- It **secretes** the **silk** around its body as **cocoon** for protection.
- The body of silk worm consists of three regions namely a head, a thorax , and an abdomen.
- The head bears 3 pairs of eye spots and chewing mouth parts.
- The thorax has three pairs of true legs.
- The abdomen has 10segments it contains 5 pairs of pseudolegs and an anal horn.
- The larva has 9 pairs of spiracles
- The **larva** has a pair of **silk glands**. They secrete silk around their body and it forms the cocoon
- Inside the cocoon ,the larva changes into the pupa.
- The **silk** is reeled from the **cocoon**.
- The **rearing of silk worm** for commercial production of silk is called **sericulture**.

# ADAPTATIONS OF PLANKTON-CYPRIS

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | THECOSTRACA |






# ADAPTATIONS OF PLANKTON-CYPRIS

## COMMENTS

- Cypris is a a type of crustacean, commonly known as **mussel shtimp**
- It inhabits in freshwater pools.
- The bdy is enclosed in bivalve carapace
- It has a median eye, two pairs of antennae,one pair of mandibles, two pairs of maxillae and six pairs of thoracic legs.
- The abdomen is reduced
- The body is enveloped in a bivalved carapace.
- A pair of sessile compound eyes are seen.
- There are six pairs of thoracic appendages.
- Anterior antennae are four jointed and each bears a characteristic disc.
- Posterior antennae are absent.
- Six pairs of biramous thoracic appendages are present. Short abdomen ends in a caudal fork.
- The larva contains a mass of germ cells.
- It occurs in Sacculina and barnacles (Cirripedia).
- This free swimming larva helps in dispersal of the species.
- They are feed for the hydra and small fish
- The major planktonic adaptations are parthenogenetic reproduction, drought resistant eggs and the capacity to swim without feeding.

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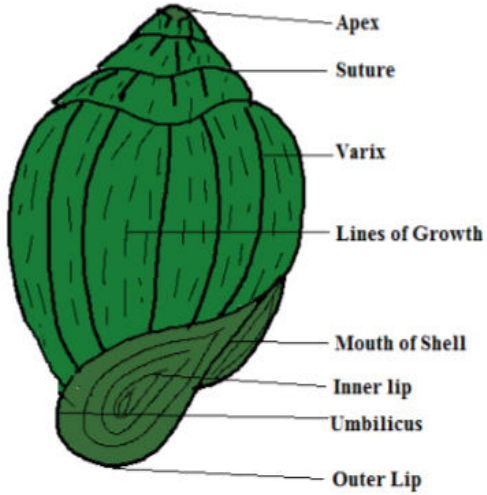
# PHYLUM :MOLLUSCA

# PILA

| | |
|---|---|
| PHYLUM | MOLLUSCA |
| CLASS | GASTROPODA |





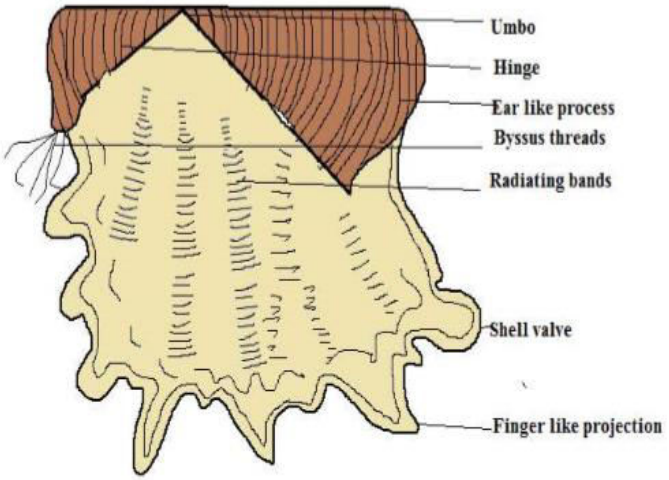

# PILA

## COMMENTS

- It is commonly known as **apple snail**.
- It is classified under the phylum Mollusca and the class Gastropoda.
- It lives in pond ,tank,lakes and paddy fields.
- It is an **amphibious** form adapted to live in water as well as on land. They respire in water by ctenidium and on land by pulmonary sac.
- The soft body is **protected** by the a spirally coiled univalve **shell**.
- The shell has body **whorls**.
- It has an opening called **shell mouth**.
- The shell mouth is closed by an **operculum**.
- The soft body is divisible into head, foot, and visceral mass.
- The spirally coiled visceral mass contains all the main organs of the body. It also exhibits the phenomena of **torsion**.
- The skin covering the visceral mass is called the **mantle**.
- The mantle protects the visceral mass and head,serves as an additional respiratory organ and secretes the shell
- The broad foot with the flat ventral surface helps in creeping.
- It can feed on aquatic plants.The digestive system contains **radula**.
- It is **oviparous**.

# PEARL OYSTER

| | |
|---|---|
| PHYLUM | MOLLUSCA |
| CLASS | BIVALVIA |





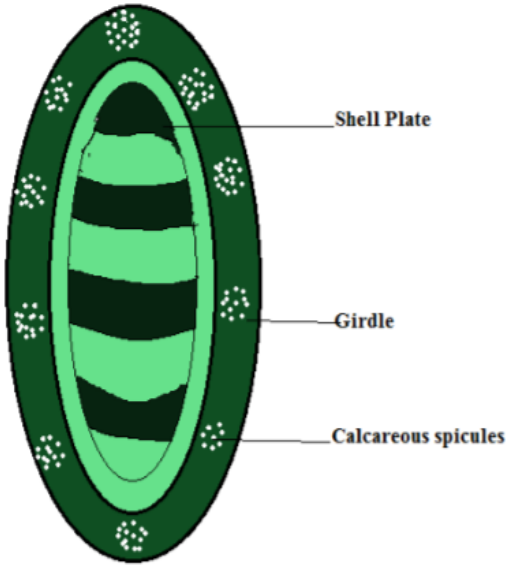

# PEARL OYSTER

## COMMENTS

- It is commonly known as **Indian pearl oyster**.
- It is classified under the phylum Mollusca and the class Bivalvia.
- It is **sedentary** animal with two unequal valves.
- The body has **bilateral symmetry**
- The body is **laterally** compressed.
- One valve is attached to the rock and the other one is free.
- Head is absent
- There is a wing like process at the hinge portion.
- **Respiration** is by paired **gills**
- The foot is small.
- There are no siphons.
- It **produces natural pearls**.

# CHITON

| | |
|---|---|
| PHYLUM | MOLLUSCA |
| CLASS | POLYPLACOPHORA |





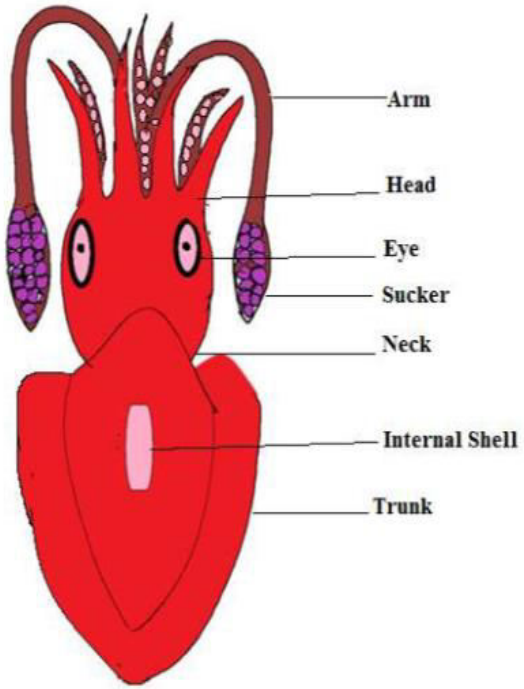

# CHITON

## COMMENTS

- It is a marine mollusc attached to the **rocks**.
- It is classified under the phylum Mollusca and the class Polyplacophora.
- The body is **bilaterallysymmetrical**.
- The body is **dorso ventrally** compressed.
- The **foot** is broad and flat.
- There is a **calcareous** shell and it consists of **eight plates**.
- It has **no distinct head**.
- The **radula** is present.
- Sexes are separate and the development is indirect.
- **Nocturnal**, **herbivorous** (feeding on algae) and are used as food and for decoration .

# SEPIA

| | |
|---|---|
| PHYLUM | MOLLUSCA |
| CLASS | CEPHALOPODA |






# SEPIA

## COMMENTS

- It is commonly known as **cuttle fish**
- It **inhabits** in the **marineecoystem** and is commonly used as food.
- It is anadvanced marine mollusc placed in the phylum Mollusca and the class Cephalopoda
- It can swim actively in the shallow water
- It has an **internal shell**
- The body is divisible into three regions , namely **head,trunk and neck**.
- The head possesses **a pair of large eyes** and **5 pairs of arms**.
- The four pairs of arms bear suckers.
- In **male**,the**hectocotylized** arm helps in copulation.
- The trunk bears **lateral fins**.
- The neck contains a funnel.
- The **ink gland**ejects ink-like fluid to escape from the enemies.

# SOLEN

| | |
|---|---|
| PHYLUM | MOLLUSCA |
| CLASS | BIVALVIA |




# SOLEN

## COMMENTS

- It is commonly known as **razor-clam**.
- It is classified under the phylum Mollusca and the class Bivalvia.
- It is a marine organism inhabiting in **sandy burrows**.
- The shell valves are long, of equal size, with parallel straight margins and with terminal umbo.
- Solenid shells do not close completely, so posterior and anterior ends of the shells are always open.
- The elongate shell is narrow and thin.
- The strong **foot** helps in **burrowing**.
- The larger inlet siphonhelps to pull the water to feed on planktons.
- The animal swims backward by the jerking action of the foot.
- Razor clams have been widely preferred around the world for food especially in Europe and south eastern Asia.
- The **filter-feeding habit** of razor clams can improve water quality as they are **bioindicators** of heavy metals such as Mg,Fe, Cu, and especially Zn in their environment

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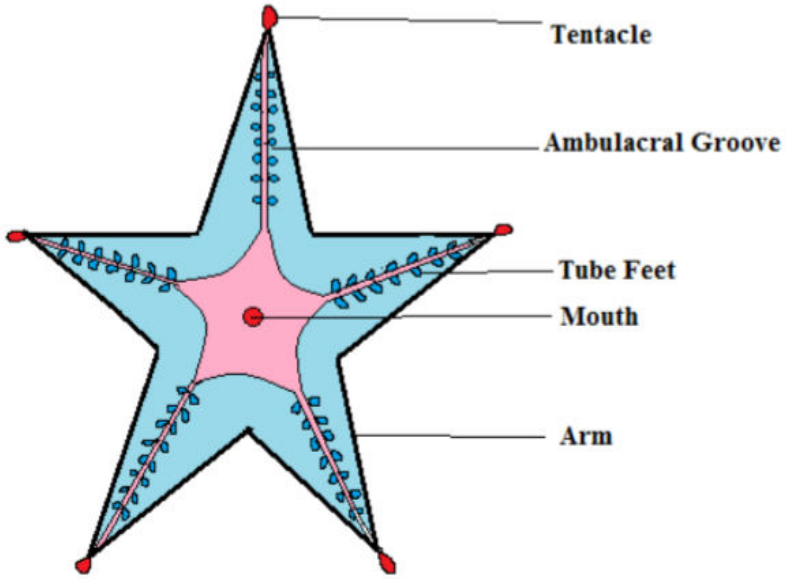
# PHYLUM :ECHINODERMATA

# STARFISH

| | |
|---|---|
| PHYLUM | ECHINODERMATA |
| CLASS | ASTEROIDEA |





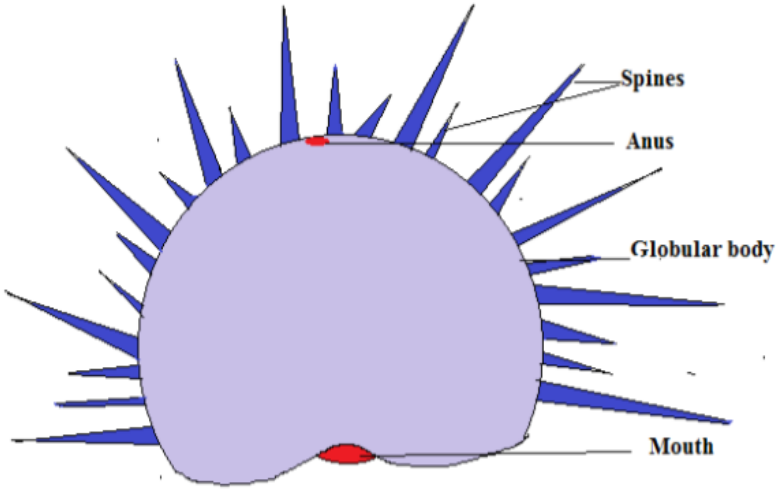

# STARFISH

## COMMENTS

- *Asterias* ***is*** commonly known as **star fish**. Taxonomists have placed it under the
- Phylum Echinodermata and the Class Eleutherozoa
- The body has a **central disc** and **five arms** and it is **radially symmetrical**.
- The **mouth**, **pedicellariae** and **five ambulacral grooves** with water vascular system are seen on the **oral surface**.
- The **anus** and the **madreporite** are seen on the**aboral surface**.
- The dermal **branchia** helpsin **respiration**.
- The **pedicellariae** are useful in **offense and defence**.
- Water vascular system helps in circulation of nutrientsand excretion.
- The **tube feet** help in **locomotion** and feeding.
- It is **carnivorous**.
- The **development is indirect**

# SEA URCHIN

| PHYLUM | ECHINODERMATA |
|---|---|
| CLASS | ECHINOIDEA |





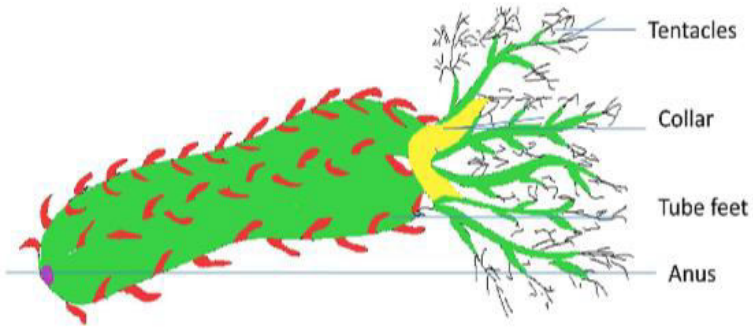

# SEA URCHIN

## COMMENTS

- **Echinus** is commonlyknown as Sea Urchin.It is placed under the phylum, Echinodermata and the class Echinoidea
- It is a **marine organism**, living in rocky areas
- The body is **globe shaped** .
- The **mouth** lies in the middle of the oral pole.
- The **peristome** possesses five pairs of buccal tube feet.
- The body is covered by a **test** or **corona**.
- The test is covered with spines.Long sharp spines protect many sea urchins from predators.
- The test is made up of **ossicles**.
- The surface of the shelL is divided into alteratingambulacra and interambulacral areas
- The **digestive system** has a special apparatus knows as **aristotle's lantern**.
- The radial ambulacral canal bears tube feet
- Sexes are separate
- Development includes a free swimmjng larva, **echinopluteus larva**

# SEA CUCUMBER

| PHYLUM | ECHINODERMATA |
|---|---|
| CLASS | HOLOTHUROIDEA |





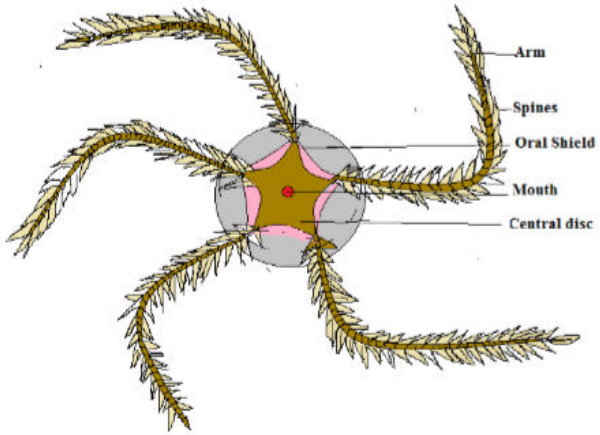

# SEA CUCUMBER

## COMMENTS

- **Cucumaria** is commonly known as sea cucumber.
- It is a **marineanimal**
- Its cylindrical body has mouth and anus at the opposite end.
- The mouth is surrounded by ten branched tentacles.Below the tentacles there is a collar
- There are no arms .
- The skin is tough and it contains spiicules
- The tube feet are arranged in ten rows.There is no pedicellariae
- Respiratory trees are present
- It plays a major role in nutrient recycling and enhances the productivity in marine ecosystem
- It is used as traditional Chinese medicine to treat various kinds of diseases such as arthritis, fatigue, constipation etc.,

# BRITTLE STAR

| | |
|---|---|
| PHYLUM | ECHINODERMATA |
| CLASS | OPHIUROIDEA |



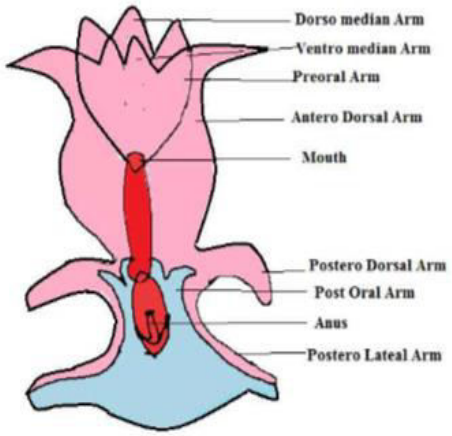



# BRITTLE STAR

## COMMENTS

- Ophiothrix is popularly called as brittle star.
- It lives in shallow marine water
- It is seen beneath the stone during night
- The body has a central disc and five arms
- Long flexible and jointed arms helpin locomotion
- The tube feet in the arms help in capturing the food by suspension feeding
- The oral surface has the mouth and madreporite
- The anus is absent
- Beneath the central disc, five genital bursae are seen
- The water vascular system has no tiedmann's bodies
- The larva is called ophioplueteus
- Brittle star has a key role in arctic food web.

# BIPINNARIA LARVA OF STARFISH






# BIPINNARIA LARVA OF STARFISH

## COMMENTS

- The bipinnaria is **the first stage in the larval development of starfish**.
- This belongs to the class Asteroidea of the phylum Echinodermata.
- 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 bands of cilia help in movement and feeding.
- The anterior end of the archenteron develop as mouth whereas the blastopore becomes the anus.
- Bipinnaria larva possesses **5 pairs of ciliated arms.** These arms are used for swimming in water.
- The following arms develop from pre oral and post oral ciliated bands :paired Pre oral arms, Post oral arms, Postero lateral arms, Antero dorsal arms and Postero dorsal arm and a median Dorsal and Ventral arm.
- This larva helps in **dispersal of the species.**

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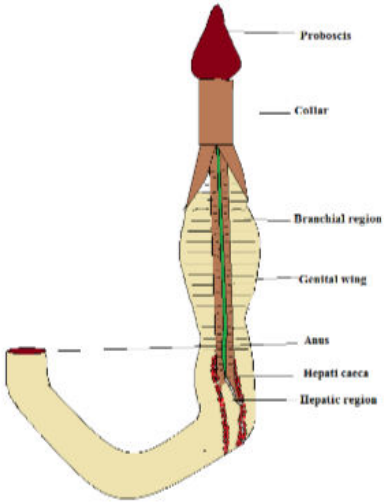
# PROCHORDATES

# BALANOGLOSSUS

| | |
|---|---|
| SUBPHYLUM | HEMICHORDATA |
| CLASS | ENTEROPNEUSTA |





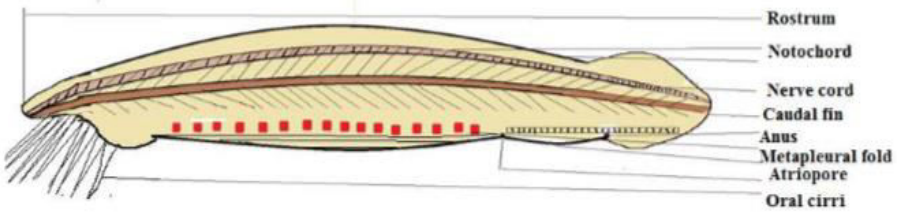

# BALANOGLOSSUS

## COMMENTS

- Balanoglossus is a **protochordate** and is commonly called **acorn worm**.
- It is a **marine animal** and has **burrowing in habit**
- It is cylindrical in shape, growing to a length of 10 to 50 cm.
- The body consists of **three regions** namely an anterior **proboscis** , a **collar** and a posterior long **trunk**. The proboscis is conical in shape. It is used for burrowing. The collar connects the proboscis with the trunk.
- The **trunk** is long and is transversely wrinkled. It consists of three regions , namely an anterior **branchio genital region** ,a **middle hepatic region** and a **posterior abdominal** region.
- The branchial region contains
- two rows of branchial apertures.
- The genital region contains gonads.
- The hepatic region contains hepatic ceaca.
- The mouth is located at the anterior end of the collar.
- The anus is situated at the posterior end of the abdomen.
- The notochord is represented by an outgrowth of the buccal diverticulum.
- The sexes are separate and fertilization is external.
- The development is indirect and it includes a larva called tornaria larva.
- Balanoglossus is a connecting link between invertebrate and chordate.

# AMPHIOXUS

| | |
|---|---|
| SUBPHYLUM | CEPHALOCHORDATA |
| CLASS | LEPTOCARDII |





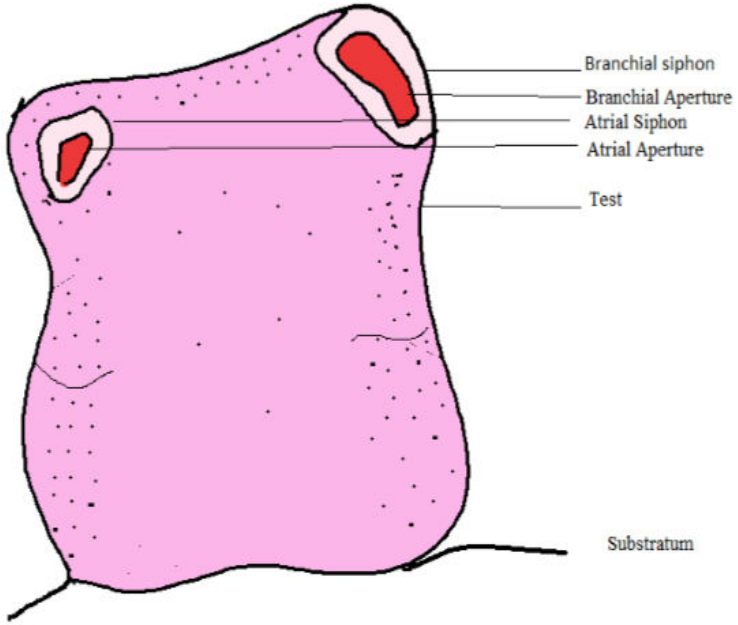

# AMPHIOXUS

## COMMENTS

- It is a **protochordate**
- It is commonly called **lancet.**
- This fish like animal is a **burrowing form** in **marine ecosystem**.
- The body is **laterally compressed** and pointed at both ends
- The anterior end has a snout called **rostrum**.
- The anterior end has a snout called rostrum.
- The body contains a **dorsal fin** a **ventral fin** and a **caudal fin**.
- On the ventral side there are two folds of skin called **metapleural folds.**
- The **myotomes** are arranged on both sides and are separated by **myocommata**.
- The mouth is situated ventral to the rostrum and is guarded by **oral hood** bearing numerous **oral cirri**.
- A single **atriopore** lies ventrally at the junction of metapleural fold and the ventral fin.
- The **anus** lies on the left side just in front of the posterior end.
- The sexes are separate.
- The notochord extends from the anterior end to the posterior end.
- The development is indirect.

# HERDMANIA

| | |
|---|---|
| SUBPHYLUM | UROCHORDATA |
| CLASS | ASCIDIACEA |






# HERDMANIA

## COMMENTS

- Herdmania is a **protochordate** and it is commonly called a **sea squirt**.
- It is a **marine animal**.
- It is a **sedentary animal** attached to the substratum with the help of **foot**.
- The body is covered by a thick covering **tunic** or **test**.
- The free end of the body is provided with two external opening called **branchial aperture** and **an atrial aperture** ,situated on branchial siphon and atrial siphon respectively.
- The mouth opens to the outside by an branchial aperture and the anus, opens to the outside by atrial aperture.
- The branchial and atrial aperture have four lips.
- The alimentary canal is **U shaped**.
- The **pharynx** contains **many pairs of gill slits**.
- They are **hermaphrodites**.
- The development is **indirect** and it includes a free swimming larva called ascidian **tadpole larva**
- The tadpole larva contains the **notochord** in the **tail region**,but the **adult has no notochord.**
- The larva undergoes **retrogressive metamorphosis** to become an adult

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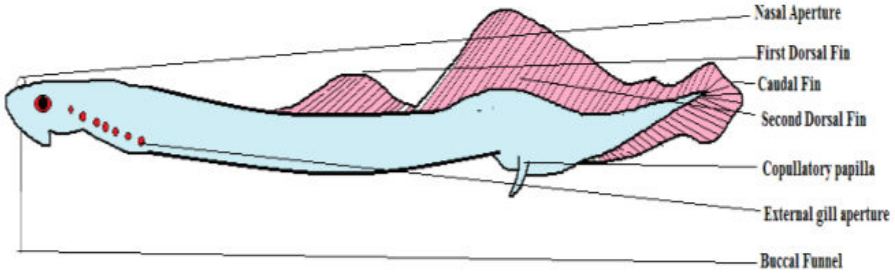
# CHORDATES

# PETROMYZON

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | CYCLOSTOMATA |





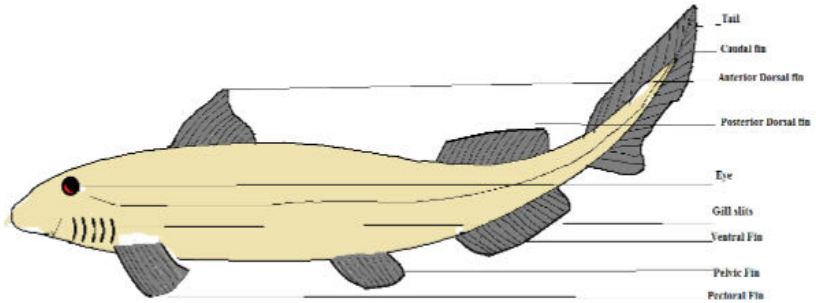

# PETROMYZON

## COMMENTS

- Petromyzon is popularly known as **"Sea Lamprey"**
- *Petromyzon marinus* is a **marine organism**. It is an **ectoparasite**. It sucks blood of fishes and turtles.
- It has an elongated cyclindrical and **eel like body**.
- The body consists of 3 regions namely **head ,trunk and a tail**.
- The head is cylindrical and has **a buccal funnel**, a mouth, a single naris ,a pair of eyes and seven pairs of gill slits.
- The mouth is surrounded by a cup like structure called buccal funnel.
- The centre of the buccal funnel has a circular mouth. A tongue protrudes through the mouth.
- The tail is laterally compressed. It has a caudal or tail fin.
- The **skeleton is cartilaginous** and not bony. It is made up of skull, vertebral column, and a set of rods.
- The circulatory system is closed type.
- The **excreatory system** is made up of a pair of **mesonephric kidneys**

# SHARK

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | NEOSELACHII |





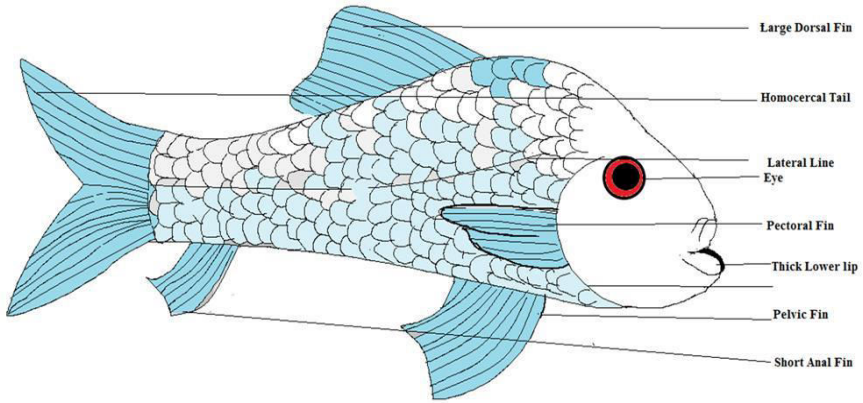

# SHARK

## COMMENTS

- It is commonly known as dog fish or dog shark.Its zoological name is *Scoliodon sorrakowah*
- It is placed under the Phylum- chordata; Sub-phylum-Vertebrata;Super Class – Pisces; and Class- Chondrichthyes since its **skeleton is made of cartilage**
- It is a marine animal .It has **placoid scales** and **a ventralmouth**.
- The jaws are provided with **homodont teeth**.
- There are **two dorsal fins** and **a ventral fin.** The first dorsal fin is triangle shaped and the second dorsal fin is rectangle shaped.
- Tail is **heterocercal**and surrounded by caudal fin.
- The **pectoral and pelvic fins are paired**.
- **Five pairs of gills** are present and the gills are not covered by operculum.
- The body is sandy brown with pale spots and pale vertical stripes.
- It **feeds on planktons** that floats
- in the sea.
- It grows to a length of 21 metres
- It exhibits **sexualdimorphism**
- It yields large quantity of oil.
- It has great **experimental value** because of its availability and size

# CATLA

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |





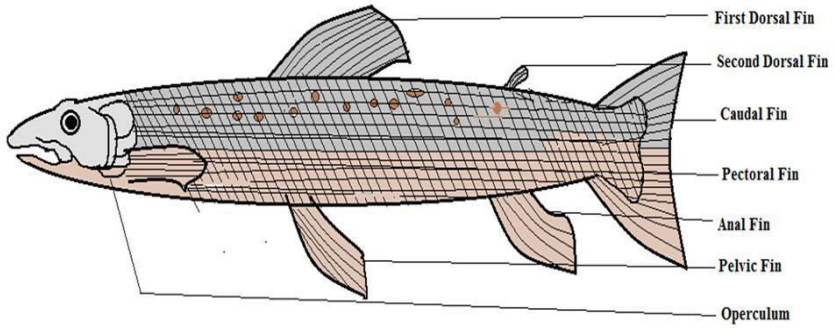

# CATLA

## COMMENTS

- It is a **bony fish**.
- It is a **food fish**
- **Head is large** with eyes but **no barbels**.
- **Dorsal fin is large** and anal fin is short.
- Lateral line continuous seen extending to the centre of the caudal fin.
- Upper lip is absent, but **prominent thick lower lip** is present.
- It is a very strong active fish.
- It lives in fresh and brackish water.
- Body is laterally compressed, fusiform and covered with **cycloid scales**.
- Jaws are without teeth.
- It is much esteemed as food. It grows to a length of 6 feet and weighs over 50 kg.
- This fish is suitable for aquaculture

# SALMON

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |





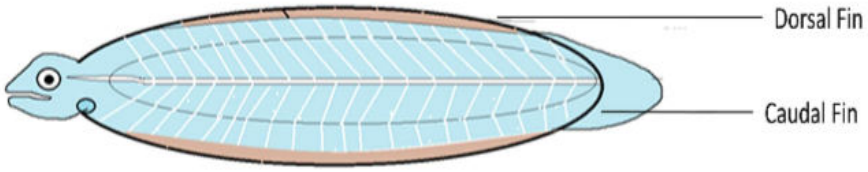

# SALMON

## COMMENTS

- It is commonly known as trout
- Salmon fish is a large **silver-coloured fish** that lives in both freshwater and marine water.
- The dorsal Fin (provides steering control and balance), the pectoral and pelvic Fins (Aids in stabilization),anal Fin(Provides balance), tail fin(helps in propulsion) and a adipose fin.
- Teeth are homodont
- The **pectoral** fins and the **pelvic fins are the paired fins**.
- **Pelvic fin is abdominal**
- They respire through gills.
- They have **swim bladders** that help them to maintain buoyancy.
- Tail is **homocercal**
- A small adipose **dorsal fin is present on the back**, is the characterisitic feature for identification.
- Salmons exhibits **anadromous migration** as they migrate from fresh water to the oceans for breeding and then return to freshwater.
- Salmon is consumed as **food** and it shares major contributor to the world production of **farmed finfish**, representing about ten billion US dollars annually.

# LEPTOCEPHALUS

| | |
|---|---|
| **PHYLUM** | **CHORDATA** |
| **CLASS** | **ACTINOPTERI** |






# LEPTOCEPHALUS

## COMMENTS

- It is the **larva of the eel**, a fresh water fish that undergoes **catadromous migration**.
- It looks like a Nerium leaf and is transparent.
- It leads a **pelagic life**.
- Leptocephali have dorsal and **anal fins confluent with caudal fins**.
- The pelvic fins are absent.
- They move with typical anguilliform swimming motions and can swim forwards and backwards
- It has a long larval period of 2-3 years.
- Then it becomes the next larva called Elver which metamorphose into an adult.
- Leptocephali differs from most fish larvae because they grow to much larger size and have long larval periods.

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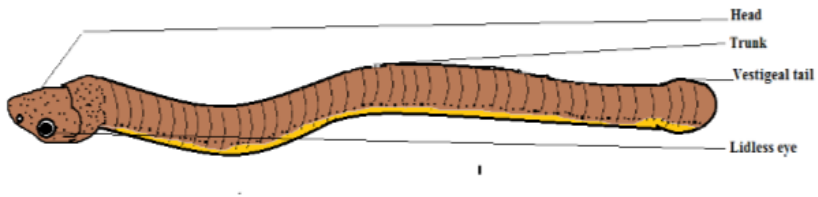
# CLASS: AMPHIBIA

# ICHTHYOPHIS

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | AMPHIBIA |





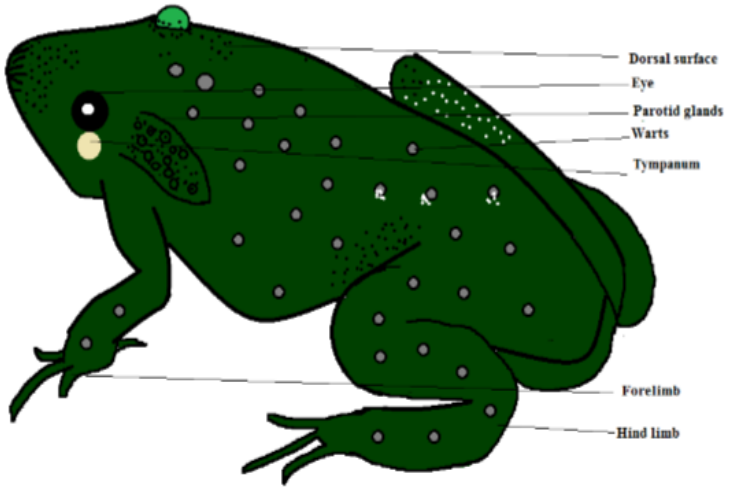

# ICHTHYOPHIS

## COMMENTS

- Ichthyophis is commonly called caecilian or **blind worm**.
- In evolutionary point of view, this animal is described as "die-hard of evolution".
- It is a **limbless amphibian**. It is a burrowing animal.
- It lives in moist places.
- It is carnivorus.
- The body is worm like with 200-400 ring like circular folds of slimy skin.
- The **skin** is wrinkled with **minute scales**.
- The body consists of a head, a trunk and a short tail.
- The head has a mouth , a pair of nostrils and a pair of eyes and a tentacular pits below the pits.
- The trunk is without limbs. The posterior end has a cloacal aperture.
- Mouth subterminal,small fish like dermal scales hidden in the skin.
- **The tail is short** and laterally compressed.
- The sexes are separate.
- **Female** shows **parental care** by coiling around the eggs.
- The larva has 3 pairs of external gills.
- It is found in Alibag ,Anaimalai and Nilgiris and Kottayam of South India.

# BUFO

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | AMPHIBIA |





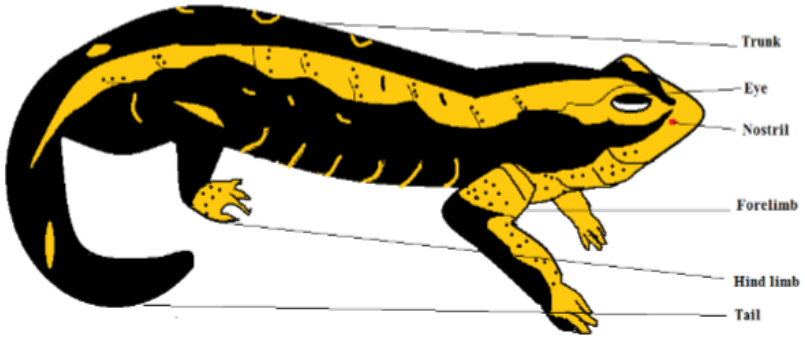

# BUFO

## COMMENTS

- Bufo is the **toad**.
- It is an **amphibian**.it **has no tail** and hence it is included in the order Anura.
- It is more terrestrial.it lives most of the time on moist land.
- It is **nocturnal** in habit.
- The **skin** is rough,dry and contains **warts**.
- The body consists of a head and a trunk.
- The head consists of a mouth, a pair of nostril, a pair of eyes and a pair of tympanum.
- Tongue is round, maxillary teeth is absent, has **partly webbed toes**.
- The skin is provided with warts.
- A pair of **parotid glands** is present behind the tympanum. they secrete a **poison fluid** which causes irritation to the victims.
- The trunk has a pair of forelimbs and a pair of hindlimbs.
- The posterior side has a cloacal aperture.
- It is **carnivorus**.
- It lays eggs in the water.

# SALAMANDER

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | AMPHIBIA |






# SALAMANDER

## COMMENTS

- **Ambystoma** is a terrestrial, **tailed amphibian**, commonly called tiger salamander or spotted salamander .
- It is a **true toad.**
- It is an **urodele amphibian.**it has a tail and hence it is included in the order urodela.
- The body consists of a head , a neck, a trunk and a tail.
- The head contains a terminal mouth , a pair of nostrils and a pair of eyes. Eyelids are present.
- A pair of **parotid glands** are present on the **head**. They secrete a poisonous fluid.
- The **neck has a gluarfold** .
- The trunk has a pair of forelimbs with 4 fingers and a pair of hindlimbs with 5 toes.
- Webs are poorly developed
- The tail is compressed without a tail fin.
- The sexes are separate. Fertilization is internal.
- The development is indirect. The larva is called **axolotyl**. This larva exhibits **neoteny**. It develops sexual organs in the larval stage , becomes sexually mature and reproduces.
- It is found in United States and Mexico.
- It lives in swampy places , it is nocturnal, hiding by day but active after dark.
- In some areas unisexual male populations occur.

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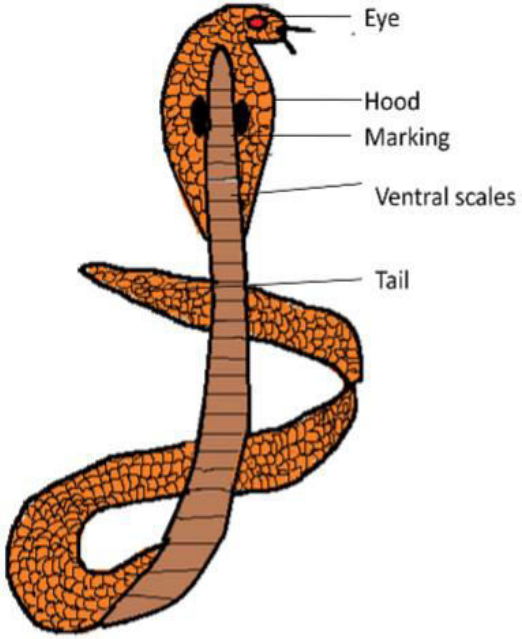
# CLASS: REPTILIA

# COBRA

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | REPTILIA |





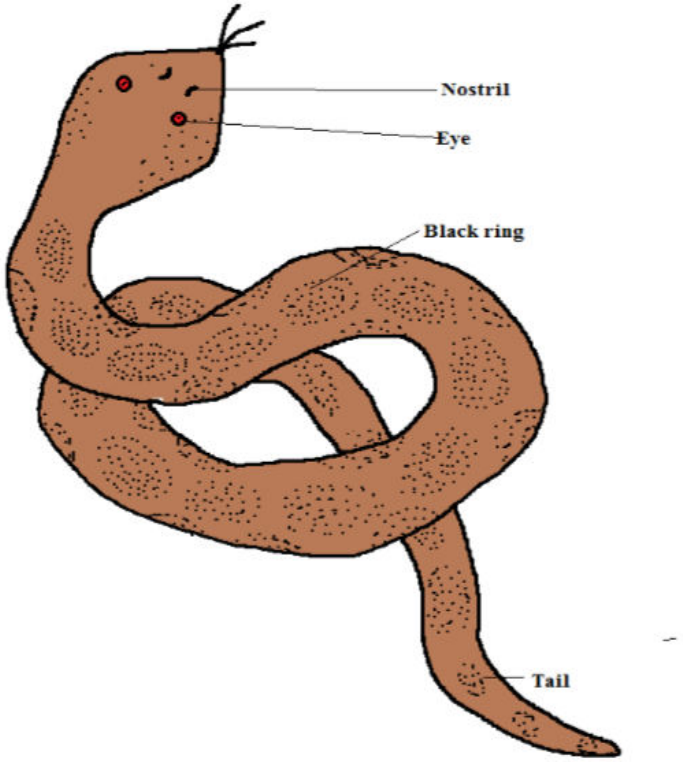

# COBRA

## COMMENTS

- It is a **poisonous snake**.
- It lives in burrows,deserted hills of termites,heaps of stones and stacks of woods.
- It is brown or black in colour and grows to a length of 6 feet.
- It feeds on frogs,lizard,rats and small birds.
- When disturbed , it raises its head and spreads its neck as a **hood** . The hood is supported by cervical ribs.
- The hood has a characteristic **spectacle mark on the dorsal side** and a pair of black patches on the ventral side.
- The head is not distinct from the body.
- The head is covered with by **shields**. The 3rd supralabial shield touches the eye and the nostril.
- It is **highly poisonous** .The poison is a **neurotoxin**. The poison affects central nervous system
- The poison of a single cobra can kill 15 person at a time.
- It has two poison glands and two fangs.
- The ventrals are enlarged and the subcaudals are double.
- Cobras are oviparous.the female lays 12-13 soft-shelled eggs and the female incubates.
- They help to maintain a prey-predator population balance in the ecosystem.
- Their venom is used to prepare antivenom.

# VIPER

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | REPTILIA |





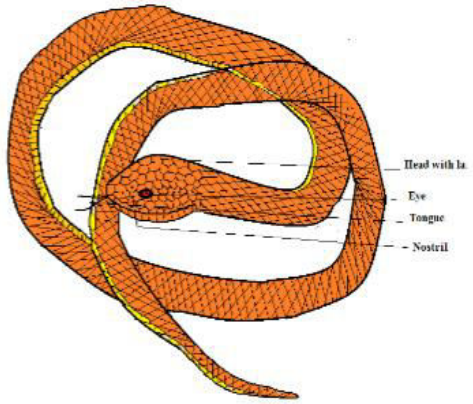

# VIPER

## COMMENTS

- It is a **poisonous** snake.
- It is commonly known as russel's viper or **pitless viper.**
- Its venom is highly poisonous and the poison is a **haemotoxin.**
- Its poison affects **circulatory system**
- It is **nocturnal** in habit.
- It grows to a length of 5 feet .
- The **head is distinct** and is triangular in shape.
- Eyes with golden iris are present.
- The head is covered with scales.
- The head bears a distinct "V-shaped" mark with the point of'v' looking forwards.
- Ventrals are broad.
- **Subcauals are double**.
- It is **viviparous** giving birth to 30 to 40 youngones at a time.
- It is **Carnivorous**. It Feeds on mice ,rats,lizard and frogs.
- They are the top predators that help keeping nuisance species like rodents and rabbits in check.
- Their venom is medically important.

# PTYAS

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | REPTILIA |





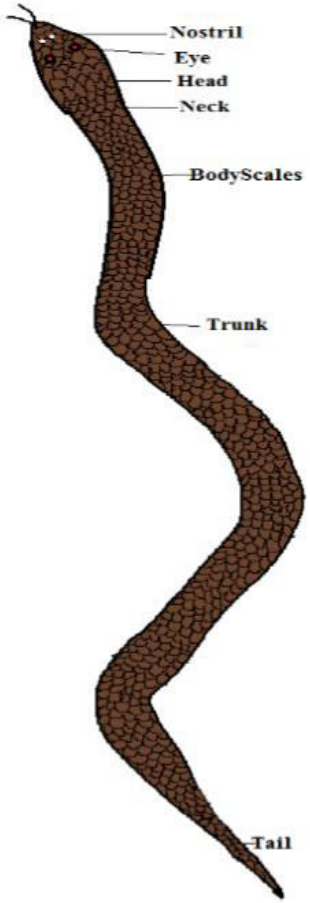

# PTYAS

## COMMENTS

- Ptyas is commonly called **rat snake**.
- It is found in India ,Burma,Italy,France,Africa and America.
- It is **non poisonous** snake.
- It lives in plains and it can also climb trees.
- It grows to a length of 7 feet.
- The colour is brown above with black cross bands on the posterior part of the body and tail and under parts are yellowish.
- The **head is distinct**.
- Eyes are large with rounded pupil and golden iris.
- The **fourth and fifth supralabial touch the eye**.
- Teeth are present but fangs are absent.
- The tail is long and **prehensile**.
- It is carnivorous in habit. It feeds on rats and considered to be a friend of the farmers.
- It is viviparous.
- They help in controlling the rodent population.
- Rat snakes are caught from the wild to feed king cobras in zoos.

# TYPHLOPS

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | REPTILIA |






# TYPHLOPS

## COMMENTS

- Typhlops is commonly called blind snake
- It is burrowing in habit.
- It is cosmopolitan in distribution . It is a non poisonous snake.
- It has a worm like body.The body is covered with scales.
- The pelvic girdle is vestigial .the head is indistinct.
- The eyes are small and covered by scales. It is carnivorous in habit. It is oviparous.
- Sebaceous glands are present on the body .
- It is brown in colour.
- Head indistinct; tail short, blunt and rounded.
- Few teeth are present in the upper jaw only.They reproduce by laying eggs.
- They are non-venomous and harmless snake.
- Blind snakes feed on the eggs and larvae of both termites and ants and also eat soft-bodied arthropods and their eggs.

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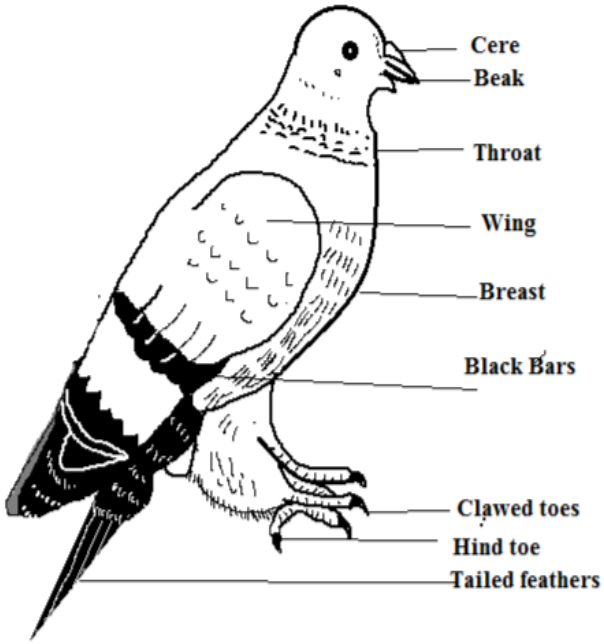
# CLASS: AVES

# PIGEON

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | AVES |






# PIGEON

## COMMENTS

- Pegeon is the most common **domesticated** bird , used as **messengers** in olden days.
- It is a slaty grey bird with glistening metallic green on the neck and the upper breast.
- They live in flocks.
- It is mostly seen in **semidomesticated** conditions.
- It is commonly found in grain warehouses,railway stations and old buildings.
- Wild pigeon occupy hilly forts and such like places.
- It feeds on cereals,pulses,groundnuts,etc.,
- The members of both sexes do all domestic duties.
- Body is divisible **into head, neck, trunk and tail**.
- Head contains **large eyes** and silt like nostrils.
- The **forelimbs** are modified into **wings**.
- The **hind limbs** are modififed for **bipedal locomotion**
- Upper and lower beaks are covered by the horny sheath,called rhampotheca.
- The base of the upper beak has a patch of skin called cere.
- The pigeons serve as food for predators such as peregrine falcons, hawks, foxes and martins.
- They also control insect species in an environment as well as weeds such as thistles. These birds also play a part in seed dispersal.

# OSTRICH

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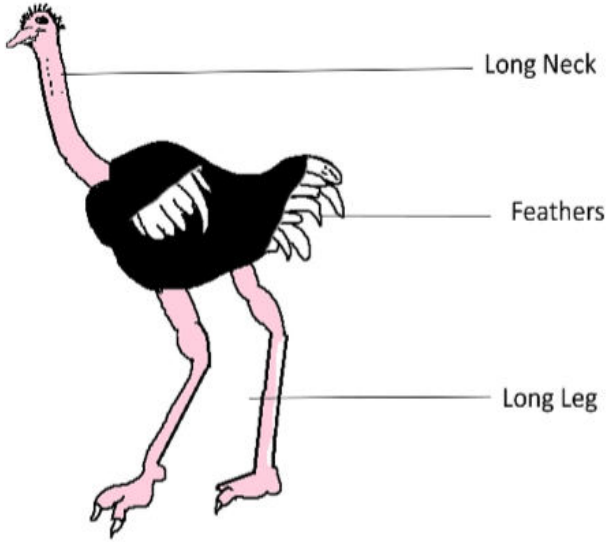
|---|---|
| PHYLUM | CHORDATA |
| CLASS | AVES |






# OSTRICH

## COMMENTS

- Ostrich are **the largest of living birds**.
- They grow to a height of 2.4 metres and height about 157kg
- The **thighs are large** and bare.
- There are no rectrices.
- There are only two toes.
- The **neck is long** and bare.
- Ostriches are **omnivores** but mainly herbivores.
- They have the **habit of picking up and swallowing** any bright or metallic objects.
- Ostriches are **polygamous**. The males usually have one major hen and 2 or more minor hens.
- It weighs about 1.5kg.
- The eggs hatch in 42 to 48 days.
- The youngones are **precocious**.
- Ostriches are **economically important** as they are raised commercially in farms for their meat and feathers.

# ARCHAEOPTERYX

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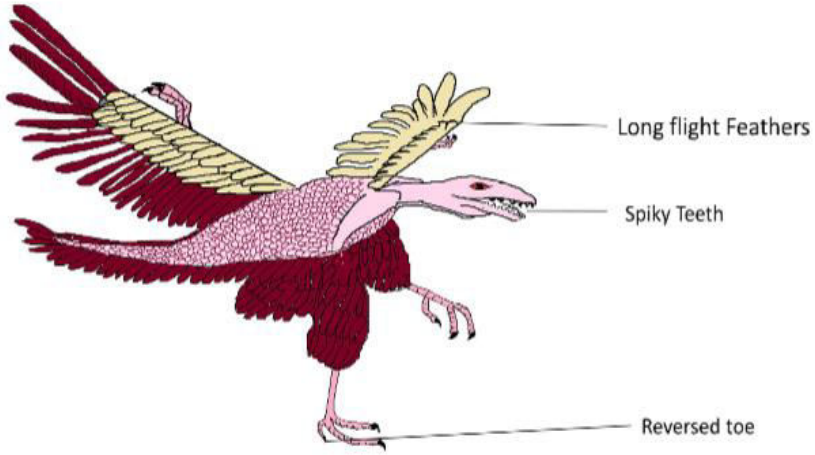
|---|---|
| PHYLUM | CHORDATA |
| CLASS | AVES |






# ARCHAEOPTERYX

## COMMENTS

- Archaeopteryx is a **first toothed bird**.
- It is a **connecting link** between reptiles and birds.
- It is **fossil animal**. Hence it is called a missing link.
- Though it is a bird ,it retains many reptilian characters.hence it is intermediate between reptiles and birds.

### REPTILIAN CHARACTERS

- Jaws are provided with homodont teeth.
- The tail is long ,lizard like and with 20 free caudal vertebrae.
- Bones are not pneumatic.
- Cervical vertebrae are fewer ,9 or 19.

### AVIAN CHARACTERS

- Presence of feathers. If the feathers of archaeopteryx were not preserved in the fossil ;it would have been taken for some bipedal diapsid reptile.
- Fore limbs are modified as wings.
- Tail bears two rows of feathers.
- Rounded brain case.
- Bones in the skull are intimately fused.
- Beaks are present.
- Bones in limbs and girdles are bird like
- A' V'-shaped furcula is present.
- Tibia and fibula are present
- A keel is present on the sternum.
- It was **the first reptilian fossil found with clear evidence of feathers**.
- *Archaeopteryx* is a good example for a transitional fossil between non-avian dinosaurs and birds. It plays an important role in the evolutionary study of origin of birds, and also the study of dinosaurs.

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# CLASS: MAMMALIA

# PANGOLIN

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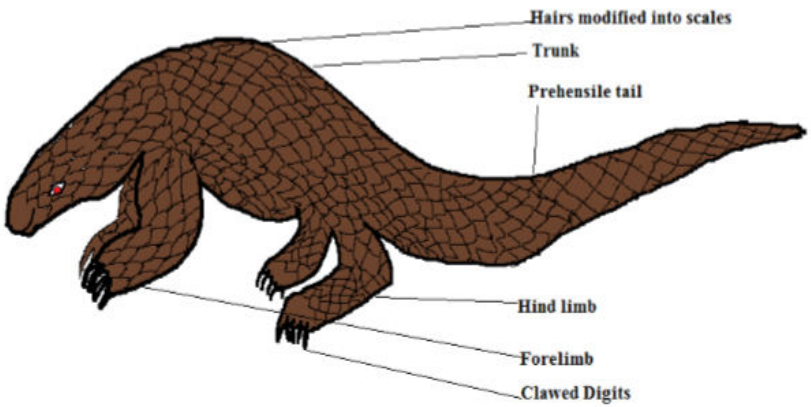
|---|---|
| PHYLUM | CHORDATA |
| CLASS | MAMMALIA |






# PANGOLIN

## COMMENTS

- Manis is commonly knowns as **pangolin** or scaly anteater.
- The dorsal surface of the body is covered with imbricate **epidermal scales** Hairs are present inbetween the scales. The scales cover the head,trunk,and even limbs.
- The head is produced into a short **pointed snout**.
- **Teeth are absent** and the tongue is long ,viscous and extensible and adapted for feeding on ants and termites.
- The limbs are short and provided with powerful claws for digging.
- The **tail** is long and **prehensible**.
- It is nocturnal in habit and **insectivorous** in diet.
- It has the habit of rolling into a ball as a protective measure.
- They help to control the population of ants and termites and help in destruction of pests

# KANGAROO

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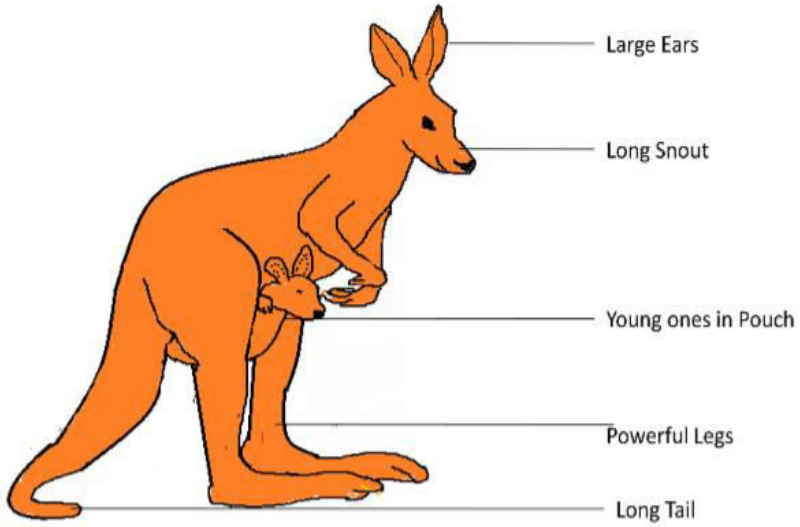
|---|---|
| PHYLUM | CHORDATA |
| CLASS | MAMMALIA |






# KANGAROO

## COMMENTS

- Kangaroo(Macropus) is a **marsupid mammal**.
- It lives in **Australia** and **Tasmania**.
- It is terrestrial,gregarious and herbivorous.
- It grows to a height of 2 metres.
- The body consist of head,neck,trunk and a tail.
- Anterior half of the body is small ,but the posterior half is large.
- **Forelimbs** are short used for feeding and not for **walking**.
- **Hind limbs** are long and thick and used for **locomotion**.
- Tail is long,round and thick and used as a balancing organ while jumping.
- It exhibits bipedal locomotion.
- The **female** has a **marsupium** on the ventral side.
- Gestation period is 35 to 45 days .the newly born youngones is 3cm long. It is kept inside the marsupium for 4 to 6months.
- It is hunted for flesh,fur and sport.
- They play an important role of **promoting the regeneration of native plants.**
- Kangaroos' soft padded feet and long tail are integral to the ecological health of the land, as regenerators of native grasses.
- The excretory matter of Kangaroo is a natural fertiliser that promotes the health of the soil.

# RABBIT

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | MAMMALIA |




# RABBIT

## COMMENTS

- Rabbit is an example for **typical mammal** as its body is covering with hair and provided mammary glands..
- It gives birth to youngones and nourishes them with milk.
- It is a warm blooded animal.
- It enjoys cosmopolitan distribution.It lives in forest. It is **gregarious**. It lives in groups.
- It is a **burrowing** or fossorial animal. It is **herbivorous**. It is **domesticated** for flesh.
- It is used extensively for biological and medical researches.
- Rabbit is **polygamous** and one male lives with many females.
- It is usually brown in colour.
- It is about 16 inches long and it weighs 2 to 4 pounds.
  Rabbits **alter plant species composition and vegetation structure through grazing and seed dispersal** and helps to preserve plant species diversity.
- Rabbit burrows provide nest sites and shelter for vertebrates and invertebrates

# WHALE

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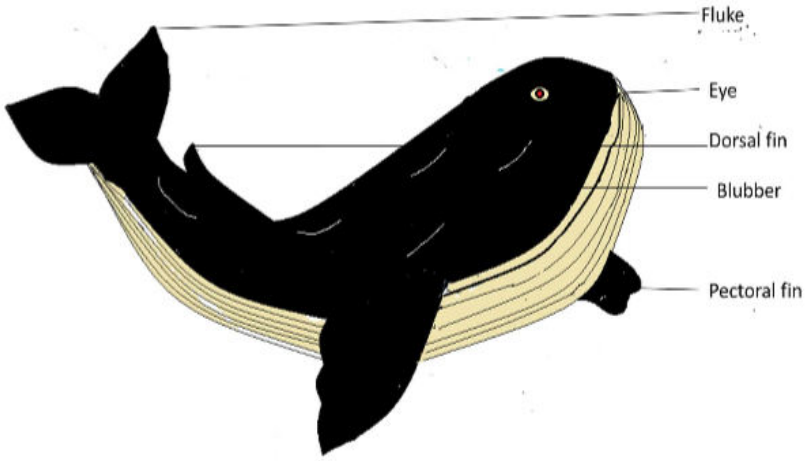
|---|---|
| PHYLUM | CHORDATA |
| CLASS | MAMMALIA |






# WHALE

## COMMENTS

- Whales are **aquatic mammals**.
- They are **the largest living animals**.
- They are **marine animals**.
- They belong to the order cetacea.
- Blue whale is the largest whale.
- It reaches a length of 100 feet and weighs 150 tonnes.
- The teeth are replaced by baleen plates.
- It is a **plankton feeder**.
- The pectoral fins are modified into the flippers. The tail has flukes.
- Whales are well adapted for aquatic life.
- Their aquatic life is secondary.
- Whales are an important part of the marine food chain and play a huge role in maintaining the health of our oceans.
- They play a significant role in capturing carbon from the atmosphere; thus playing their part in the fight against climate change.

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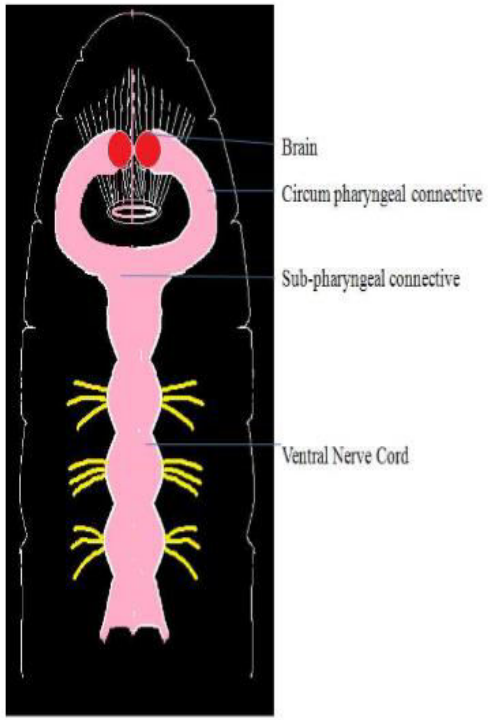
# ANATOMICAL OBSERVATION

# EARTHWORM: NERVOUS SYSTEM






# EARTHWORM: NERVOUS SYSTEM

## COMMENTS

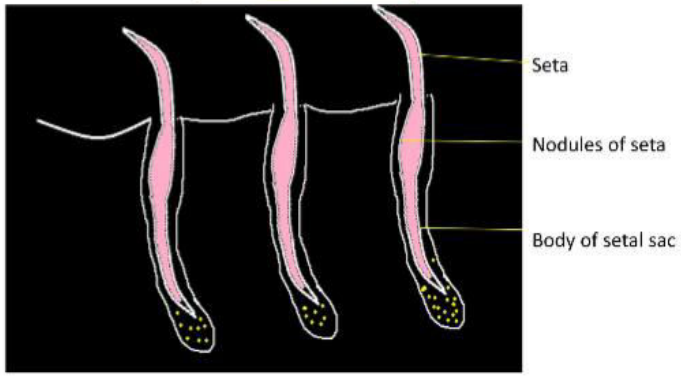
- Earthworm has a well developed nervous system. The nervous system of earthworm consists of Central, Peripheral and Sympathetic nervous system

## CENTRAL NERVOUS SYSTEM

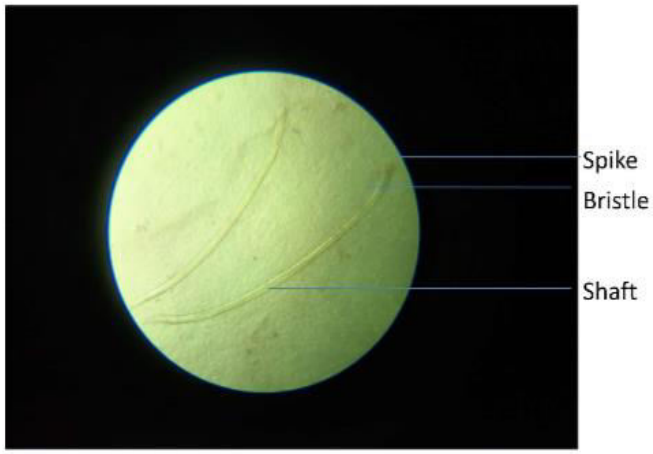
- It consists of the nerve ring or brain ring and the ventral nerve cord.
- **THE NERVE RING :** A pair of cerebral or supra pharyngeal ganglia is fused together to form brain which lies dorsally in the 3$^{rd}$ segment. From the brain , a pair of circum –pharyngeal connective arise one on each side, encircle the pharynx and meet ventrally in the 4$^{th}$ segment
- **NERVE CORD:** The double ventral nerve cord originates from the sub-pharyngeal ganglia and runs on the mid-ventral side beneath the ventral vessel, extending to the posterior end of the body.
- **PERIPHERAL NERVOUS SYSEM:** The nerves arise from central nervous system and supply to various parts of the body. The nerves,2-3 pairs arise from the brain, 2-3 pairs of nerves arise from the circum-pharyngela connective, 3 paris arise fromsub-pharyngeal ganglion and 3 pairs of nerves arise from each segmental ganglion
- **SYMPATHETIC NERVOUS SYSTEM:** It includes the nerve plexus situated in the wall of the alimentary canal and some other internal organs.

# EARTHWORM: BODY AND PENIAL SETAE

Body setae




Penial setae






# EARTHWORM: BODY AND PENIAL SETAE

## COMMENTS

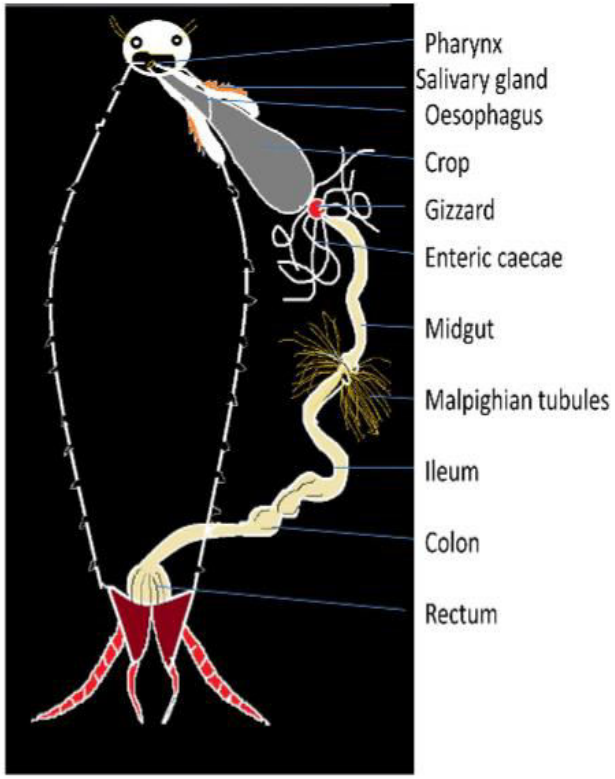
### BODY SETAE

- The skin of earthworm contains numerous bristle like, f shaped structure called setae.
- They are enclosed in a sac called setal sac, formed of chitin.
- Each setae has three regions, namely the base, the nodules and the neck. The base is located inside the setal sac. The nodulus is the middle swollen region.The neckprojects outside.
- The setae are used for locomotion.

### PENIAL SETAE:

- A pair of setae are protruding through each male genital aperture.
- The penial seta consists of a shaft, a spike and numerous bristles.
- They are used for copulation.

# COCKROACH : DIGESTIVE SYSTEM






# COCKROACH : DIGESTIVE SYSTEM

## COMMENTS:

The digestive system of cockroach includes the mouth-parts,alimentary canal and associated glands.

## ALIMENTARY CANAL

It consist of three regions, the fore-gut or stomodaeum , the mid-gut or mesenteron and the hind-gut or proctodaeum.

FORE-GUT:

- It is composed of the pre-oral cavity; mouth,pharynx,oesophagus, crop and gizzard
- The preoral cavity is bounded in front by the labrum,posteriorly by the labium and an each side of the mandible and maxilla.
- The mouth lies on the roof of the pre-oral cavity.
- The mouth leads into a tubular pharynx, which is followed by a slender,narrow oesophagus.
- It expands into a large sac called the crop.
- The crop opens into a gizzard.

## MID-GUT:

It is a short narrow tube line with glandular endodermal cells. Mid gut arises seven or eight blind tubular out growths called hepatic caeca.They project into the haemocoel.

## HIND GUT

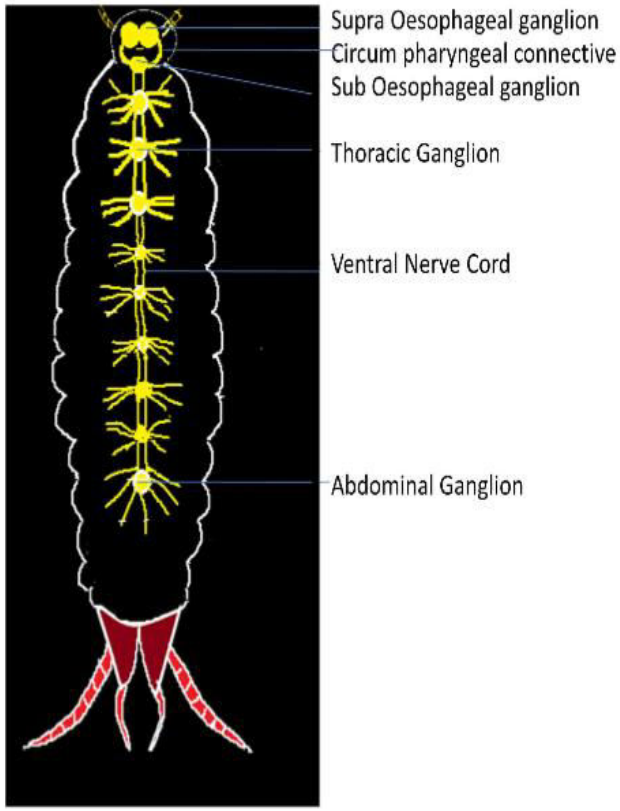
It is formed of three parts,namely ileum ,colon and rectum. The rectum opens by the anus lying posteriorly below the tenth tergum.

## DIGESTIVE GLANDS:

SALIVARY APPARATUS: cockroach has a salivary apparatus.

It is located on the sides of oesophagus. It consists of two pairs of salivary glands and a pair of salivary receptacles.

# COCKROACH : NERVOUS SYSTEM






# COCKROACH : NERVOUS SYSTEM

## COMMENTS:

The nervous system comprises of three parts, including the central nervous system, peripheral nervous system and autonomic or sympathetic nervous system.

### CENTRAL NERVOUS SYSTEM

- The central nervous system consists of a brain , a ventral nerve cord and ganglia.
- The brain is the supra-oesophageal ganglion.it is a large, white bilobed mass and it lies in the head above the oesophagus.
- Below the oesophagus there is another ganglion,the sub-oesophageal ganglion.
- The brain and the sub-oesophageal ganglion are connected on either side of the oesophagus by a nerve called circum oesophageal connective.
- A double ventral nerve cord starts from the sub oesophageal ganglion and runs backwards along the midventral line of thorax and abdomen.
- The last abdominal ganglion is the largest one. It is formed by the fusion of a number of ganglia.

### PERIPHERAL NERVOUS SYSTEM

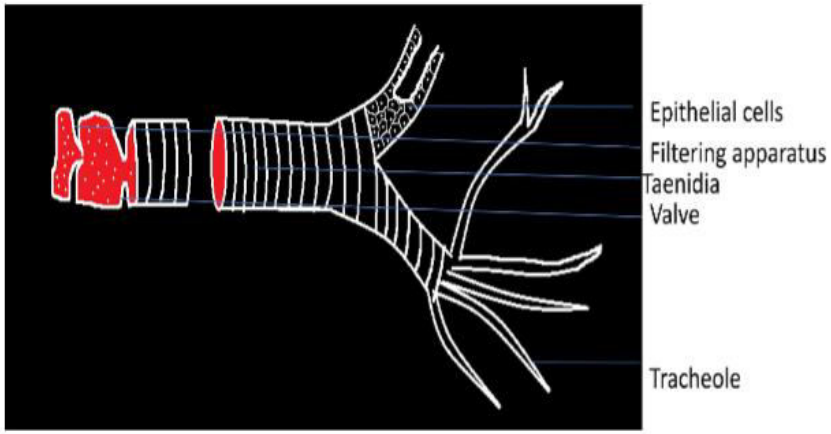
The peripheral nervous system comprises the nerves which arise from the central nervous system and to go various parts of the body .three pairs of nerves which are known as optic,antennary and lobro frontal nerves.

The sub- oesophageal ganglion supplies mandibular,maxillary and labial nerves to the mandibles and maxillae and labium respectively.

### AUTONOMIC OR SYMPATHETIC NERVOUS SYSTEM

It includes few ganglia and connectives.A frontal ganglion is lying on the oesophagus just in front of the brain. It is connected to the brain by a nerve called frontal connective.A third ganglion is located on the crop and it is known as ingluvial ganglion. The fourth ganglion called proventricular ganglion is lying on the gizzard.

# COCKROACH : TRACHEA






# COCKROACH : TRACHEA

## COMMENTS:

Cockroach exhibits aerial respiration. The respiratory system is formed of a system of air filled tubes called tracheal system. The tubes of the tracheal system are called tracheae.

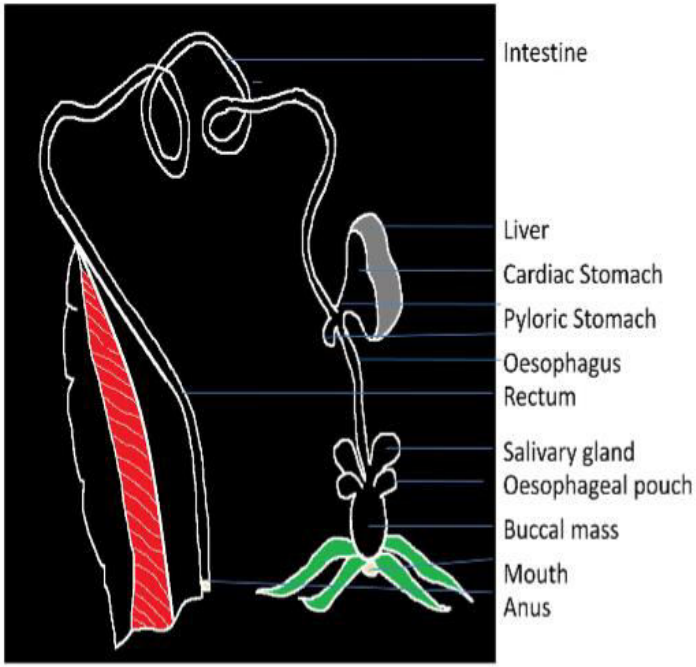
There are 6 large longitudinal tubes called tracheal trunks. They are interconnected by transverse commissures. The spiracle opens into a wide chamber called atrium. The atrium has a filtering apparatus and a valve. The tracheal trunks branch and rebranch to form a network of fine tubes called tracheoles.

- The respiratory structures, the tracheae, are considered as most, efficient for utilizing atmospheric oxygen. The respiratory organs consist of tracheae or air tubes and their branches or tracheoles which are directly communicated with the exterior.
- The tracheae open to the exterior by ten pairs of apertures, the spiracles or stigmata. Two are placed on each side of the thorax; one between pro-and mesothorax and the other between meso-and metathorax. Eight occur on each side of the abdomen between terga and sterna of the first eight segments.
- The stigmata are guarded by hairs, etc., to prevent the entrance of harmful particles. Each spiracle is controlled by muscular valves. From each spiracle leads inward a small tube which ends in a stout trachea and all of them are connected by longitudinal and transverse tracheae.
- There are two lateral longitudinal tracheal trunks, one on each side of the body. They are connected by several transverse tracheae, and the tracheae form a system of intercommunicating network. Each trachea divides and subdivides into numerous branches and the ultimate, very fine branches entering the organs are called tracheoles. The tracheoles end in tissues. The wall of the trachea is strengthened by chitinoid lining in the firm of spiral threads.

### Mechanism of Respiration:

The alternate expansion and contraction of the abdomen brings inhalation and exhalation of air in the tracheal system. The opening and closing of the spiracles are also dependent on the $CO_2$ concentration of the inhaled air. The walls of the tracheoles allow gaseous exchange and diffusion takes place between the cell sap and the lumen of the tube. The tissues get direct supply of oxygen from the atmospheric air.

# PILA:DIGESTIVE SYSTEM






# PILA:DIGESTIVE SYSTEM

## COMMENTS:

The digestive system is formed of the **alimentary canal** and **digestive glands**.

### ALIMENTARY CANAL

- Alimentary canal is well developed and consisits of the mouth ,buccal mass, oesophagus, stomach
- intestine,rectum and anus.
- Mouth is a slit like opening and leads into buccal mass. The mouth cavity contains a pair ofcuticular jaws and a radula. The radula is ribbon shaped and it lies on the elevated ridge odontophore on the floor of buccal mass.
- Radula is formed of flap and a narrow strap.The strap contains transverse rows of teeth. The teeth are seven in number.They are,Central (or)median rachidian teeth,Two small lateral teeth and Four marginal teeth.
- The teeth are secreted by odontoblast. Buccal mass leads into the oesophagus,it opens into the stomach. There are two pouches(oesophageal pouches) lying near anterior oesophagus.
- The stomach is divisible into two region namely,Cardiac region (sac) and Pyloric region (tubular)
- A small rounded caecum arises from pyloric region and leads into intestine .
- Intestine is long and coiled,it elongates into rectum which opens into the mantle cavity by the anus.

### DIGESTIVE GLANDS:

Pila has two types of digestive glands, they are **salivary glands** and the hepatopancreas.

### SALIVARY GLAND:

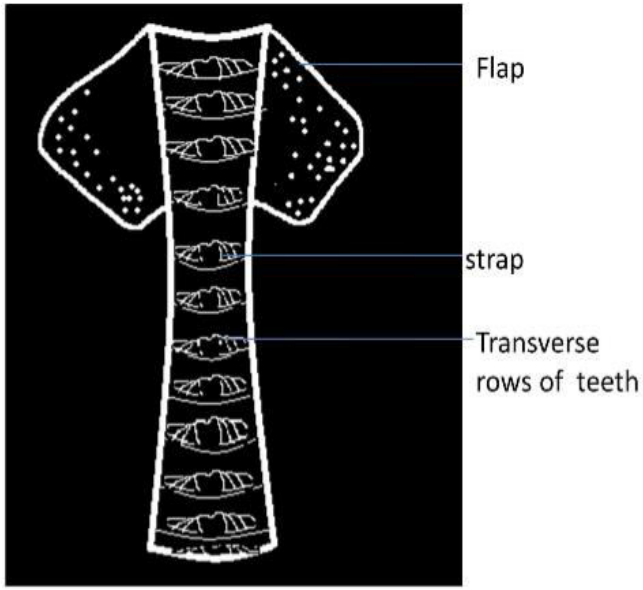
Pila has a pair of salivary gland ,located at the dorsal side of oesophageal pouches. Each gland has a salivary duct and opens into buccal cavity. Saliva contains mucous and enzymes.

### HEPATOPANCREAS:

It lies in visceral mass, brownish in colour. It is formed of two lobes. The tubules of each lobe unite together to form a common duct called hepatic duct . It opens into stomach at junction of cardiac and pyloric region.

Hepatopancreas is formed of 3 types of cells,Secretory cells,Resorptive cells and Lime containing cells. The Secretory cells secrete enzymes. The resorptive cells digest proteins intracellularly. The lime containing cells store calcium carbonate

# PILA: RADULA



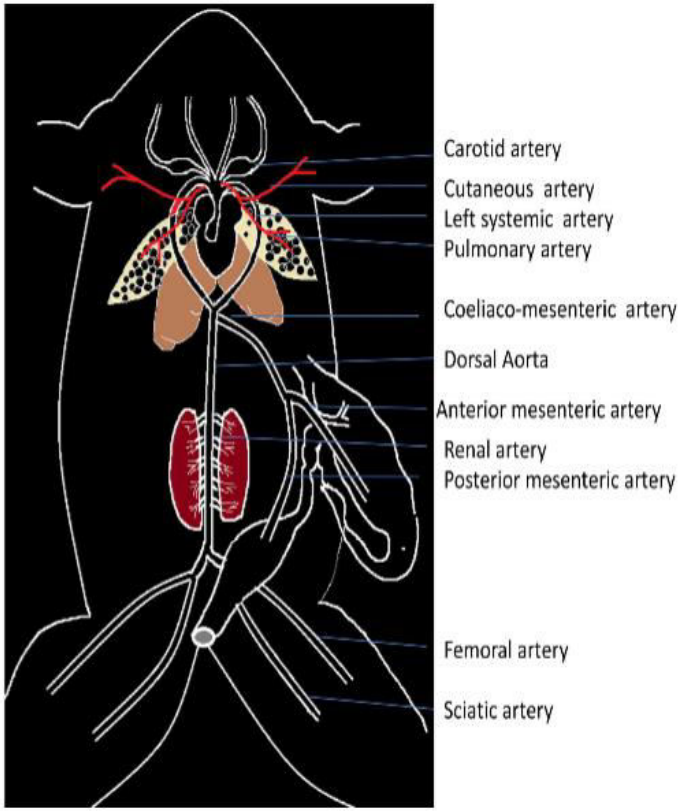



# PILA: RADULA

## COMMENTS:

- Radula, a rasping organ is present in the radular sac of the buccal cavity, is a unique characteristic feature of mollusc.
- The radula has many transverse rows of horny teeth .
- There are 7 teeth in each row. Two marginal, one lateral tooth on each side and a central tooth in the middle. The dental formula is 2,1,1,1,2. The radula moves forward and backward on the odontophore, the elevation in the floor of the buccal cavity. This movement helps in rasping the food particles and the movements are knowns as “chain saw” movements
- The teeth are made up of chitin with sharp cutting projections. They help to cut the plant food
- The teeth of radula are renewed by odontoblasts.

# FROG: ARTERIAL SYSTEM






# FROG: ARTERIAL SYSTEM

## COMMENTS:

The system of blood vessels carrying blood from the heart to various parts of the body is called the arterial system. The arterial system starts from a large vessel called truncus arteriosus .it arises from ventricle through conus arterious.The truncus arterious divides into two aortic arches.Each arch divides into three branches namely carotid arch ,systemic arch and pulmocutaneous arch.

**CAROTID ARCH**:Carotid arch supplies the blood to the head region. Carotid arch of each side gives external carotid artery and internal carotid artery.Internal carotid supplies blood to the tongue and hyoid apparatus.It has a small carotid labyrinth which detects changes in blood pressure.

**PULMOCUTANEOUS ARCH:** It supplies blood to the lungs

**SYSTEMIC ARCH**:Each systemic arch curves around the oesophagus and meets the systemic arch of two sides forming a median vessel, the **dorsalaorta** lying close to the vertebral column.From each systemic arch, many arteries arise.

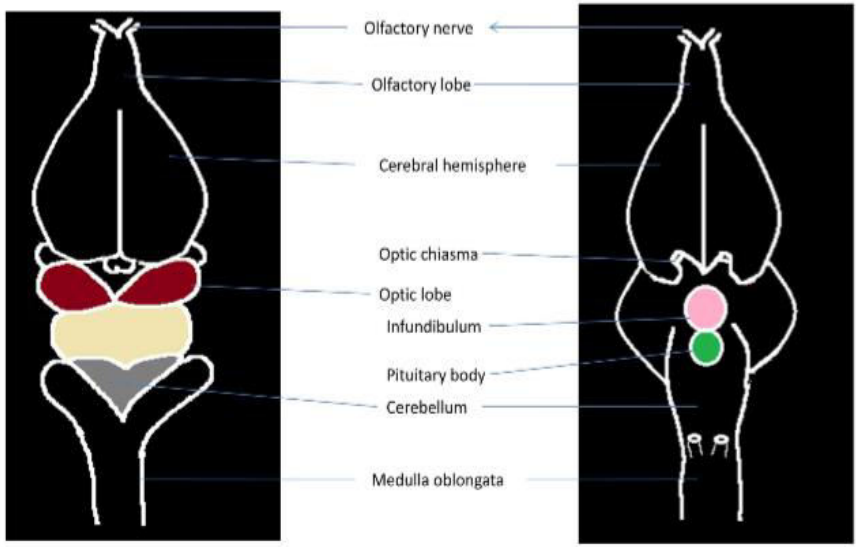
**Sub Clavian Artery** : It supplies blood to the **shoulder** and the **forelimbs**.

**Oesophageal Artery:**It supplies the blood to oesophagus .

The dorsal aorta runs posteriorly beneath the backbone and passes between the kidneys, it gives off arteries namely,

- **Coeliaco- Mesenteric Artery:** It is a large unpaired vessel that arises at apoint ,where systemic arches unite to form dorsal aorta it divides into two branches,**Coeliac artery** – it supplies the blood to liver and stomach.**Mesenteric artery** – it supplies blood to intestine.
- **Gonadial Arteries:**They are spermatic artery in male and ovarian arteries in female they supply blood to the gonads.
- **Renal Arteries**:It supplies blood to kidneys.
- **Iliac Arteries:**It gives off ventrally a vesiculo -epigastric artery it supplies blood to abdominal muscles and urinary bladder. Iliac divides into fernoral and sciatic arteries.**Femoralartery** supplies blood to the **pelvicregions**and upper **thighregion** . The **sciaticartery** supplies blood to **hindlimbs**.

# FROG: BRAIN




Dorsal View Ventral View



# FROG: BRAIN

## COMMENTS:

In Frog, the brain is highly developed.It is located inside the cranium .It contains three regions namely;

- Anterior prosencephalon (fore brain)
- Middle mesencephalon (mid brain)
- Posterior rhombencephalon(hind brain)

### PROSENCEPHALON:

It includes the telencephalon. The telencephalon is made up of **cerebrum. T**here are two olfactory lobes, they are responsible for sense of smell. Behind olfactory lobes, there are two large **cerebral hemisphere**.

The surface of cerebral hemisphere is smooth . The cerebrum is a seat of intelligence and consciousness and it regulates the voluntary movements.

The **diencephalon** is posterior to the cerebral hemisphere.There is a small knob like structure called **pineal body** attached to the epiphydis.

The ventral side of diencephalon has a X- shaped structure called **optic chiasma**, formed by optic nerves. Just behind the optic chaisma, infundibulum is present . It carries a hypophysis.Infundibulum and hypophysis join together to form **pituitary gland. It** is an endocrine gland.

### MESENCEPHALON:

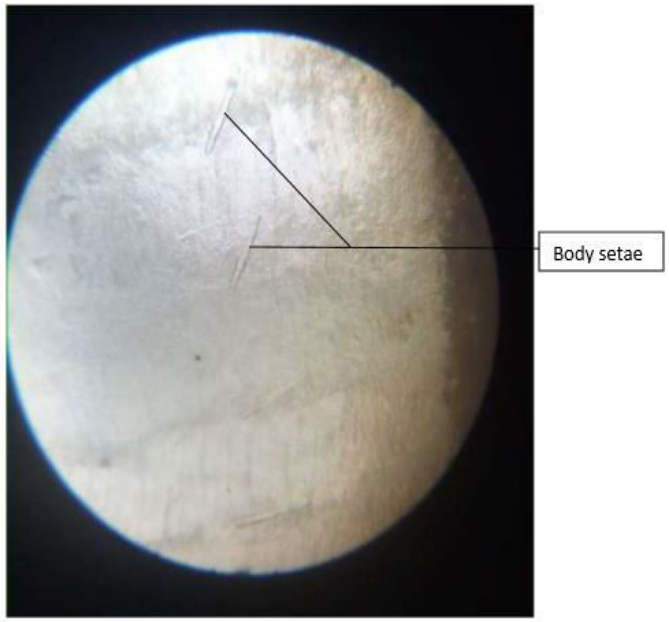
Mid brain has a pair of oval shaped bodies called **optic lobes**. As optic lobes are two in number , they called corpora bigemina.

### RHOMBENCEPHALON:

It consists of anterior **cerebellum** and a posterior **medulla oblongata**. The cerebellum coordinates the movement of the body .The medulla oblongata regulates respiration, heart beat , metabolism etc.,

# MOUNTING

## BODY SETAE OF EARTHWORM






## BODY SETAE OF EARTHWORM

COMMENTS:

**AIM:** To mount the body setae of earthworm

**MATERIALS REQUIREMENT:**

| | |
|---|---|
| **BIOLOGICAL SAMPLE:** | Mature live Earthworm |
| **EQUIPMENT :** | Compound Microscope, Camera/ smart phone for capturing images, |
| **GLASSWARE AND APPARATUS:** | Smallbeaker, forceps, spirit lamp, scissor, dropper Petridish, Slide, Coverslip, |
| **CHEMICALS :** | 10% KOH solution |

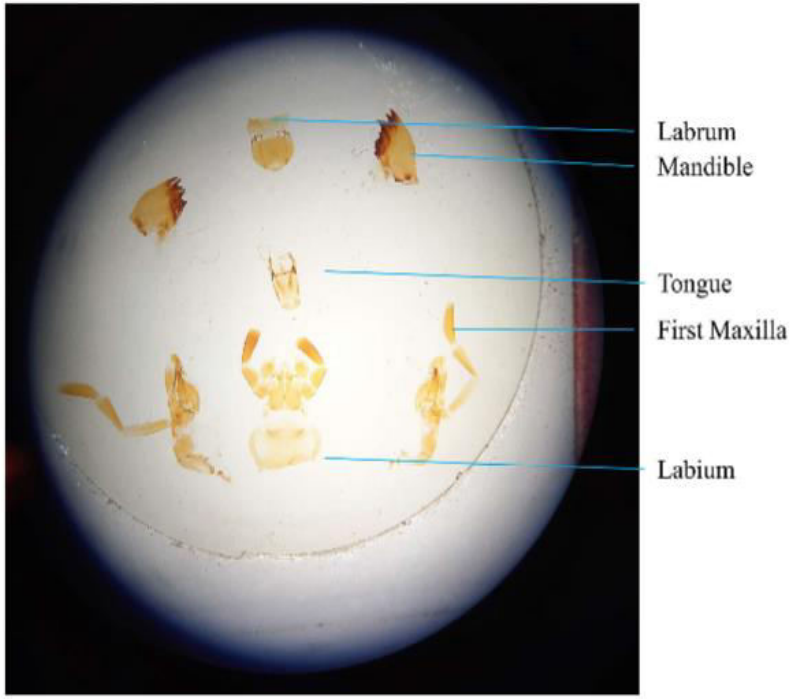
**PROCEDURE:** A mature, live earthworm was taken and kept in a beaker containing water. A cut was made using a razor blade to get a small segment(ring form). Again the cut was made in the lateral side to get a sheet of skin. It was well cleaned by removing blood vessels and other debris using water. As the setae, found in the ventral side, this area(the external side facing up) has to be kept on the slide. Following, two drops of 10% KOH solution was added , placed a cover slip over it without air pubbles. A gentle press was made using the tip of the needle or any other materials to make smear. The prepared slide was observed using the compound microscope.

**RESULT** : Each segment of the ventral side contains numerous body setae. The setae were clearly visible

**INFERENCE:** The embedded setae are protruded outside of the setal sac when KOH is added. The shape of the setae was noted and recorded.

**OUTCOME:**Students learnt the technique ofmounting the earthworm's body setae and handling of compound microscope.

# MOUTH PARTS OF COCKROACH






# MOUTH PARTS OF COCKROACH

## COMMENTS:

In cockroach,the mouth-parts is of the **chewing or mandibulate** type.The appendages found around the mouth are called the mouth-parts. Mouth parts consists of the labrum, the mandible, the first maxillae, the second maxillae and the hypopharynx.

**LABRUM** : It is the upper lip. It lies in front of the mouth.

**MANDIBLES** : The mandibles have teeth like denticles on their inner edge.the mandibles move from side to side.

**HYPOPHARYX** : It is the tongue located inside the buccal cavity. A salivary duct opens into the base of the hypopharynx

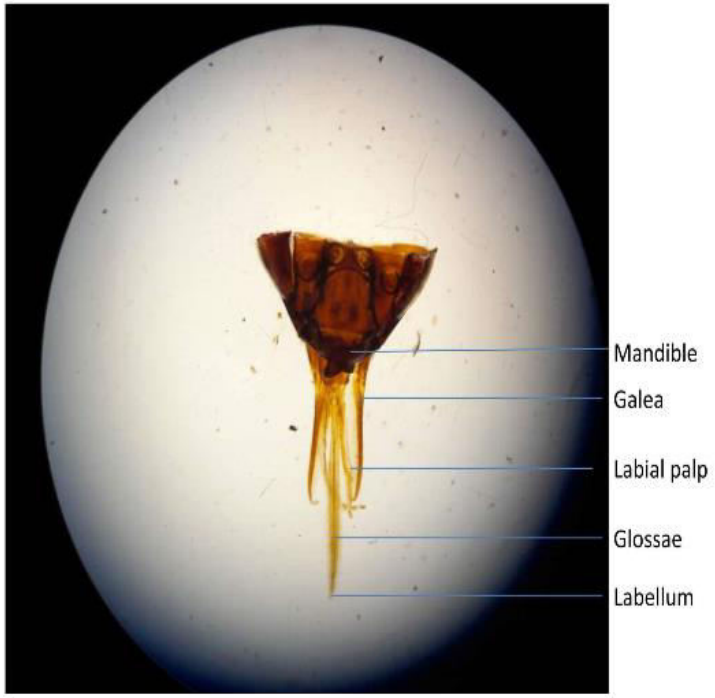
**FIRST MAXILLAE:** Each maxilla is biramous and consists of **three parts,** the basal protopodite, the inner endopodite and the outer exopodite. They are also used for cleaning the antennal palps and front legs.

**LABIUM** : Labium is the lower lip. It is also called second maxillae. it lies behind of the maxillae. It consist of three parts, submentum, mentum and prementum.

The prementum bears of labial palps, a pair of paraglossae and a pair of glossae.

The glossae are elongated and united to form a ligular tongue.

# MOUTH PARTS OF HONEYBEE






# MOUTH PARTS OF HONEYBEE

## COMMENTS:

The mouth parts of honeybee is of chewing and lapping type. The mouth parts consist of labrum, epipharynx, mandibles, labellum, maxilla and labium

**LABRUM** : *It* is the upper lip which lies beneath the clypeus.

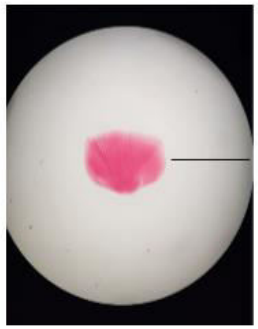
**EPIPHARYNX** : It is the organ of taste which projects beneath the labrum.

**MANDIBLES** :The spoon shaped mandibles are the paired "teeth" situated on either side of the labrum that can be opened and closed to chew the food and to manipulate wax. Apart from these, it helps in the ingestion of pollen grains, cleaning other bees, biting other workers or pests and for supporting the proboscis

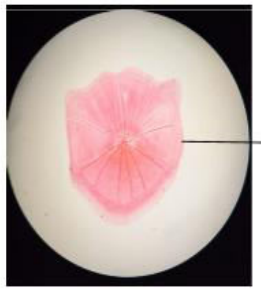
**MAXILLA** :Each maxilla consists of two parts namely cardo and stipes, which are seen on either side of the prementum.

**LABIUM** :It is the lower lip, which formed of prementum, mentum, submentum, paraglossa, glossa and lapial palp. In the labium, galea is elongated tapering and blade like which protects the ligula of labium. Lacinea is absent. Maxillary palps are vestigial in condition . Paraglossa are very much reduced. The glossa is curved downwards and inwards forming a central cavity. Glossa is very much elongated and gathers the food. Besides, it is an organ for touch and taste.

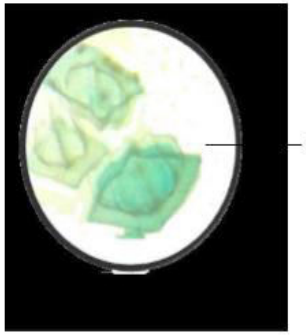
# SCALES IN FISHES



Ctenoid scale



Cycloid scale



Placoid Scale



# SCALES IN FISHES

## COMMENTS:

- The tough and slippery scales protect the body externally from parasites and external injuries.
- Since the scales slide over each other, they provide flexibility to the fish during swimming.
- They help in calculating the age of fishes.
- They indicate period of migration, food scarcity and illness.
- the cycloid scales are found in three major carps.These show alternating grooves and ridges.
- The ctenoid scales are found in perciform fishes

### CTENOID SCALE

- Ctenoid means comb- like. These scales have teeth.
- They are present in teleost fishes and some actinopterigians.they are dermal in origin.
- They are oval in shape.
- They are attached to the skin by the anterior end and the posterior end is free.
- The posterior margin has comb like teeth called cteni .
- They are arranged in an overlapping fashion.
- It is made up of two layers.
- Some growth lines are thick and they called annuli.
- Grooves are arranged in center they are called radii.

### CYCLOID SCALE

- Cycloid scales are **circular** in shape.
- They are found in bony fishes like herring,trout,minnows etc.,
- They are dermal in origin.
- They are arranged in overlapping fashion.
- It is made up of two layers.
- The central part of the scale is called focus.
- The focus is surrounded by growth rings.
- Some growth lines are thick and they are called annuli.

### PLACOID SCALE

- Placoid scales are found in the cartilaginous fishes such as shark.
- They are dermal in origin. They form the exoskeleton
- Each placoid scale consists of a diamond shaped basal plate and a spine is a trident

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VVVC/DBT-SCS/2020-2021/Zoology /Practicals procedure /Invertebrata & Chordata

# FIELDWORK & IDENTIFICATION

# FIELDWORK & IDENTIFICATION OF INSECTS

| | | |
|---|---|---|
| 1 |  | **BUTTERFLY – POLLINATOR**<br>It comes under the oderLepidoptera.The body and the wings are covered with minute scales. |
| 2 |  | SPIDER-BENEFICIAL PREDATORS<br>It belongs to the order Araneida. Its body is divided into two segments.It has eight jointed legs. It has no wings or antennae |
| 3 |  | **BLACK ANT- DECOMPOSER**<br>It is placed under the order Hymenoptera.Its body consists of head, thorax and abdomen. |
| 4 |  | **DRAGONFLY- BIOINDICATOR**<br>It is belonging to the order Odonata.. It has long membranous wings. They have a long and slender body and short antennae |
| 5 |  | LADYBIRD BEETLE –PEST CONTROLLER<br>It is a tiny insect having half spheres body, spotted rounded or oval shaped domes.It is kept under the order Coleoptera. They have short legs and antennae |



# FIELDWORK & IDENTIFICATION OF INSECTS

COMMENTS:

**AIM:** to collect and record any five insects from the surronding environment

**MATERIALSREQUIREMENT**:

**EQUIPMENT:** Camera/Smart phone

**PROCEDURE**:Using the camera/ smart phone, any five insects's image was photographed. Key characters were studied and identified using the manual and the role of insects in its specific habitat was learnt.

**RESULT:**Insects were identified and recoreded

**INFERENCE**: The unique group of insects in specific ecosystem was observed

**OUTCOME**: Students were motivated to preserve and conserve the insects along with the associated flora. Interest was created among the students on the observation and documentation of insects. The diversity of insects and their sigificant role in the ecosystem were learnt.

# FRESHWARER PLANKTONS

# DAPHNIA

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | BRANCHIOPODA |



# DAPHNIA

## COMMENTS:

- Daphnia, commonly called water flea.
- It is a drifting organism living in fresh water ponds.
- It has a laterally compressed body covered by carapace.
- There is a spine at the posterior end of carapace.
- The long biramous antennae and a pair of antennules are seen on the head.
- The antennules help in swimming.
- A compound sessile eye and a nuchal organ are present on the spherical head.
- Leaf like appendages on the thoracic region help in collecting food.
- There are no appendages in the abdomen.
- This plankton is a filter feeder.
- It reproduces by parthenogenesis.

# CYCLOPS

| | |
|---|---|
| PHYLUM | ARTHROPODA |
| CLASS | HEXANAUPLIA |



# CYCLOPS

COMMENTS:

- Cyclops is a free swimming plankton, inhabiting in fresh water ponds.
- The elongated body is divided into three divisions namely cephalothorax, thorax and abdomen.
- Head and the first thoracic segment forms the cephalothorax.
- A median eye is seen on the head.
- There are five segments `in the thorax.
- The second to fifth thoracic appendages help in swimming.
- There are four segments in the abdomen.
- Appendages are absent in abdomen.
- A pair of caudal styles are at the posterior end of abdomen.
- Sexes are separate.
- Two egg sacs are seen in the abdomen of female.
- This crustacean is an intermediate host for the guinea worm.

# COMMERCIAL FISHES

## FOOD FISHES

## CATLA

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |



# CATLA

COMMENTS:

- *Catla catla* is a Indian major carp.
- It is commonly called major South Asian carp.
- It is an economically important South Asian edible fish, native of India.
- It is a freshwater fish, living in the river.
- It has a deep and oblong body with large head.
- The lower lip is larger than the upper lip.
- The dorsal side is blackish grey and the lateral side and silvery.
- It has paired pectoral fins and pelvic fins and an anal fin, a single dorsal fin and a caudal fin.
- The caudal fin is bilobed and homocercal.
- The scales are cycloid.
- It is a surface feeder, feeding on zooplankton.
- It grows fast with the surface feed.
- It grows to a maximum length of 1.8 m and 4.5kg. In one year, it attains 2kg.
- It breeds in the river during rainy season.
- It can breed artificially by hypophysation.It can be cultured by monoculture, polyculture and integrated fish culture. Hence the commercial farming in freshwater pond is very profitable.

# ROHU

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |



# ROHU

## COMMENTS:

- Rohu is an Indian major carp.
- Rohu is a freshwater bony fish. It lives in the river.
- It is an indigenous fish, native of India.
- More than twenty four species of Labeo are known.Eg.*Labeo rohita, L. calbasu, L. fimbriatus*
- Rohu is having a **spindle-shaped** body.
- The colour of the body is bluish or greyish on the dorsal side.
- The **lateral sides are silvery** in appearance.
- Mouth is subterminal.
- The lips are thick and fringed with inner transverse folds above and below.
- There is **one pair of barbels**.
- It contains pectoral fins , anal fin, dorsal fin and caudal fin.
- The scales are cycloid.
- It lives in the middle column of water. So it is called column feeder.
- Rohu feeds on filamentous algae.
- It breeds during monsoon period.
- Rohu is distributed in Godavari and Krishna rivers.
- It attains a weight of 1kg in one year. It grows up to 1m.
- It can be cultured in polyculture , monoculture and integrated fish culture.So, it is successfully cultured edible fish of high market value.

# MRIGAL

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |



# MRIGAL

## COMMENTS:

- *Cirrhinus mrigala* is a riverine fish, commonly called mrigal.
- It is a **freshwater fi**sh.
- It is an Indian major carp.
- It is an indigenous fish, native of India .
- Body is dark grey on the dorsal side and the **ventral side is orange coloured**.
- Mouth is subterminal and not fringed,
- It has a wide mouth and thin lips.
- The fins include pectoral fin, pelvic fin, anal fin, dorsal fin and caudal fin.
- It has a pair of barbels.
- The caudal fin **is bilobed** and it is **homocercal**.
- It has cycloid scales.
- The feed item consists of mud, algae and decaying vegetation. It is a detritivorous fish.
- It is a bottom feeder.
- It breeds during monsoon flood.
- It can attain a weight of 0.8 kg in one year.
- It can be cultured in monoculture, polyculture and integrated fish culture.So, it is successfully cultured edible fish of high market value.

# ORNAMENTAL FISHES

## GOLDFISH

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |



# GOLDFISH

COMMENTS:

- Gold fish(***Carassiusauratus***) is an ornamental fish belonging to carp family.
- It is red or red white or black in colour.
- It was one of the earliest fishes domesticated. It is a coldwater fish.
- It is the native of China.
- It has no stomach. So it cannot digest excess of proteins. Hence it releases large amount of waste . Overfed fishes have a trailing of faeces from the cloaca.
- It is an omnivore.It also feeds on aquarium plants.
- It is oviparous.
- Maximum length is 59cm and weight is 4.5 kg.
- It can live for 20 years.
- It is fed twice a day.
- It can produce pigments in light. If left in the darkness the gold fish turns white.
- The optimum temperature for the growth is 20 to 24° C
- The body is short and the back is smooth and curved.
- The caudal fin is two or three or four lobed.It has high market value in the international market.
- A number of varieties of gold fish is available. They are
  - ✓ Telescopic eye
  - ✓ Veil tail
  - ✓ Butterfly tail
  - ✓ Calico
  - ✓ Comet
  - ✓ Lion head
  - ✓ Oranda
  - ✓ Pearl scale
  - ✓ Fan tail
  - ✓ Celestial eye

# SIAMESE FIGHTER FISH

| | |
|---|---|
| PHYLUM | CHORDATA |
| CLASS | ACTINOPTERI |



# SIAMESE FIGHTER FISH

## COMMENTS:

- *Bettasplendens* commonly called as Fighteris an ornamental fish living in ponds and ditches.
- The fish is brilliantly coloured with elongated fins in the male .They are widely known for their brilliant colours and large, flowing fin. The natural coloration of *B. splendens* is generally green, brown and grey, while the fins are short.*B. splendens* usually grows to a length of about 6–8 cm.
- Male is bigger than female.
- I t is omnivore and oviparous
- The optimum temperature required for its growth is 24-29 C
- The male cares for the eggs in the bubble nest.
- The male is aggressive to other males. Hence it is kept in separate tanks.This ornamental fish also has high demand in the market.
- The two male fishes of fighter species should not be kept together in the same tank. Only one male should be kept in a tank.

# FEATHERS OF BIRDS


| | |
|---|---|
| 1 | Cockatiel (Parrot) |
| 2 | Grey Francolin (கௌதாரி) |
| 3 | Grey junglefowl ( காட்டுக் கோழி) |
| 4 | Black chicken (Kadaknath) |
| 5 | Wild Turky ( காட்டு வான்கோழி) |
| 6 | Myna (மைனா) |
| 7 | Swan (அனனப் பறவை) |
| 8 | Indian Peafowl ( மயில்) |



# FEATHERS OF BIRDS

## COMMENTS:

**FEATHERS**

Feathers are epidermal growths that form a distinctive outer covering, or plumage found in all birds.Feathersare composed of the protein beta-keratin and made up of the same basic parts, arranged in a branching structure.

**Structure:-The calamus** extends into a central rachis which branches into **barbs,** and then **into barbules** with small hooks that interlock with nearby barbules. The diversity in feathers comes from the evolution of small modifications in this basic branching structure to serve different functions.

**Types of Feathers**

Flight feathers are found on the **wings and tail**. The wing feathers, also called **remiges** are specially adapted for flight.Tail feathers, or rectrices, are arranged in a fan shape and help in steering in flight. The tail feathers of the (male)peacock are most decorative feathers and called **a train**. They make up a long, flowing display of color and help in courtship.

- **Contour feathers** cover the bird's body and streamlines its shape. Cntour feathers help in waterproofing the body.Tthe vibrant green contour feathers of male *Eclectus* Parrots (*Eclectusroratus*) serve a camouflage function during foraging trips in the rainforest canopy.
- **Down feathers** have little or no shaft. They are soft and fluffy with flexible barbs and relatively long barbules that trap air close to the bird's warm body and help in insulation.
- **Semiplumes** and filoplumes are feathers hidden beneath the body, create a fluffy insulating structure.Bristle feathers are very stiff with only a few barbs found at the base. They are commonly found on the head and protect the bird's eyes and face.