

PRACTICAL - II :
AQUACULTURE
(DZ00L22)
(MSC-ZOOLOGY)



ACHARYA NAGARJUNA UNIVERSITY

CENTRE FOR DISTANCE EDUCATION

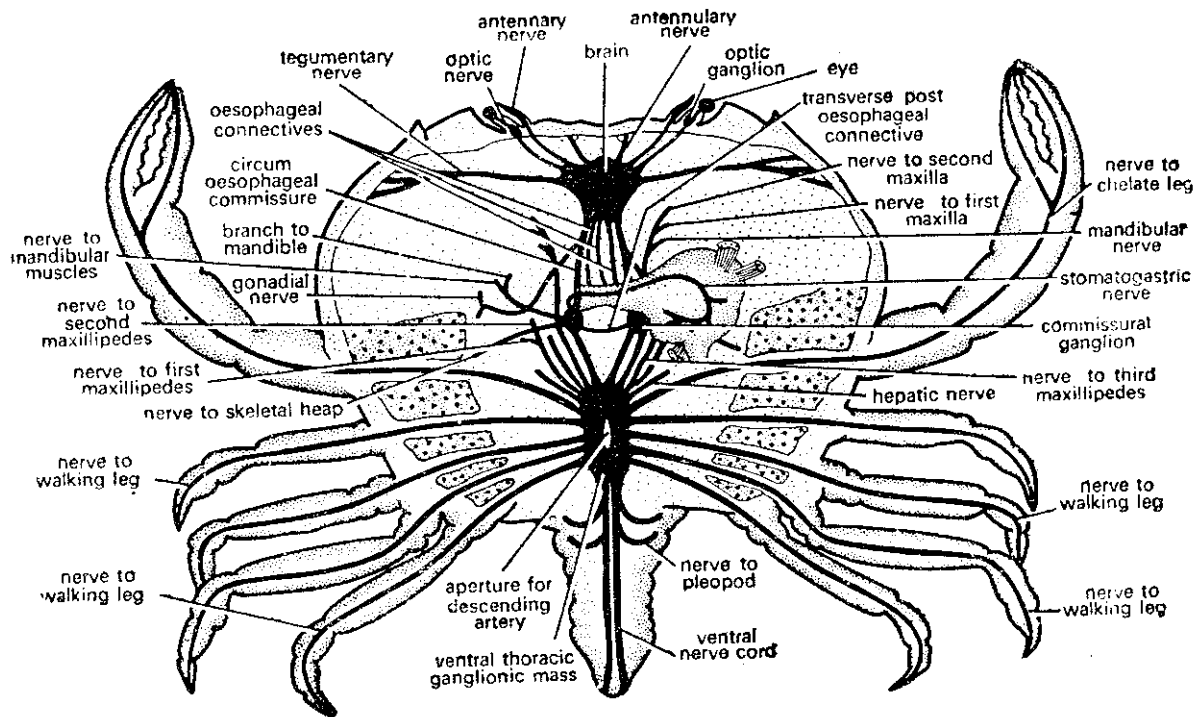
NAGARJUNA NAGAR,

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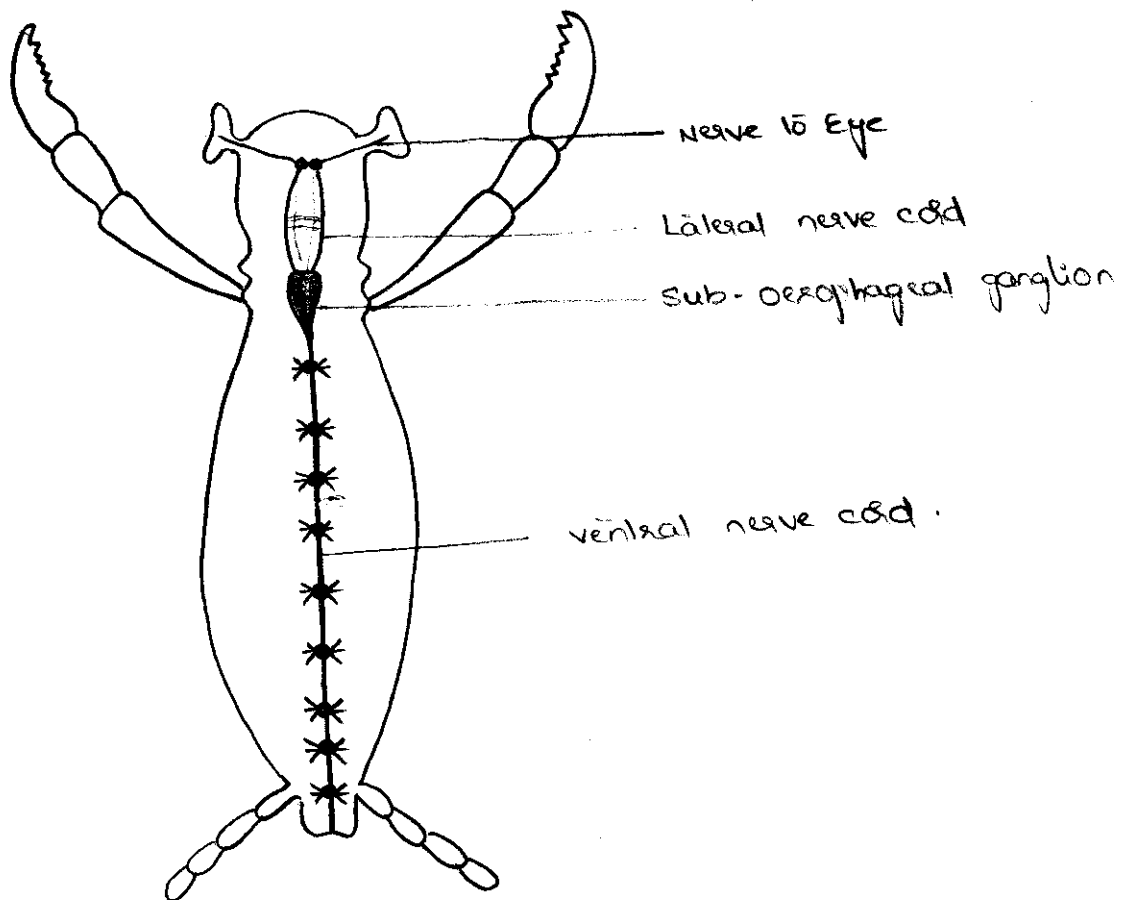
ANDHRA PRADESH

PRACTICAL - I

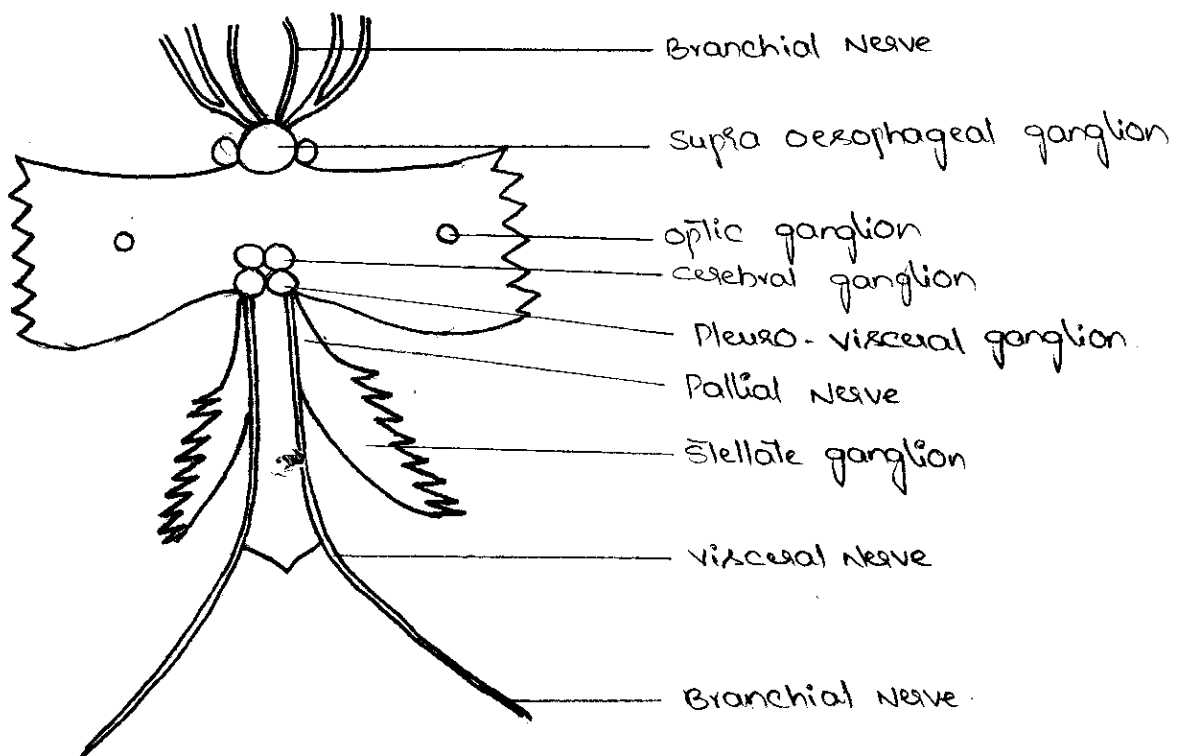
Paratelphusa masoniana (Fresh-water crab)



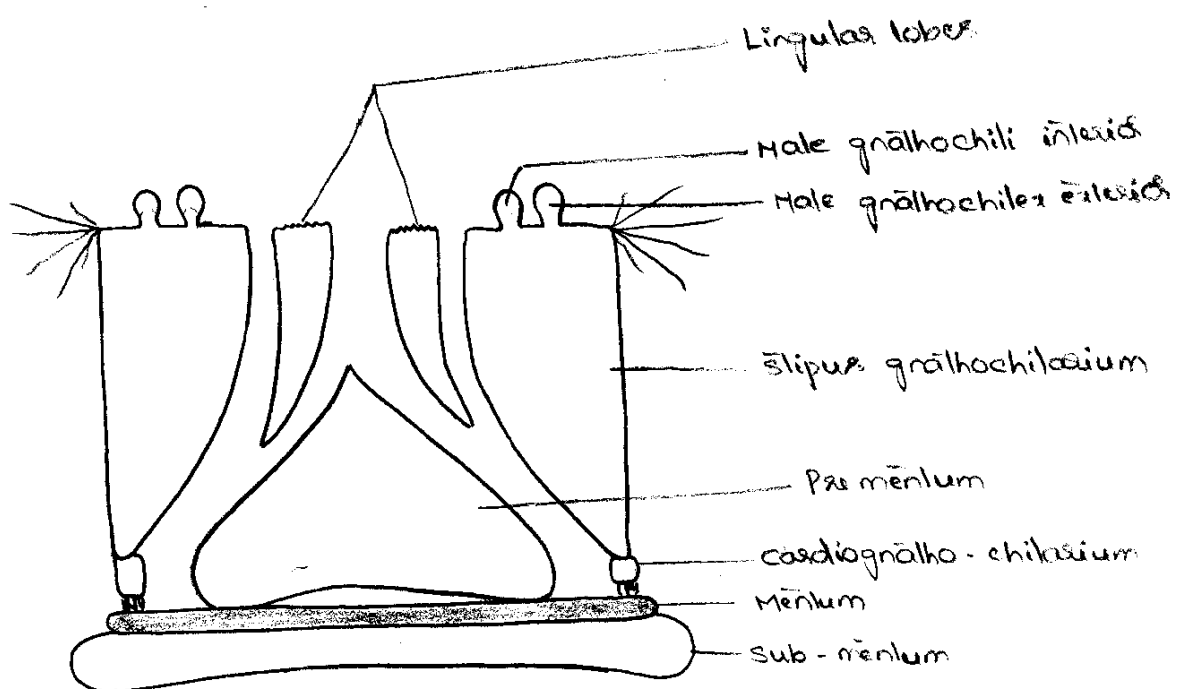
SQUILLA NERVOUS SYSTEM



SEPIA NERVOUS SYSTEM

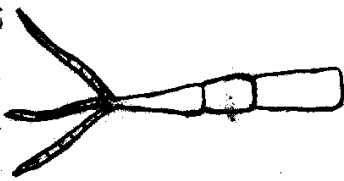


GNATHOCHILARIUM OF MILLIPED

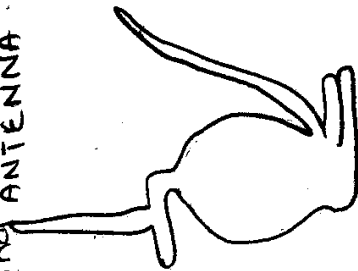


SQUILLA APPENDAGES

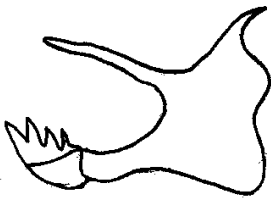
FIRST ANTENNA



2ND ANTENNA



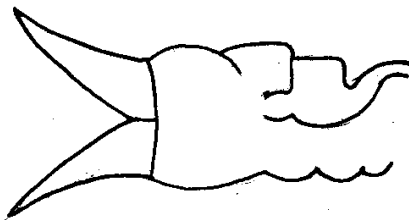
MANDIBLE



1ST MAXILLA



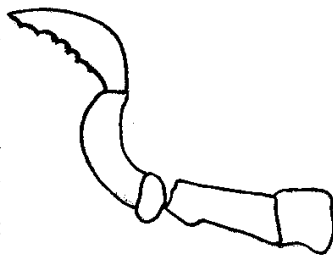
SECOND MAXILLA



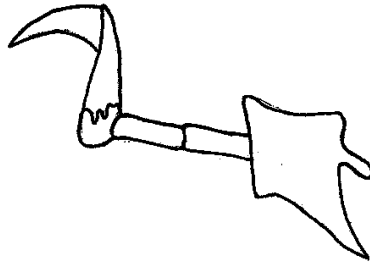
1ST MAXILLIPED



2ND MAXILLIPED



3RD MAXILLIPED



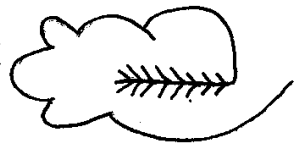
THORACIC LEG



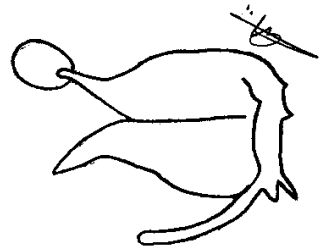
PLEOPOD WITHOUT BRANCHIAL FILAMENT



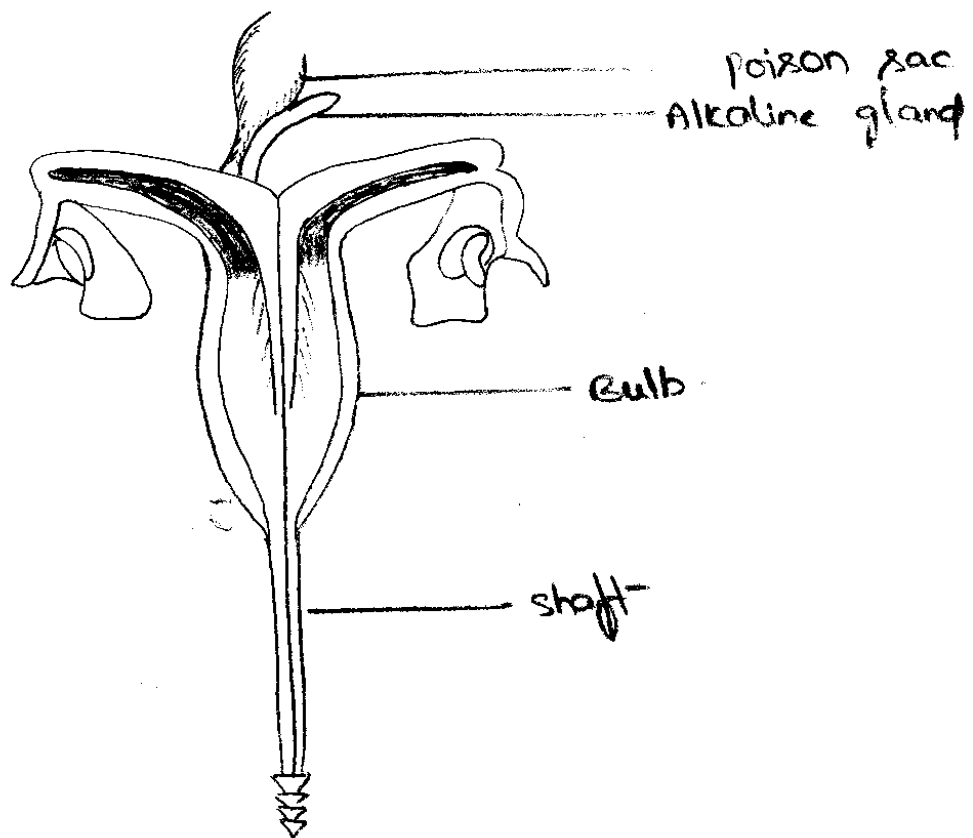
PLEOPOD WITH BRANCHIAL FILAMENT



UROPOD



STING OF HONEY BEE



POLYSTOMELLA (Elphidium)

Phylum : Protozoa
 Class : Sarcodina
 Order : Foraminifera
 Genus : *Polystomella*

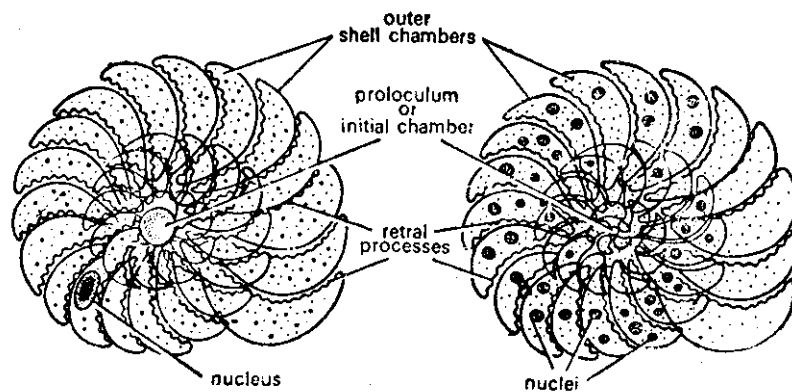


Fig. 1. *Polystomella*

Habit and habitat: *Polystomella* is a marine form found near the bottom of the sea.

Characters:

1. Body is enclosed in a shell of calcium carbonate.
2. The shell has many chambers (multilocular) which communicate with one another.
3. The shell is also perforated by many pores through which protoplasm flows out.
4. Pseudopodia radiate from the external protoplasm long, delicate, and often anastomosing reticulopodia are used in food trapping and locomotion.
5. Contractile vacuole absent.
6. *Polystomella* is dimorphic. It occurs in two distinct forms, viz., macrospheric and microspheric differing from one another in the size of the central chamber and the number of nuclei.
7. The animal feeds on diatoms and protozoans.
8. Reproduction by multiple fission. Life cycle shows an alternation of generation.
9. New chambers are added in a spiral manner so that the shell is like that of some snails.
10. It is a multilocular form having many chambered shell. It begins in a single chamber, the proloculum as the animal increases in size.

CERATIUM

Classification:

Phylum	.. Protozoa
Subphylum	.. Plasmodroma
Class	.. Mastigophora
Order	.. Dinoflagellata
Genus	.. <i>Ceratium</i>

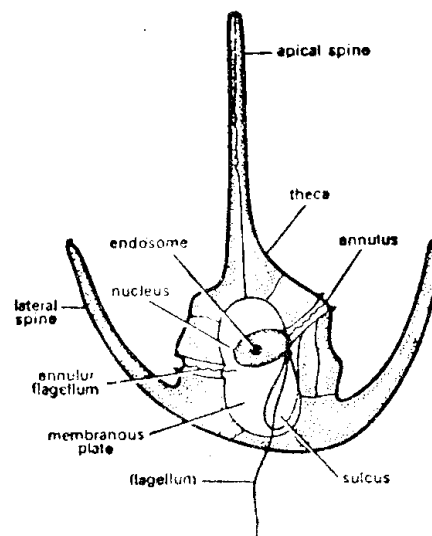


Fig. ___ *Ceratium*

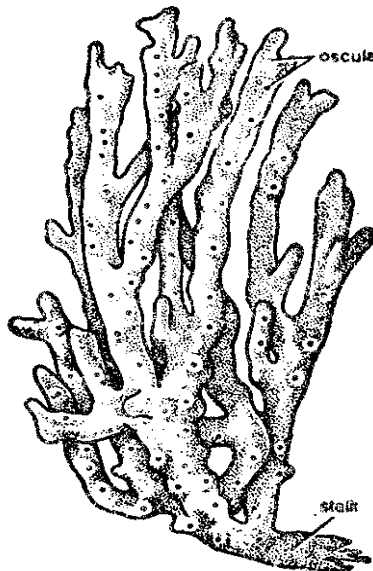
Characters

1. Body is usually covered with a grooved cellulose wall known as lorica or theca.
2. The covering of the body consists of variable number of plates which are variously sculptured.
3. Shape of the body is triangular due to the presence of an anterior or apical and two lateral spines or horns.
4. There are two grooves on the shell or theca, a transverse and a longitudinal, each containing a flagellum which projects out through a pore.
5. Transverse groove is called annulus and runs like a circular or spiral girdle around the body.
6. Longitudinal groove or sulcus extends obliquely backwards.
7. Single large and central nucleus.
8. Chromatophores are numerous, green in fresh-water forms and yellow or brown in marine forms.
9. Reproduction by fission. Cyst formation also occurs.

CHALINA

Classification

Phylum	Porifera
Class	Demospongiae
Order	Haplosclerina
Genus	<i>Chalina</i>



Characters

1. The sponge is orange or red, yellowish brown in colour.
2. *Chalina* is popularly known as dead man's finger because it is shaped like a hand with many fingers. It is also known as Mermalid's gloves.
3. The surface of the body is flattened consisting of bunches of finger-like branches.
4. Each branch or finger like structure is perforated by numerous oscula.
5. Skeleton comprises spongin fibres in which siliceous spicules are embedded.
6. Reproduction both asexual and sexual. Asexual by regeneration and budding. Sexual by producing free-swimming larva.
7. The spicules are silicious and monoxons.
8. Growth pattern is dependent upon various factors like availability of space, type of substratum and velocity and type of water currents. Its shape is an adaptation to different environmental factors.

PHYSALIA

Classification:

Phylum	Coelenterata
Class	Hydrozoa
Order	Siphonophora
Genus	<i>Physalia</i>

Characters

- Physalia* is a colonial hydroid commonly known as Portuguese man of war.
- Colony has a large pneumatophore or float which is brilliantly coloured as blue or purple.
- The float or pneumatophore is bladder-like, elongated pointed at both the ends, 6 to 12 cm long. The upper surface of the float is produced into a crest or sail.
- A gas gland present inside the float secretes a gas of a composition similar to air. This helps the animal in floating over the surface of water.
- The swimming bells or nectocalyces are absent.
- Colony exhibits remarkable polymorphism and the phenomenon of division of labour.
- Beneath the float are hanging down the three types of zooids and tentacles.
 - Gastrozooids are simple polyps with mouth but without tentacles. These are nutritive in function.
 - Dactylozooids are of two types, large as well as small. These are provided with tentacles bearing numerous nematocysts. These catch the fishes and other prey, etc.
 - Conozooids are branching blastostyles bear clusters of medusae. Male medusae are reduced and remain attached. Female medusae are free-swimming.
- Tentacles are large and bear stinging batteries or nematocysts to kill the large fishes and prey.

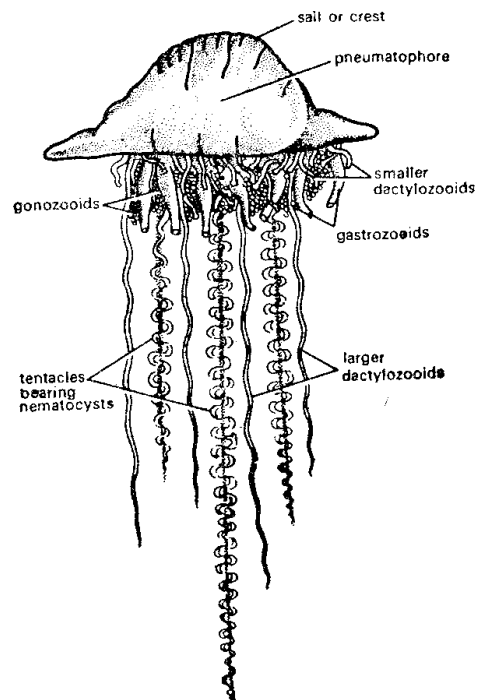


Fig. __ *Physalia*

FUNGIA

Classification:

Phylum	Coelenterata
Class	Anthozoa
Order	Madreporaria

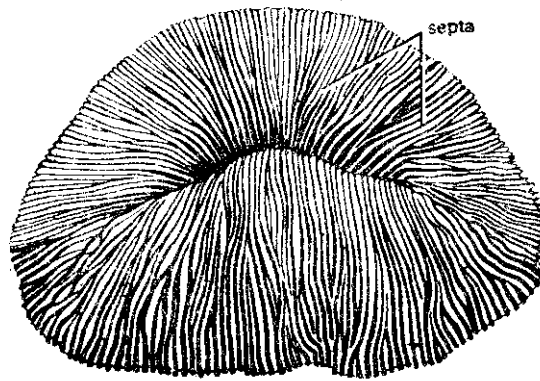


Fig. __ . *Fungia*

Habit and habitat: *Fungia* is a solitary and marine coral found in warm seas usually in Gulf of California.

Characters:

1. *Fungia* is commonly known as mushroom coral.
2. The mushroom coral is of large size; with discoidal corallite, convex on the upper and concave on the lower surface.
3. Septa are numerous and connected together by small synaptacula.
4. Theca is present only on the lower surface.
5. Adult animal bears a single large polyp with many tentacles.
6. Siphonoglyph absent.
7. Reproduction resembling more or less transverse fission.
8. Also known as stony coral, produce a CaCO_3 skeleton. Skeleton is secreted by the epidermis of the lower half as well as the basal disc. This secreting process produce a cup, within which the polyp is fixed.

METRIDIUM

Classification:

Phylum	Coelenterata
Class	Anthozoa
Order	Actiniaria

Habit and habitat: *Metridium* is a large sessile, brightly coloured, solitary, flower-like, form. It is a marine form, found attached to the rocks, piles of wharves and solid objects from tide pools to a depth of 90 fathoms.

Characters:

1. *Metridium* is commonly known as **sea anemone**.
2. Body is short, cylindrical and radially symmetrical, divisible into three distinct regions, pedal disc, column and oral disc.
3. Pedal disc is muscular broad base or foot by which it is attached to the substratum.
4. Column is differentiated into two portions, a distal thin-walled short capitulum and a proximal thick-walled scapus by a groove and collar.
5. The wall of the scapus is perforated by small openings called cinclides
6. Oral disc is lobed and flat having a slit-like mouth in the centre which is surrounded by numerous short, hollow marginal tentacles arranged in a number of circles.
7. Mouth leads into a short gullet which finally opens into the gastrovascular cavity.
8. Gullet or stomodaeum is provided usually with one or two siphonoglyphs.
9. Gastrovascular cavity is divided into compartments usually by six pairs of mesenteries.
10. Sexes are separate. Gonads are borne on the mesenteries.
11. Asexual reproduction by fragmentation and budding.

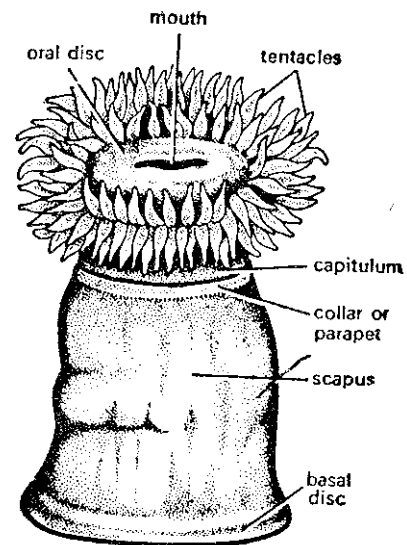


Fig. __ . *Metridium*

PLANARIA (Dugesia)

Classification:

Phylum	Platyhelminthes
Class	Turbellaria
Order	Tricladida
Genus	<i>Planaria</i>

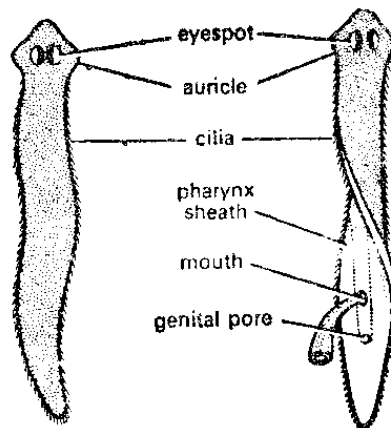


Fig. __ *Planaria*

Habit and habitat: *Planaria (Dugesia)* is a fresh-water triclad. It is found in the fresh-water streams, springs, ponds and lakes under the stones throughout the temperate zones.

Characters:

1. Body is elongated, bilaterally symmetrical and dorsoventrally flattened.
2. They are 2-15 mm in length and brown to black in colour.
3. Head is triangular with conspicuous auricles and two eyes.
4. Digestive system consists of mouth, proboscis, pharynx and branched intestine.
5. Mouth is situated on the ventral surface behind the middle of the worm.
6. Proboscis is enclosed in the proboscis sheath.
7. Pharynx plicate directed backwards.
8. Intestine forks into three diverticulated branches, one anterior and two posterior.
9. Genital pore is situated a little posterior to the mouth.
10. Reproduction sexual, asexual and by regeneration.
11. *Planarians* are extensively used for the experimental purpose, e.g., regeneration and grafting, etc.

FASCIOLA

Classification:

Phylum	Platyhelminthes
Class	Trematoda
Order	Digenea
Genus	<i>Fasciola</i>
Species	<i>hepatica</i>

Habit and habitat: *Fasciola hepatica* is found as an endoparasite in the bile ducts of liver of sheep.

Characters:

1. *Fasciola hepatica* commonly known as liver fluke.
2. Body is leaf like, dorso-ventrally flattened measures 25-30 mm in length and 4-5 mm in breadth.
3. Anterior end is small and conical, while the posterior end is large more rounded in front than behind.
4. An oral sucker is situated apically and a larger highly muscular ventral sucker (acetabulum) is located a little posterior to the oral sucker.
5. Mouth is situated at the anterior end and is surrounded by the oral sucker.
6. Digestive system is simple, pharynx is muscular, oesophagus short and branched and diverticulated intestine.
7. Between the oral and ventral sucker is a median genital pore through which pass eggs to the exterior.
8. Excretory pore lies at the extreme posterior end of the body.
9. Hermaphroditic. Male system consists of tests, vasa deferentia, seminal vesicle, ejaculatory duct and penis, while female system comprises ovary, uterus and vitelline glands.
10. Life cycle is complicated includes an intermediate host, *Lymnaea* a mollusc.
11. Liver-fluke causes a disease known as liver rot.

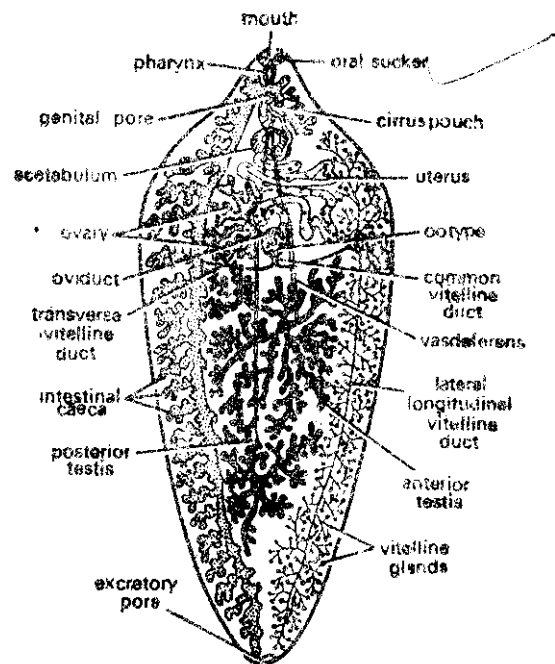


Fig. __ *Fasciola hepatica*

Cercaria Larva of Fasciola hepatica

Comments:

1. Body of cercaria is flat and oval bearing a tail.
2. Body is covered by cuticle and body wall consists of cuticle, muscles and mesenchyme.
3. It has two suckers, an anterior oral sucker surrounding the mouth and a ventral sucker situated in the middle of body.
4. Digestive system comprises, mouth, muscular pharynx, oesophagus and inverted “ Π ” shaped intestine.

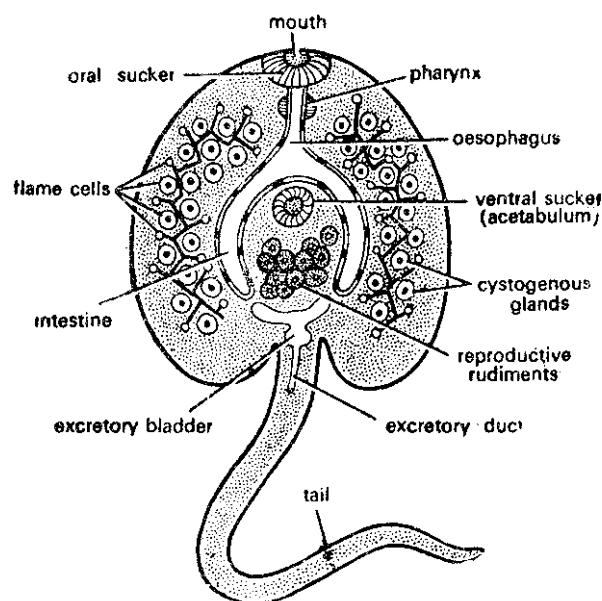


Fig. ____ . *Cercaria* larva of *Fasciola hepatica*.

5. Excretory organs of the flame cell type are present.
6. Body space is filled with parenchyma and contains a few cestogenous glands on each side which form the cyst of the future larva.
7. Rudimentary reproductive organs are also seen.
8. Cercaria larva comes out from the redia through the birth pore and also from the body of snail.
9. It is a free-swimming larva and after swimming for a short period it attaches to the aquatic plants.
10. Finally cercaria larva undergoes encystment and the encysted larva is known as metacercaria which is swallowed by the final host, sheep.

CYSTICERCUS LARVA OF TAENIA SOLIUM

Comments:

1. Cysticercus larva is also known as bladder-worm and develops in the muscles of pig, the intermediate host.
2. The onchospheres first reach the stomach of pig with faeces of man.
3. The onchospheres further migrate to the muscles where the hooks are lost and the cells in the centre of the embryo disappear and thus producing a single layered large ovoid bladder known as bladder worms or cysticercus.

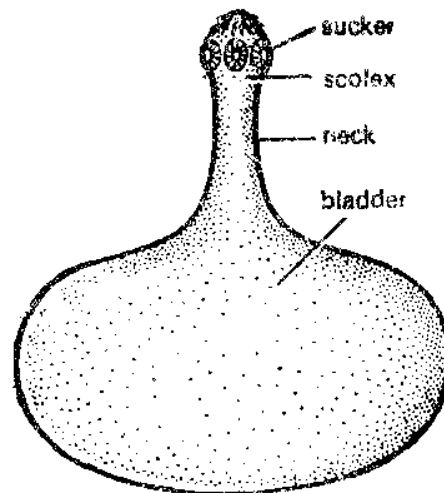


Fig. ____ *Cysticercus* larva of *Taenia solium*.

4. As the bladder increases in size an invagination takes place at one side.
5. On this invagination suckers and hooks are formed and this part is known as prosclex.
6. The further development of cysticercus larva takes place when it is eaten by man with the muscles of pig.
7. Cysticercus consists of a sac or bladder-like structure, having invaginated prosclex measuring 6-18 mm in length.
8. The bladder is opalescent made up of a single layer and filled with a fluid.
9. The contaminated part of pig muscles is called measly pork.
10. Cysticercus in measly pork is found between muscle fibres and connective tissue.
11. If raw pork is ingested by man, the cysticercus is freed, the scolex evaginates and an adult worm develops.

ASCARIS

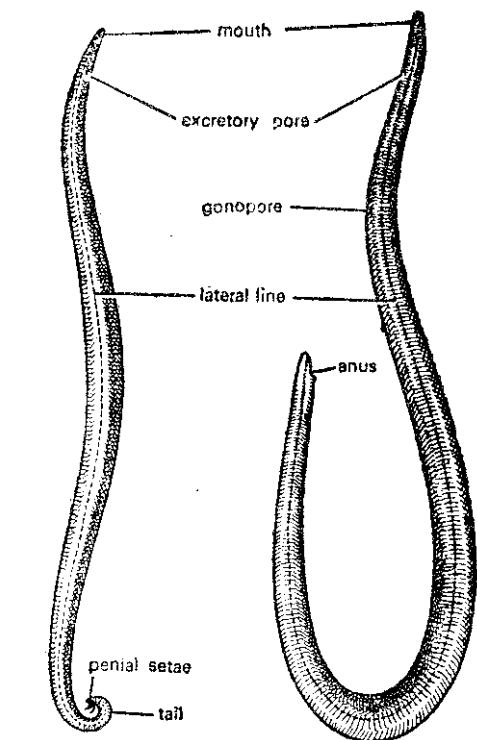
Classification

Phylum	Aschelminthes
Class	Nematoda
Order	Ascaroidea
Genus	<i>Ascaris</i>
Species	<i>Lumbriocoides</i>

Habit and habitat: *Ascaris lumbricoides* is a common endoparasite in the small intestine of man in all parts of the world.

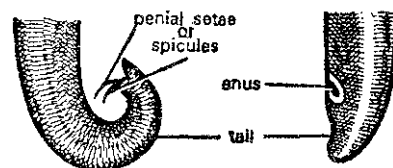
Characters:

1. *Ascaris lumbricoides* is commonly known as round worm.
2. Body is elongated, cylindrical, pointed at both ends.
3. Surface of the body is marked with four longitudinal lines, these are known as mid-dorsal, midventral and two lateral lines.
4. Mouth provided with a median dorsal and a pair of symmetrical submedian ventral lips.
5. Excretory pore is small and lies on the ventral side about 2 mm away from the anterior end.
6. Sexes are separate and sexual dimorphism is well marked.
7. Male is about 15 to 31 cm in length with the posterior end curved ventrally.
8. Male is provided with a pair of curved spicules known as penial setae on its posterior end.
9. Female is large reaching a length of 20 to 35 cm with the posterior end straight and blunt.
10. Female genital aperture lies about one-third of the length of the body from the anterior end.



ASCARIS MALE

ASCARIS FEMALE



Posterior end of male. Posterior end of female.
Ascaris.

CHAETOPTERUS

Classification:

Phylum	Annelida
Class	Polychaeta
Order	Sedentaria
Genus	<i>Chaetopterus</i>

Habit and habitat: *Chaetopterus* lives in parchment-like U-shaped tubes open at both the ends embedded in the mud encrusted with sand and debris.

Characters:

1. *Chaetopterus* is usually 15 to 25 cm length.
2. The body is divisible into three distinct regions, anterior, middle and posterior.
3. The anterior region is flat and bears usually nine pairs of simple parapodia which are large expanded notopodia, a small prostomium and a funnel-shaped peristomal collar with a pair of peristomial cirri.
4. The middle region comprises five segments, first anterior most is produced laterally into great wings directed forwards, next segment carries a pair of sucker and the rest three segments carry membranous folds so called fans formed by the fusion of the notopodia.
5. The posterior region comprises thirty similar segments which are devoid of setae.
6. Mouth is wide and funnel-shaped.
7. The food comprises mainly small organisms which are carried in by the currents of water set up by fans.
8. *Chaetopterus* is highly phosphorescent emits blue-green light.
9. Reproduction is usually asexual and by transverse fission.

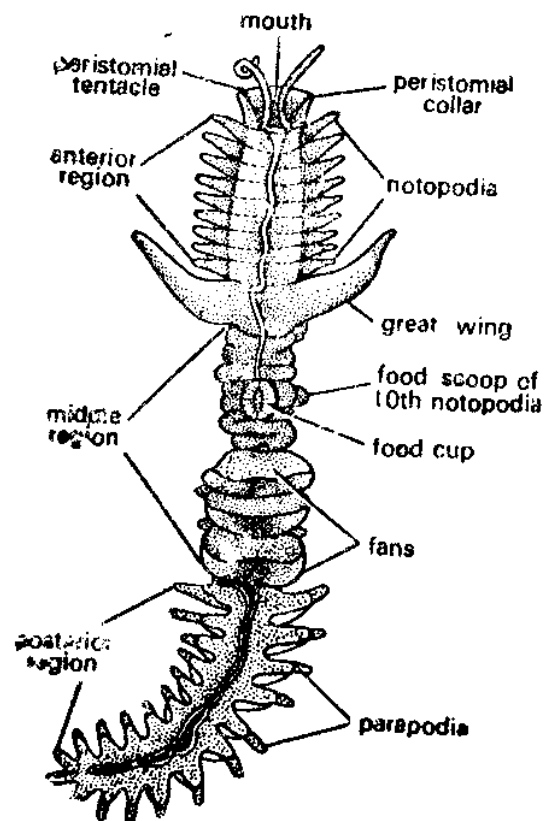


Fig. ____ *Chaetopterus*

POLYNOE

Classification:

Phylum	Annelida
Class	Polychaeta
Order	Errantia

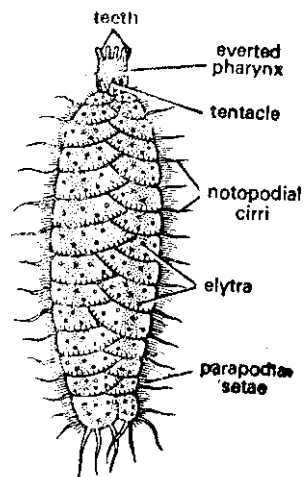


Fig. __ *Polynoe*

Habit and habitat: *Polynoe* is marine form and found near the shores hidden under stones.

Characters:

1. Body is short, broad and oval with few segments.
2. It has a covering of elytra which are modified dorsal cirri.
3. Elytra do not contain setae and have rich nerve supply.
4. The illuminating elytra are easily cast off when disturbed or elytra are shed off to deceive the enemies.
5. Head bears three tentacles and two pairs of peristomial cirri.
6. Pharynx is protrusible.
7. It is carnivorous and said to eat one another.
8. Several species of *Polynoe* are phosphorescent.
9. The fertilized ova and embryos adhere to masses under each elytra.

STREPTOCEPHALUS

Classification:

Phylum	Arthropoda
Class	Crustacea
Order	Branchiopoda

Habit and habitat: *Streptocephalus* has the peculiar habit of swimming on its back near the surface of water with its leaf-like appendages and occurs in fresh-water ponds and ditches.

Characters:

1. *Streptocephalus* is commonly known as fairy shrimp
2. Body is long and subcylindrical, beautiful orange red colour.
3. Carapace or dorsal shield is absent.
4. Body can be distinguished into three regions, head, thorax and abdomen.
5. Sexual dimorphism is common, i.e., male and female are easily distinguishable.
6. Head bears a pair of antennules, a pair of antennae, a pair of mandibles and two pairs of maxillae.
7. In male antennae are long and modified for holding female during copulation.
8. On the dorsal side of the head a nuchal sense organ and a median eye are present.
9. Trunk consists of nineteen segments, of these the first eleven segments bear each a pair of broad foliaceous appendages.
10. The twelfth trunk segments carries the genital opening.
11. The segments from 13 to 19 constitute the abdomen which is devoid of appendages.
12. Anus lies ventrally in front of the telson.

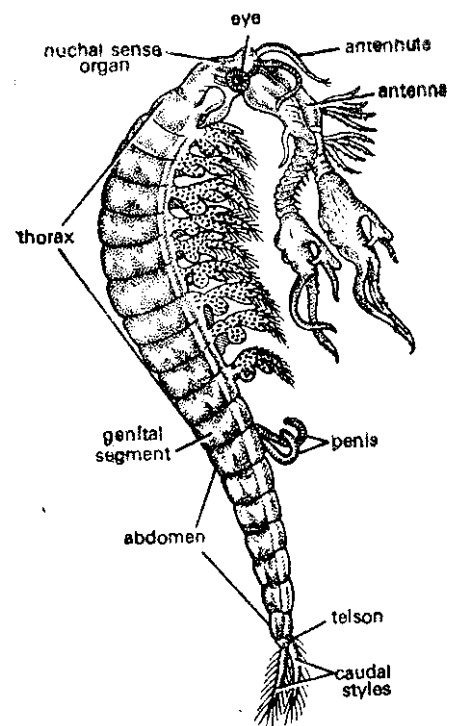


Fig. __ . *Streptocephalus* (Male)

CHITON**Classification:**

Phylum	Mollusca
Class	Polyplacophora
Order	Chitonina

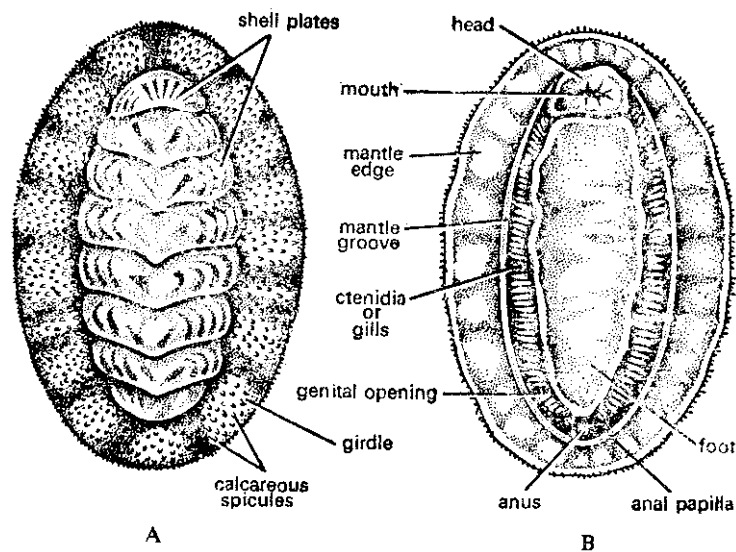


Fig. ___ *Chiton*
A-Dorsal view; B-Ventral view

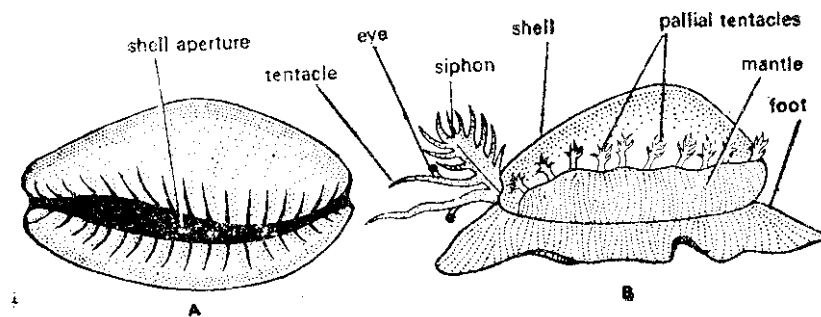
Habit and habitat: *Chiton* is a sluggish, marine animal found attached to the rocks, empty shells and corals between tide marks.

Characters:

1. Shell is calcareous, present on the dorsal side and composed of eight overlapping plates.
2. Head is not distinct. Eyes and tentacles are absent.
3. Body is elongated, bilaterally symmetrical and dorsoventrally compressed and consists of shell, foot, mantle and the visceral mass.
4. Foot is ventral, muscular with a flat sole extending along the whole length of the body. It serves for creeping and adhering to the substratum.
5. Mantle covers greater part of the body and partly covers the edges of the shell plates.
6. Mouth and anus are at opposite ends.
7. Numerous pairs of bipectinate ctenidia lying on either side of the body in the mantle groove.
8. Sexes are separate, gonad is single and median and gonoducts are paired.
9. Development includes a trochophore larva.
10. Chitons are macrophagous.
11. Each plate is similar to others except for the first and last, the cephalic and anal plates.

CYPRAEA**Classification:**

Phylum	Mollusca
Class	Gastropoda
Order	Mesogastropoda

Fig. __ *Cypraea*

Habit and habitat: *Cypraea* is marine and found in Indian and Pacific oceans among coral reefs and rocky ground.

Characters:

1. *Cypraea* is commonly called cowry.
2. The shell is convolute, oval above and flattened below.
3. The surface of the shell is smooth, polished and brightly coloured.
4. Shell opening is long, narrow and serrated.
5. Mantle is reflected over the shell laterally and provided with tentacular filaments.
6. Operculum is absent.
7. In the young stages, the shell has a prominent spire and long siphon.
8. The shells of cowry were used for ornaments and as coin in olden days in India.
9. Ctenidium monopectinate and attached to mantle.
10. Ventrally flattened foot is present.
11. Spine enclosed within the last whorl of shell.

ANTEDON**Classification:**

Phylum	Echinodermata
Class	Pelmatozoa
Order	Articulata

Habit and habitat: *Antedon* is marine, found at moderate depths attached to the rocks and stones.

Characters:

1. *Antedon* is commonly known as feather star.
2. Body consists of a central disc or calyx and a series of five radiating arms.
3. Central disc or calyx is differentiated into an upper oral surface and lower aboral surface.
4. Oral surface is covered with a soft and leathery skin, the tegmen bearing the central mouth and the anus on a papilla in an inter-radius.
5. Aboral surface bears several slender cured joined cirri supported by small ossicles which serve for attachment.
6. Each arm divided at its base into two, so that there are ten long slender flexible arms, bearing lateral pinnules.
7. Five ambulacral ciliated grooves radiate from the mouth towards the arms, where each divide into two and the branches extend along the oral surface of the arms.
8. Tube feet or podia without suckers present along the edges of ambulacral grooves.
9. Sexes are separate, gonads contained in the dilated bases of pinnules.
10. Development includes a pentacrinoid larva with jointed stalk.
11. The tegmen is supported by loose spicules. On the lower side of the calyx is knob like structure which is the stung of the stalk by which the animal was originally attached.

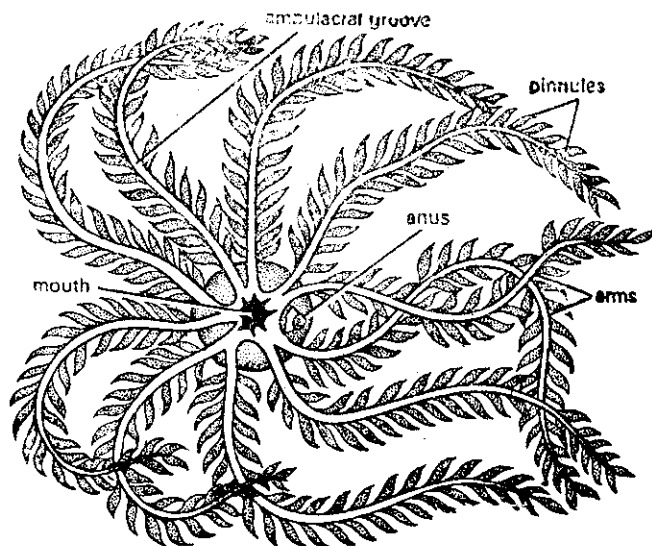


Fig. __ *Antedon*

HOLOTHURIA

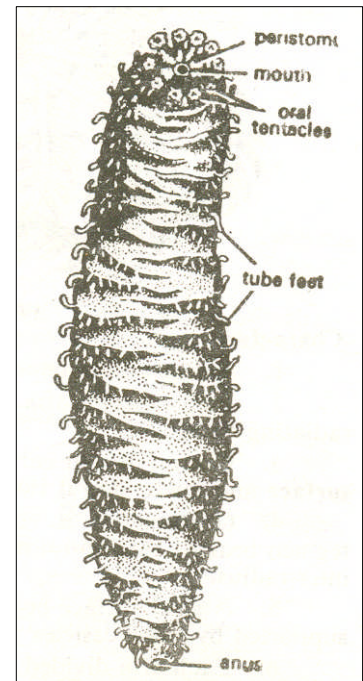
Classification:

Phylum	Echinodermata
Subphylum	Eleutherozoa
Class	Holothuroidea
Class	Aspidochirota
Genus	<i>Holothuria</i>

Habit and habitat: *Holothuria* is found in shallow tropical seas.

Characters:

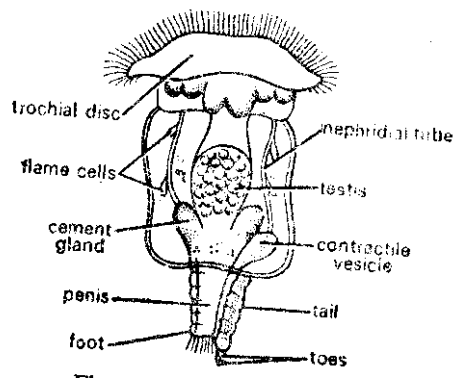
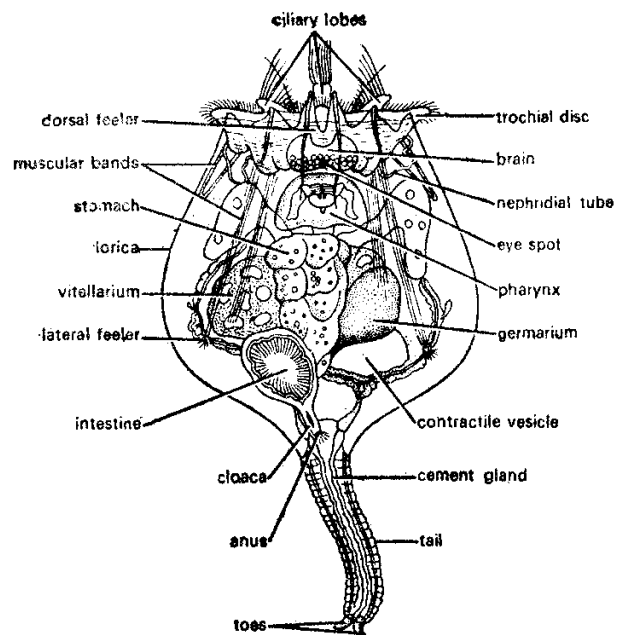
1. Body is elongated, bilaterally symmetrical bearing the mouth and anus at opposite ends.
2. Body bears numerous podia or tube feet, locomotory on the ventral surface and papillate on the dorsal surface.
3. Body wall is leathery having a skeleton of minute ossicles.
4. Mouth is anteriorly placed, surrounded by 15-30 peltate tentacles.
5. Respiratory tree is well developed.
6. Cuvierian tubule are also present.
7. Madreporite is internal.
8. Sexes are separate, gonad single tuft attached to left side of the dorsal mesentery.
9. Development includes auricularia larva.
10. *Holothuria* feeds by pushing sand containing organic food into mouth with the help of tentacles.



DFig. ___
Holochuria

BRACHIONUS**Classification:**

Phylum	Rotifera
Order	Monogonata
Genus	<i>Brachionus</i>

Fig. __ *Brachionus* (Male)Fig. __ *Brachionus* (Female)

Habit and habitat: *Brachionus* is a fresh-water rotifer, found in abundance in ponds and ditches, etc.

Characters:

1. *Brachionus* is commonly known as wheel animalcule.
2. It is microscopic. The female measures about 1/3 mm in length.
3. The body is divisible into two distinct parts – a broad anterior region, the trunk and a slender movable tail.
4. The trunk is enclosed in a glassy cuirass or lorica formed by the thickening of the cuticle.
5. The tail is wrinkled superficially and ends in two slender processes, the toes.
6. Dorsal surface of the trunk is convex, while the ventral surface is fattened and bears the mouth.
7. The anterior portion of the body projects from the lorica in the form of a transverse disc, the trochial disc with a prominent edge fringed with cilia.
8. Three ciliary lobes are present at the anterior end.
9. The anus is dorsal in position and is placed at the junction of the tail with the trunk.
10. Sexes are separate.

SIPUNCULUS

Classification:

Phylum	Annelida
Class	Sipunculoidea
Genus	<i>Sipunculus</i>

Habit and habitat: *Sipunculus* is found in burrows in sand or crevices in rocks at moderate depth off the coast in most countries outside the tropics.

Characters:

1. Body is elongated and cylindrical worm-like without segmentation.
2. Parapodia and setae are absent.
3. Anterior part of the body is slightly narrower than the posterior part. The narrow anterior part can be drawn into larger posterior portion and is, therefore, called introvert.
4. The introvert is covered with chitinous papillae and bears terminal mouth surrounded by tentacular folds.
5. Posterior part is marked by a series of squarish area due to crossing of transverse and longitudinal muscles and devoid of papillae.
6. Anus is placed anterodorsally at the base of introvert.
7. Coelom is spacious traversed by strands of connective tissue and muscle fibres.
8. Single pair of nephridia lying in the anterior region of the body.
9. Sexes are separate.
10. Development is indirect having a trochophore larva.

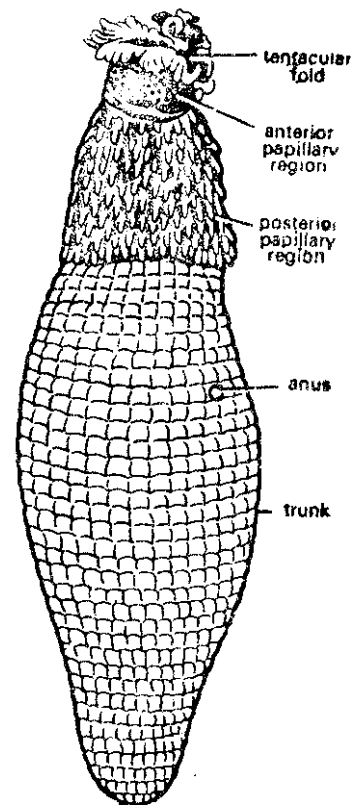


Fig. — *Sipunculus*

LINGULA

Classification:

Phylum	Brachiopoda
Order	Inarticulata
Genus	<i>Lingula</i>

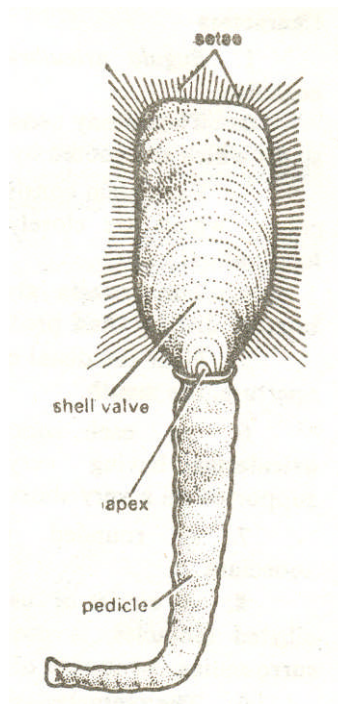


Fig. __ *Lingula*

Habit and habitat: *Lingula* lives in vertical burrows in the bottom sand. It is found in the tropical and subtropical waters of the Indo-West Pacific area.

Characters:

1. Body is covered by a shell.
2. Shell consists of two valves which are nearly alike, oblong and ore or less convex.
3. Shell valves are not united by a hinge.
4. A long pedicle passes out between the proximal end of two valves.
5. There is no shell loop for the support of the lophophore.
6. Intestine is very large and anus is present.
7. Nephridia are exceptionally broad and flattened.
8. The two valves are only held together by muscles. The shell is secreted by the underlying dorsal and ventral mantle lobes.
9. Mantle lobes bears chitinous setae which are believed to have protective and sensory function.

SAGITTA

Classification:

Phylum	Chaetognatha
Genus	<i>Sagitta</i>

Habit and habitat: *Sagitta* is a planktonic animal, found in large number in both littoral waters and the open sea. It feeds actively on unicellular plants and animals, crustacean larvae and other small marine animals.

Characters:

1. *Sagitta* is commonly known as arrow worms.
2. The body is elongated and nearly cylindrical and is divisible into head, trunk and tail.
3. The head is marked off by its somewhat rounded form.
4. The junction of trunk and tail is indicated by the ventrally placed anus.
5. Tail bears a horizontal expansion the caudal fin.
6. Trunk bears two lateral fins.
7. Mouth is ventral and have bristles around it.
8. Anus is also placed ventrally at the junction of trunk and tail.
9. Coelom is spacious and divided by mesenteries.

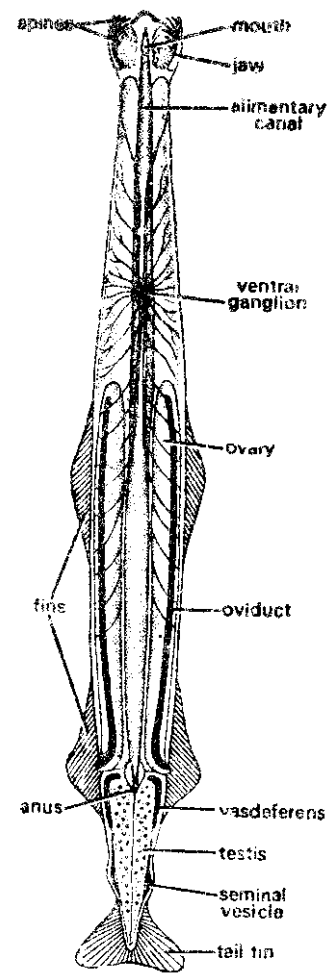


Fig. ___ *Sagitta* (Ventral view)

VIRGULARIA

Classification:

Phylum	Coelenterata
Class	Anthozoa
Order	Pennatulacea
Genus	<i>Virgularia</i>

Habit and habitat: *Virgularia* is a colonial and marine Anthozoa.

Characters:

1. *Virgularia* is commonly called walking stick.
2. The body is divisible into proximal part which is curved and distal part, the rachis.
3. The rachis is elongated like walking stick.
4. the polyps or anthocodia are grouped and slightly fused into transverse or oblique rows lying at regular intervals along the stem.
5. The siphonozooids are found just below each row of polyps.
6. *Virgularia* is bioluminescent.

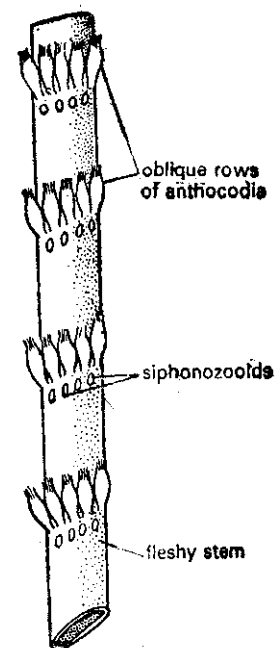


Fig. __ *Virgularia*

PTEROEIDES

Classification:

Phylum	Coelenterata
Class	Anthozoa
Order	Pennatulacea
Genus	<i>Pteroeides</i>

Pteroeides resembles *Pennatula* very much but differs from it in the following characters:

Characters:

1. *Pteroeides* bears numerous small anthocodia or autozooids on the lateral pinnules, supported by a fan-like arrangement of spicules.
2. The siphonozooids are also found only on the pinnules.
3. Body is divided into an elongated proximal stalk (or) peduncle, devoid of anthocodia and a distal rachis, the region of secondary polyps.
4. Peduncle ends with an enlarged end bulb and found embedded in soft bottoms.
5. Peduncle bears on each side a succession of flattened fleshy leaves, provided with anthocodia.
6. Dimorphic, possesses autozooids and siphonozooids.

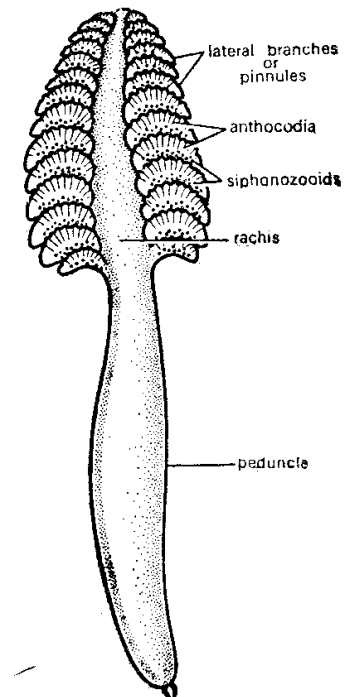


Fig. ____ *Pteroeides*

PENNATULA

Classification:

Phylum	Coelenterata
Class	Anthozoa
Order	Pennatulacea
Genus	<i>Pteroeides</i>

Habit and habitat: *Pennatula* is a sedentary and colonial Anthozoa. It is found fixed in the mud in deep waters of South Carolina.

Characters:

1. *Pennatula* is commonly called as sea pen or sea feather.
2. Colony is elongated and bilaterally symmetrical divisible into two parts, the stalk and the rachis.
3. The proximal or basal part is called the stalk or peduncle embedded in the mud or sand. It is devoid of zooids.
4. The distal or upper part is called the rachis, bears rows of lateral fleshy projections known as leaves or pinnules.
5. Colony is dimorphic having two kinds of zooids:
 - (i) Autozooids
 - (ii) Siphonozooids
6. Skeleton consists of a long horny unbranched axis which supports the rachis and does not extend into lateral pinnules.
7. *Pennatula grandis* is about 50 cm in length. It is orange in colour.

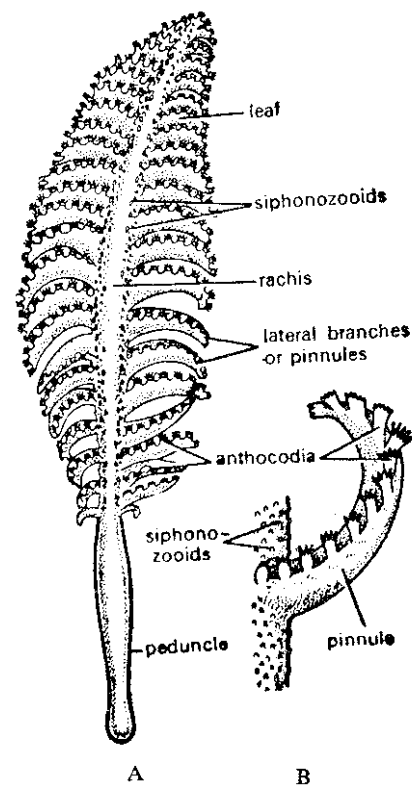


Fig. __ *Pennatula*

PATELLA**Classification:**

Phylum	Mollusca
Class	Gastropoda
Order	Archaeogastropoda
Genus	<i>Patella</i>

Characters:

Habit and habitat: *Patella* is a sluggish, marine gastropod, found attached to the rocks and feeding on minute algae.

1. *Patella* is commonly called true limpet.
2. It is a small oval gastropod.
3. Shell is oval and rounded without operculum.
4. Head is distinct bears a pair of stout, sensory tentacles and eyes.
5. Foot is ventral, broad and flat used for creeping and adhering.
6. True mantle cavity is restricted anteriorly and the ctenidia or gills have disappeared.
7. Secondary mantle cavity extends all round between the foot and mantle and contains a series of pallial gills or secondary branchiae for respiration.
8. Radula composed of very few, strong hooked teeth in each row.
9. *Patella* is eaten by poorer class in several countries like France, Italy and Ireland.
10. Single bipectinate gill is present within the mantle cavity.

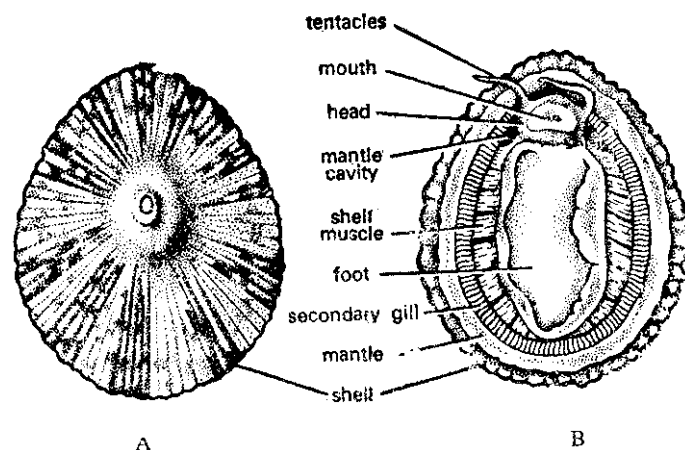


Fig. ___ *Patella*
A-Dorsal view; B-Ventral view

MUREX

Classification:

Phylum	Mollusca
Class	Gastropoda
Order	<i>Neogastropoda</i>
Genus	<i>Murex</i>

Characters:

Habit and habitat: *Murex* is a marine form found between low water mark and 100 fathoms.

1. Shell with a prominent spire and ornamental with spines.
2. Eyes placed at the base of tentacles.
3. Long proboscis and siphon well developed.
4. Radula with two or three teeth in each row.
5. Salivary glands and liver contain the proteolytic enzymes.
6. It is carnivorous feeding on living and dead animals.
7. Some species of *Murex* are destructive to Oyster beds.

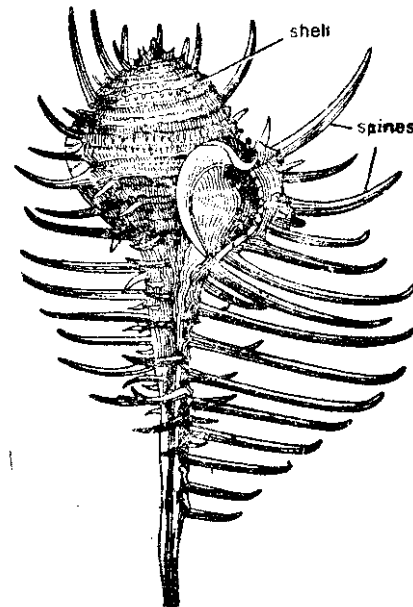


Fig. ___ *Murex*

ECHINUS

Classification:

Phylum	Echinodermata
Class	Echinoidea
Order	Camarodonia
Genus	<i>Echinus</i>

Characters:

Habit and habitat: *Echinus* is marine, found in the sea in the rocky places.

1. *Echinus* is commonly known as sea urchin.
2. Body is globular in shape, somewhat flattened at the two poles forming distinct oral and aboral poles.
3. Body is enclosed in a rigid globular shell or corona formed of closely fitted calcareous plates.
4. Entire surface of the animal except the peristome and periproct is covered with spines articulated to the shell.
5. Pedicellariae with three jaws and sphaeridia are present among the spines.
6. Mouth lies in the centre of oral pole and is surrounded by soft membrane known as peristome, through the mouth project the five teeth of Aristotle's lantern.
7. At the aboral pole is a much smaller aperture, the anus surrounded by periproct.
8. The surface of the shell is divided into alternating ambulacral and inter-ambulacral areas.
9. Numerous podia or tube feet project from the surface among the spines. these are arranged in five double rows in ambulacral areas.
10. Sexes are separate. Gonads are five large masses.
11. Development includes a free-swimming echinopluteus larva.

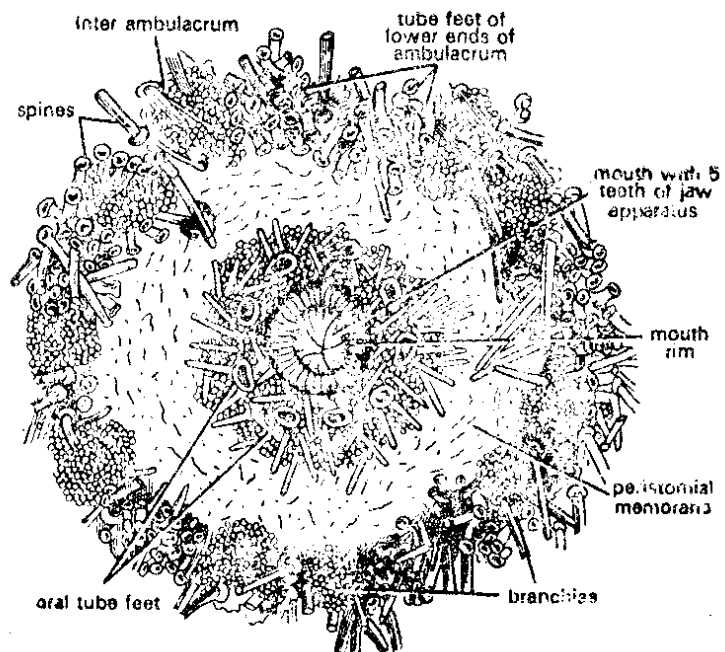


Fig. __ *Echinus* (Oral view)

OPHIOTHRIX

Classification:

Phylum	Echicerdormata
Class	Ophiuroidea
Order	Ophiarae

Characters:

Habit and habitat: *Ophiothrix* is marine and commonly found along Atlantic coast.

1. *Ophiothrix* is a common spiny brittle star.
2. It has a small rounded central disc and five slender jointed arms arising from the lower surface to the disc.
3. The arms are covered on all sides by the plates or shields fringed with spines.
4. The ambulacral grooves, dermal branchiae and pedicellariae are entirely absent.
5. The oral surface bears a madreporite and a mouth possessing five movable plates serving as jaws.
6. The oral surface also bears five oral shields and podialpores.
7. The base of each arm bears a pair of deep grooves called bursal slits through which pass to the outside the mature sex cells.
8. The tube feet without suckers are present on the lower plates of arms.
9. *Ophiothrix* possesses a great power of regenerating its lost arm.

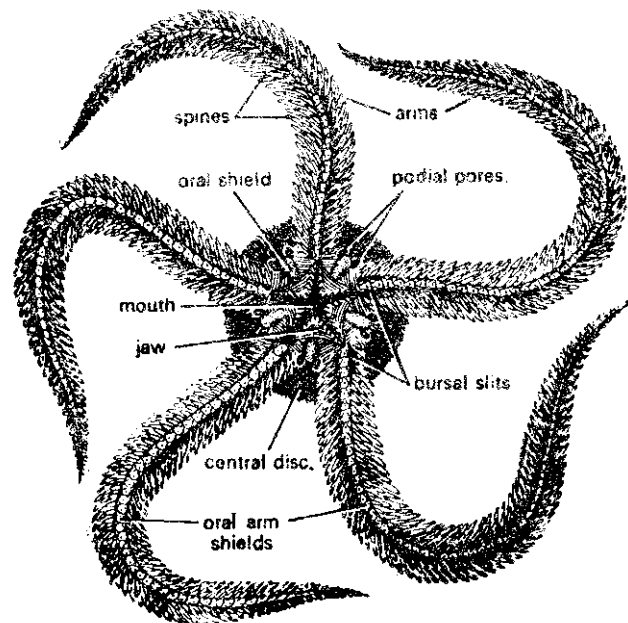
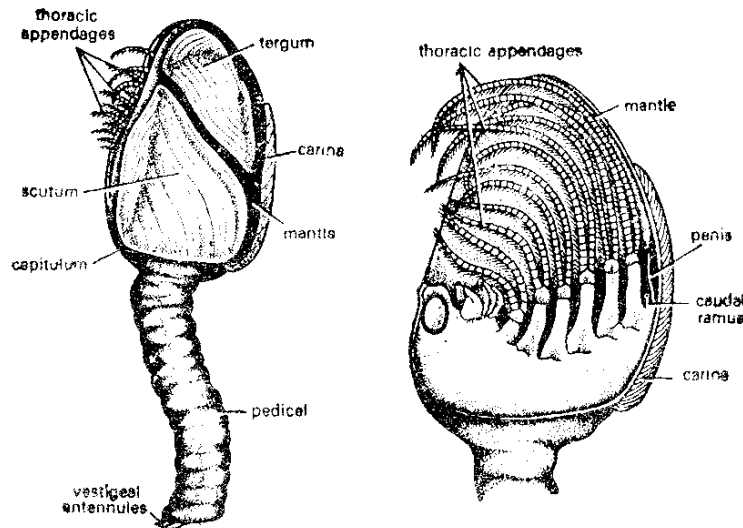


Fig. ____ *Ophiothrix* (Oral view)

LEPAS**Classification:**

Phylum	Arthropoda
Class	Crustacea
Order	Thoracica

Fig. ___ *Lepas*.

A—Entire animal; B—Carapace removed

Characters:

Habit and habitat: *Lepas* is sessile in habit and found all over the world attached to floating objects.

1. *Lepas* is commonly known as goose barnacle or ship barnacle.
2. Body consists of a long stalk or pedicel and capitulum (the body proper).
3. Pedicel is covered with a wrinkled skin and bears the body proper at its distal end.
4. Capitulum is enclosed in a bivalved carapace strengthened by five calcareous plates, proximal scuta, two distal terga and a single dorsal carina.
5. Mouth is provided with a pair of mandibles and two pairs of maxillae.
6. Antennae and paired eyes are absent.
7. Thorax bears six pairs of many jointed biramous appendages fringed with tufts for setae.
8. *Lepas* feeds upon minute organisms gathered by the thread-like feet and wafted into the mouth.

SACCOLINA

Classification:

Phylum	Arthropoda
Class	Crustacea
Order	Rhizocephala
Genus	<i>Sacculina</i>

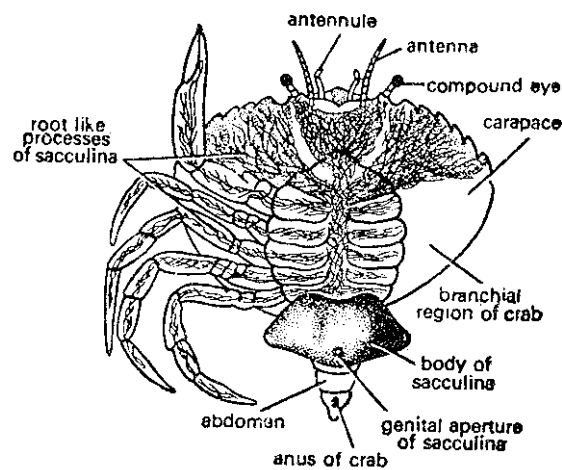


Fig. ____ *Sacculina* on crab's abdomen.

Characters:

Habit and habitat: *Sacculina* is found as parasite on crabs.

1. *Sacculina* is commonly known as root headed barnacle.
2. It has the appearance of a fleshy tumor attached by a peduncle to the abdomen of the crab on its ventral side.
3. It shows extreme degeneration due to parasitic mode of life.
4. Segmentation, appendages, mouth and anus are entirely absent.
5. Peduncle ends numerous delicate root-like filaments which ramify within body of the host and absorb nourishment.
6. Opening of the mantle cavity is placed at the hind end of the parasite.
7. Hermaphrodite, *i.e.*, sexes are united.
8. Larva is cirripede-nauplius.
9. *Sacculina* causes many changes in the secondary sexual characters of the host, a phenomenon known as parasitic castration.

ARENICOLA

Classification:

Phylum	Annelida
Class	Polychaeta
Order	Sedentaria
Genus	<i>Arenicola</i>

Habit and habitat: *Arenicola* is a marine worm, lives in U shaped burrows of sand. It is found in Mediterranean and European shores.

Characters:

1. *Arenicola* is commonly known as lug- or lobe-worm.
2. Body is stout, elongated, cylindrical worm-like measuring upto 20 cm in length and brownish or greenish in colour.
3. Body is divisible into three regions, anterior, middle and posterior.
4. Anterior region is thicker comprising of peristomium and first six setigerous segments.
5. Middle region comprises thirteen segments bearing setae and branched gills.
6. Posterior region is much thinner comprising of invariable number of segments devoid of parapodia, setae and gills.
7. Mouth lies ventral to the prostomium. The buccal region and pharynx protrude as proboscis.
8. The anus opens through the last segment.
9. Nephridia are six pairs.
10. *Arenicola* is generally used as a bait in fishing.

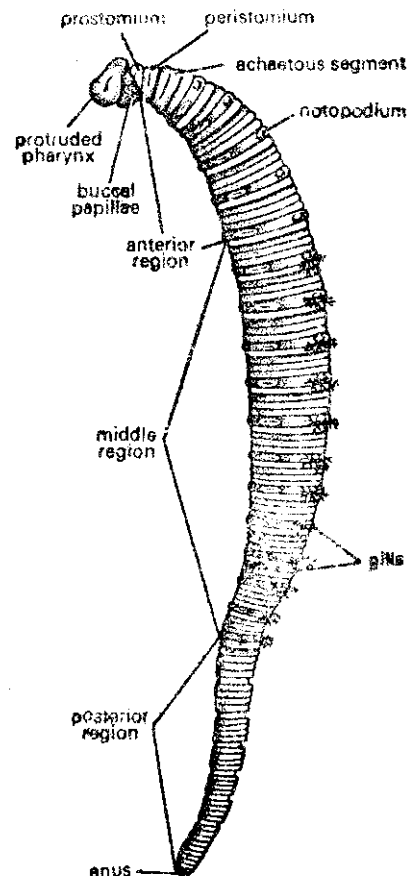


Fig. ____ *Arenicola*.

REDIA LARVA OF FASCIOLA HEPATICA

Characters:

1. Redia larva develops from the germ cells of the sporocyst.
2. The body of redia is an elongated sac-like.
3. Anterior end bears the mouth leading into muscular pharynx, which finally leads into sac-like intestine.
4. Just behind the pharynx is a muscular ring-like swelling known as collar, which helps in locomotion.
5. Posterior region is also provided with two stumpy processes known as lappets helpful in locomotion.

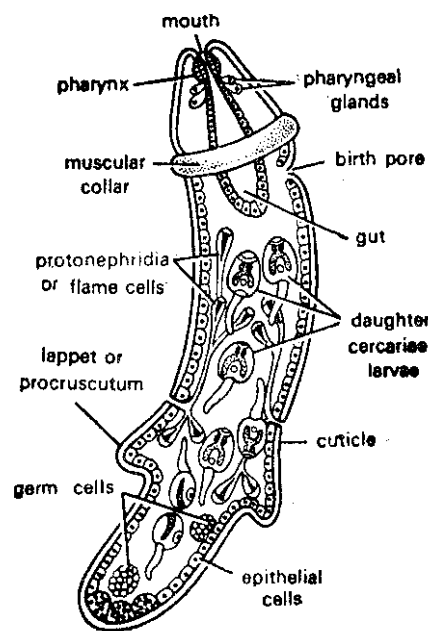


Fig. __ Redia larva of *Fasciola hepatica*.

6. Just posterior to collar a permanent aperture, the birth pore is seen.
7. The space between the body wall and intestine contains few germ cells.
8. Germ cells often gives rise to second generation the daughter radiae.
9. Redia give rise to a new type of larva known as cercaria larva from the germ cells.
10. Cercaria larva comes out from redia through birth pore.

EUPLECTELLA

Classification:

Phylum	Porifera
Class	Hexactinellida
Order	Hexasterophora
Genus	<i>Euplectella</i>

Characters:

Habit and habitat: *Euplectella* is a solitary animal. It is found abundantly in deep waters at the depth of 500 to 5,000 meters in slow running water.

1. *Euplectella* is popularly known as Venus's flower basket due to its beautiful elegant glossy shape.
2. It has a long curved, cylindrical body fastened in the mud of a sea bottom by a mass of long siliceous root spicules.
3. The size of individual varies from 15-30 cm. in length and 2-5 cm in diameter.
4. The skeleton consists of four and six-rayed siliceous spicules which are interlaced and fused at their tips forming a three dimensional network with parietal gaps.

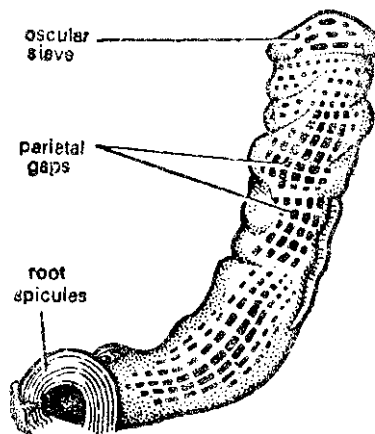


Fig. __ *Euplectella*

5. The spicules are joined together forming a network.
6. The terminal opening is closed by an oscular sieve.
7. The parietal gaps in the network of spicules connect with the spongocoel.
8. Canal system simple having thimble-shaped radial canals.

MYSIS

Classification

Phylum	Arthropoda
Class	Crustacea
Order	Mysidacea
Genus	<i>Mysis</i>

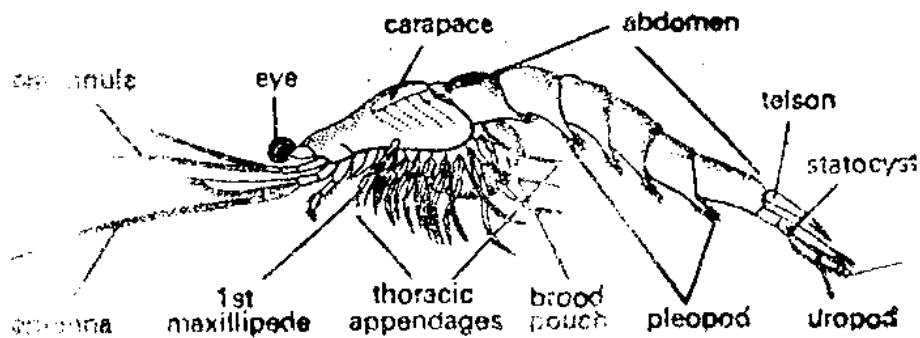


Fig. __ *Mysis*.

Characters

Habit and habitat: *Mysis* is a marine pelagic form. It is generally confined to the surface of water.

1. *Mysis* is a small transparent, shrimp-like form.
2. Body is bilaterally compressed and elongated measuring from 2-6 mm in length.
3. Carapace covers the entire thorax except the last two segments.
4. Head bears antennules, antennae and a pair of stalked eyes.
5. First pair of thoracic appendages are modified as maxillipedes and the rest are biramous serving as swimming organs.
6. Brood pouch is attached to the posterior thoracic segments.
7. Development takes place within the brood pouch, so there is no larval stage.

PLASMODIUM (Malarial Parasite)

Classification

Phylum	Protozoa
Class	Sporozoa
Order	Haemosporidia

Characters

Habit and habitat: *Plasmodium* is found as parasite in the blood of vertebrates.

1. *Plasmodium* is an intracellular blood parasite of man and other vertebrates and causes malaria.
2. The life history of Plasmodium is completed in two hosts, viz., partly in definitive host, the man and partly in intermediate host, the female *Anopheles* mosquito.
3. When an infected female *Anopheles* mosquito bites a man, sporozoites are introduced in the blood from where they reach in liver cells through blood streams and multiply to form merozoites.
4. After few schizogoneous cycles in the liver, the merozoites enter the red blood corpuscles (R.B.C.) and feed on the contents of R.B.C.
5. After 2-8 schizogoneous changes in the main blood stream, the merozoites assume different shapes and known as gametocytes.
6. Gametocytes can not develop further in the blood of man, therefore, they wait for female *Anopheles* mosquito to suck them with the blood.
7. When gametocytes are sucked in by the female *Anopheles* with the blood of man, they undergo sporogony for further development.
8. There are four species of *Plasmodium* causing different types of fever:

- (i) *Plasmodium vivax* causes benign tertian fever.
- (ii) *P. falciparum* causes malignant tertian fever.
- (iii) *P. malariae* causes quartan fever.
- (iv) *P. ovale* causes ovale or mild tertian fever.

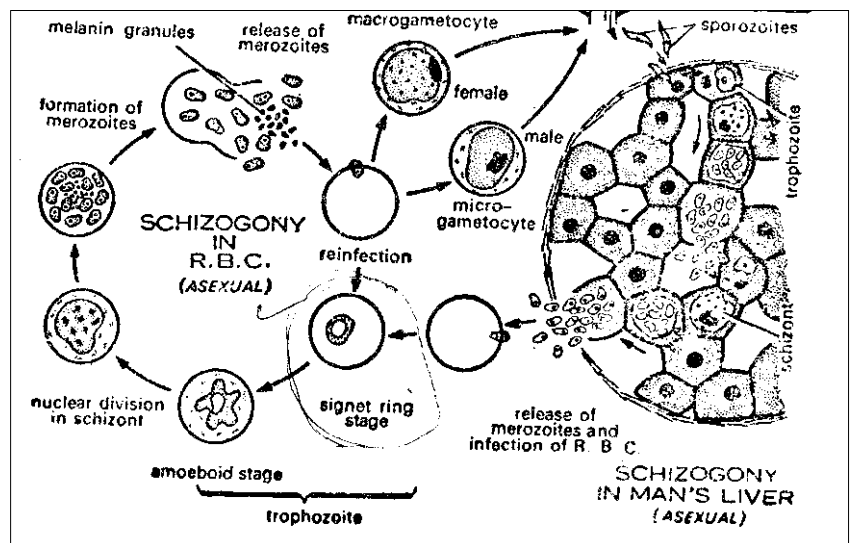


Fig. __ Life cycle of *Plasmodium*

SCOLOPENDRA

Classification

Phylum	Arthropoda
Class	Myriapoda
Order	Chilopoda
Genus	Scolopendra (Centipede)

Characters

Habit and habitat: *Scolopendra* commonly occurs under stones, in rotten logs and in houses in damp places.

1. *Scolopendra* is commonly called centipede.
2. Body is elongated and dorsoventrally flattened with numerous segments.
3. Head is distinct and bears a pair of antennae, a pair of mandibles and two pairs of maxillae.
4. Trunk segments numerous, each bearing a single pair of legs.
5. First pair of trunk appendages or maxillipedes bears a sharp claw connected with the poison gland.
6. Genital opening situated at the hind end of the body.
7. Sexes are separate.
8. Carnivorous, feeding on insects, spiders, worms slugs, etc.
9. *Scolopendra* is harmful to mankind.
10. Between the last leg bearing segment and the terminal telson are two small limbers segments – the pregenital and genital segments.

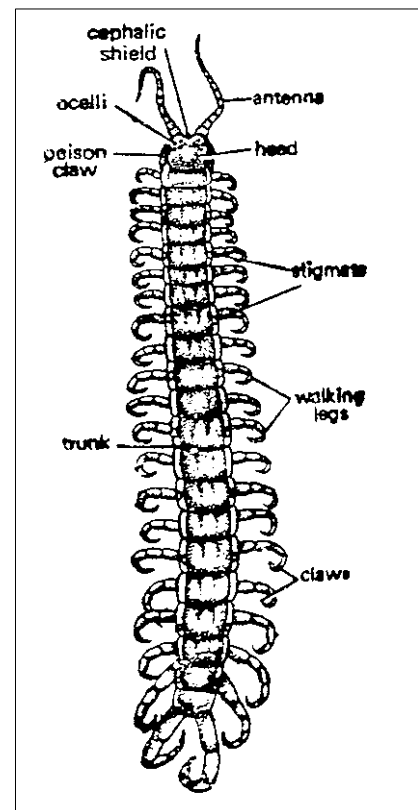


Fig. __ *Scolopendra*

DENTALIUM

Classification

Phylum	Mollusca
Class	Scaphopoda
Genus	<i>Dentalium</i>

Characters

Habit and habitat: *Dentalium* is marine and found in the sand at great depth.

1. *Dentalium* is commonly known as tusk shell.
2. Body is bilaterally symmetrical and enclosed in a tubular shell open at both ends.
3. Mantle folds are fused ventrally to form a tube enclosing the body.
4. Head is vestigial, bearing the mouth which is surrounded by a circlet of retractile tentacles, the captacula with sucker-like ends.
5. Foot is long and conical, protrudes through the anterior opening of the shell and is used in burrowing.
6. Well developed radula is present.
7. Anus lies behind the base of foot.
8. Gills are absent. Respiration by transverse folds in the lining of mantle.
9. A pair of nephridia is present with their external openings on either side of the anus.

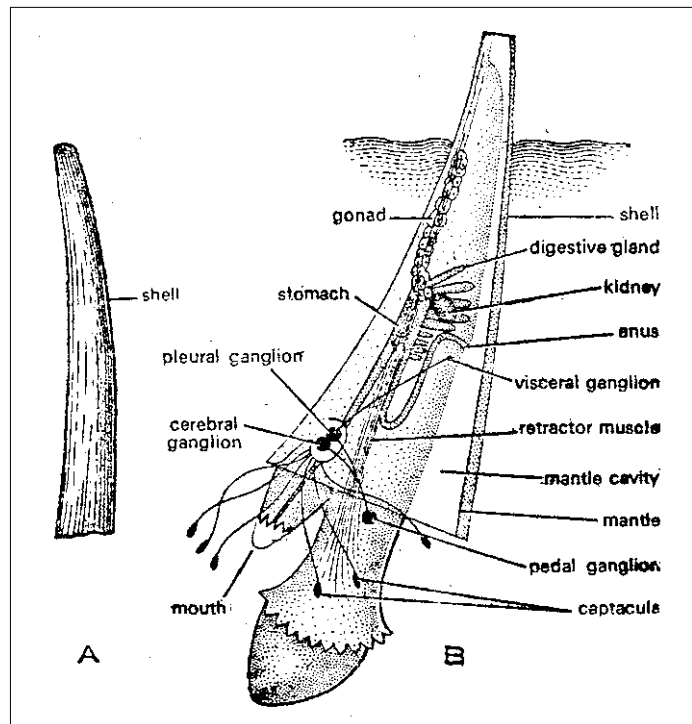


Fig. __ *Dentalium*
A-Shell; B-Structure of specimen buried in sand

10. Vascular system is poorly developed without distinct head.
11. Nervous system simple and consists of cerebral, pleural and pedal ganglia.
12. Eyes absent. Otocysts present.
13. Sexes are separate.
14. Development includes Veliger larva.
15. The shell exhibits brilliant jade green colour.

PRACTICAL-II**EXPERIMENT 5****CHICK EMBRYO STAGES RELEVANT TO THEORY****18 HOURS CHICK EMBRYO**

1. Notochord has become markedly elongated to form a conspicuous structure.
2. Notochord extending towards the cephalic region in the middle from Hensen's node.
3. Embryo of 18 hours incubation is often spoken of being in the "Head Process Stage".
4. Neural plate develops around the notochord.
5. The dark peripheral area opaqua, inner dark area pellucida, and central embryonal area are seen.
6. In the anterior region is present a small and more translucent portion area pellucida which is known as "**Proamnion**".

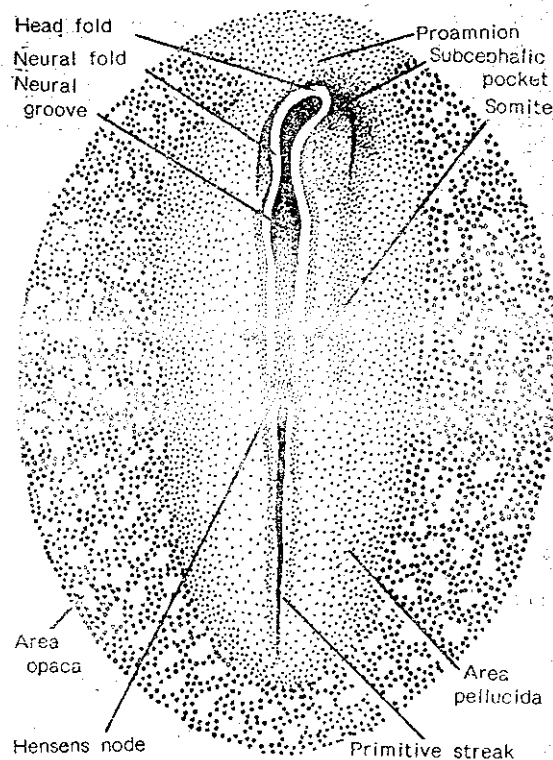
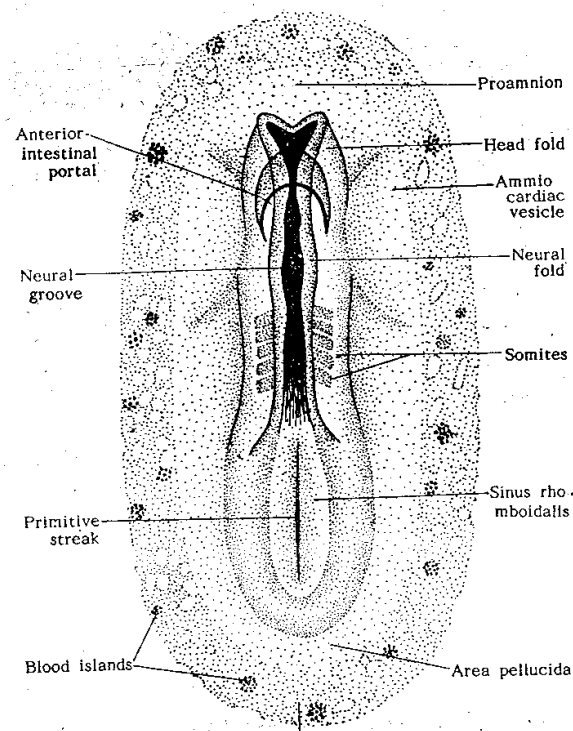


Fig. ___ 18 hours chick embryo

7. Proamnion is characterized by the absence of mesoderm.
8. Primitive streak lies in the middle of area pellucida in the posterior half.
9. Neural plate and primitive streak are separated by Hensen's node.

24 HOURS CHICK EMBRYO

1. In 24 hours of chick embryo cephalic region undergoes rapid growth. It extends anteriorly over hanging the proamnion region.
2. The cephalic region which projects free from the blastoderm may now properly be termed as the head of the embryo.
3. The space formed between the head and blastoderm is called sub-cephalic pocket.
4. In the middle line the notochord is seen. It is larger caudally near its point of origin than it is cephalically.
5. The neural plate is much more clearly marked.

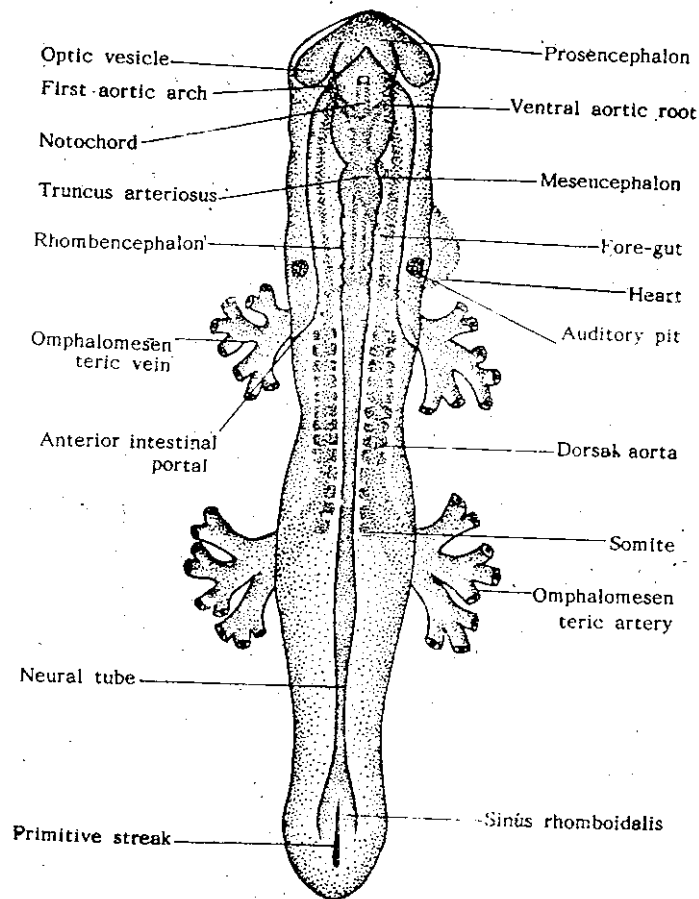


Area vasculosa

6. The neural folds appear as a pair of dark bands.
7. At its cephalic ends, the neural groove is deeper and the neural folds are correspondingly more prominent than they are caudally.
8. 4 pairs of somites are seen in the midline.
9. Primitive streak gradually decreases in size.
10. Foregut is also formed. The part of the gut caudal to the foregut is termed midgut and the opening from midgut into the foregut is called anterior intestinal portal.
11. Besides above structure of area opaca, vitellina, area pellucida, proamnion, Hensen's node, area vasculosa, blood islands and unsegmented mesoderm are also seen.

33 HOURS CHICK EMBRYO

1. The vascular area of the blastoderm is better organized and extends anteriorly but the proamnion is not yet invaded by the mesoderm.
2. At the level of optic vesicle, the head is thrust forward. Over the ectoderm and the space between it and head is called the sub-cephalic pocket.
3. The primitive streak is still prominent caudally and the notochord can be followed by primitive knot.



33 hours chick embryo

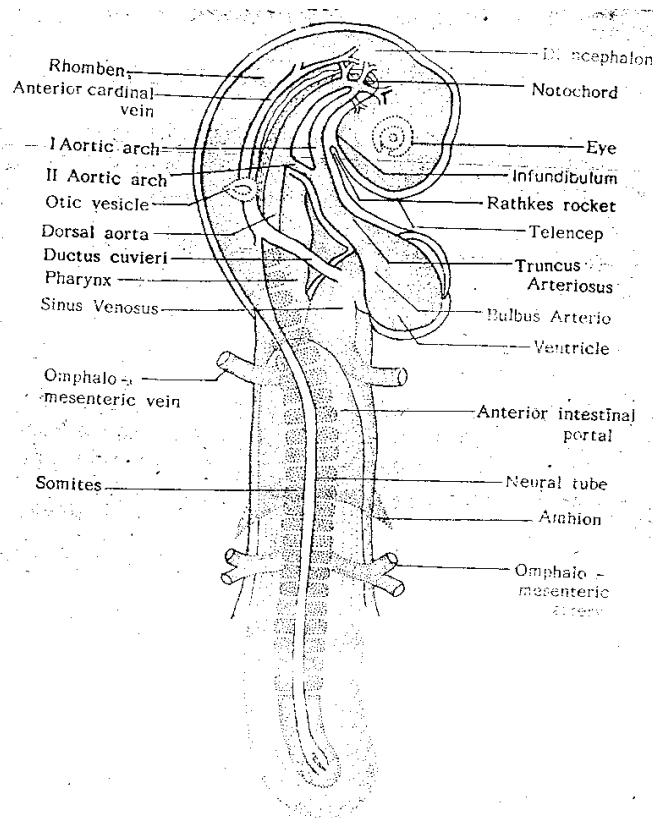
4. The heart is straight double tube lying in the midplane and ventral to the gut. It is continuous caudally with Omphalomesenteric veins.
5. Thus, the 33 hours chick has approximately **12 pairs** of somites.

36 HOURS CHICK EMBRYO

1. The embryo of 36 hours incubation shows the following important peculiarities.
2. The brain is differentiated into fore brain, mid brain and Hind brain.
3. The optic vesicles are established as paired lateral outgrowths of the fore brain.
4. 13 pairs of somites are found.
5. Primitive streak becomes shorter because of longitudinally lengthening of neural tube.
6. Mid region of heart is considerably dilated and bent to right.
7. Vitelline artery and Vitelline vein have developed.
8. Proamnion, Notochord, Neural groove, Neural fold, Area of vasculosa, area pellucida, Hensen's node are present.

48 HOURS CHICK EMBRYO

1. At 48 hours, the embryo may possess as many as 27 pairs of somites and be 7 mm long.
2. The heart beat and circulation of blood are well established.
3. The body has twisted so that the left side of the head and neck region is next to yolk.
4. The right side is upper most.
5. The head is viewed from right side, while body in dorsal view.
6. By a slight at the midbrain and a slight curvature of the hind brain the fore brain is brought into close proximity to the heart.



48 hours chick embryo

7. The anterior half of the embryo is covered by a double layer of somatic pleura. The innermost layer of which is the amnion and the other is cleorium.
8. The boundaries between the anterior part of the embryo and the extra embryonic membrane are clearly demarked.
9. The head fold of the amnion combined by its lateral folds has progressed back to the twentieth (20) Somite.
10. At the posterior end of the embryo a tail fold develops forming a boundary between the posterior anteriorly to meet the amniotic head fold.

ENUMERATION OF W.B.C. AND R.B.C. IN BLOOD

PRACTICAL-II

EXPERIMENT-1

Aim:- To enumerate WBC and RBC in blood.

Methods:- (a) Electronic Method
(b) Visual Method

Electronic method:- It depends upon 3 methods

- (i) Optic or light scattering principle (Microscopic)
- (ii) Laser or Ortho-principle
- (iii) Electrical impedance or Counter method

Visual Method:- (i) Counting chamber,
(ii) Pipette
(iii) Diluting fluid

Types of Counting chambers:

- (1) Thomas
- (2) Burker's
- (3) Funch and Rosenchal's
- (4) Neubauer's
- (5) Improved Neubauer's

Neubauer's Counting chamber:- It is a special thick glass slide measuring about 7.5 cms x 3.5 cms x 0.5 cm. It consists of a central "H" shaped groove which is oriented transversely. Both the limbs of the "H" form an elevated stage of about 0.1 mm, which is used for placing the coverslip. On either side of "H" there are reels of 9 sq. μ mts. each which are used for the cell counting. It consists of 9 squares of 1 sq. mm each. The central square is used for RBC counting. The outer squares are used for WBC counting. The central square is subdivided into 25 smaller squares of $\frac{1}{2}$ sq. mm. each and each square is further subdivided into 16 smaller squares. For WBC counting outer 4 large squares are used. For RBC counting 9 central squares are used. For platelet counting the RBC squares where all the 25 squares are counted. For absolute Eosinophil count the whole ruled area is counted.

Pipettes:- Both RBC and WBC pipette have a capillary stem, a bulb with a bead and a plastic mouth piece.

Differences between RBC and WBC pipettes

	RBC	WBC
Bulb	Large with red bead	Smaller with white bead
Markings	0.5, 10, 1.01	0.5, 1, μ
Dilution	1 : 200	1 : 20
Mouth piece	Red	White

WBC Count:- Normal total WBC count : 4,000 -11,000 cells / cu.mm

Diluting fluids:- (1) 0.5% Acetic acid or 10% Hydrochloric acid.

(2) **Turk's fluid:-** Consists of Glacial acetic acid which causes haemolysis of the non-nucleated RBC's aqueous genetian violet to stain the nucleus of WBC's and distilled water.

Procedure:- Blood is auticoagulated and fresh blood is sucked into the pipette upto the mark 0.5 cu.mm and later diluting fluid upto the mark II. The pipette is rolled between the palms and kept for about 5-10 mins. The diluting fluid present in the capillary stem portion of the pipette which is about 1 cu. mm is discarded and later the chamber is charged holding the pipette at 45° angle. Precautions must be taken to see that the fluid does not overflow into the gutter or comes above the cover slip. After charging the chamber, it is left for 5 mins. for cells to come and settle down. The total number of WBC are counted in the 4 large squares of less than 2-4, WBC is seen in each fluid → Leucopenia. If more than 4-6 cells is seen it is → Leucocytosis.

Calculation:- Depth = $\frac{1}{10}$ mm
 Dilution = 1:20
 Area = 4 sq.mm.

$$\text{Total WBC count} = \frac{N}{\frac{1}{10} \times \frac{1}{20} \times 4} = N \times 50 \text{ cells/cu.mm}$$

RBC Count:

Diluting fluid: RBC diluting fluid consists of Sodium Citrate and formaline with distilled water.

Heymen's fluid: Consists of Mercuric chloride which acts as both fixative and preservative, prevents growth of bacteria and fungus, NaCl, Sodium sulphate maintain the pH.

Gower's fluid: Glacial acetic acid and Sodium sulphate.

Procedure: Blood is drawn upto the mark 0.5 and the diluting fluid upto the mark 1.01. Rest of the procedure is the same as that of WBC count.

Calculation:- Depth = $\frac{1}{10}$ mm
 Dilution = 1: 200
 Area counted = $\frac{1}{5}$ of sq.mm

$$\text{Total RBC Count} = \frac{N}{\frac{1}{10} \times \frac{1}{200} \times \frac{1}{5}} = N \times 10,000 \text{ cells / cu mm}$$

Normal Counts and Variations:

(1) Normal WBC count: 4,000 – 11,000 is adults, more in children.

Increased (Leucocytosis)	→ Leukaemia
Rheumatoid arthritis	→ Leukaenoid reactions
Appendicitis, Abscers	→ Acute infections
Decreased (Leucopenia)	→ Aplastic anaemia
Viral infections – Smallpox	→ Bone marrow depression
Chicken pox, mumps	→ Pre leukaemia

(2) Normal RBC count:- 4.5 – 5 million / cu.mm
 more in male / less in female

Decreased:- All Anaemias (Oligocythemia)

Increased:- Polycythemia

Life span of RBC is 120 days

Absolute Eosinophil normal count:- 40-400 cell/cu.mm.

Increased:- Eosinophilia

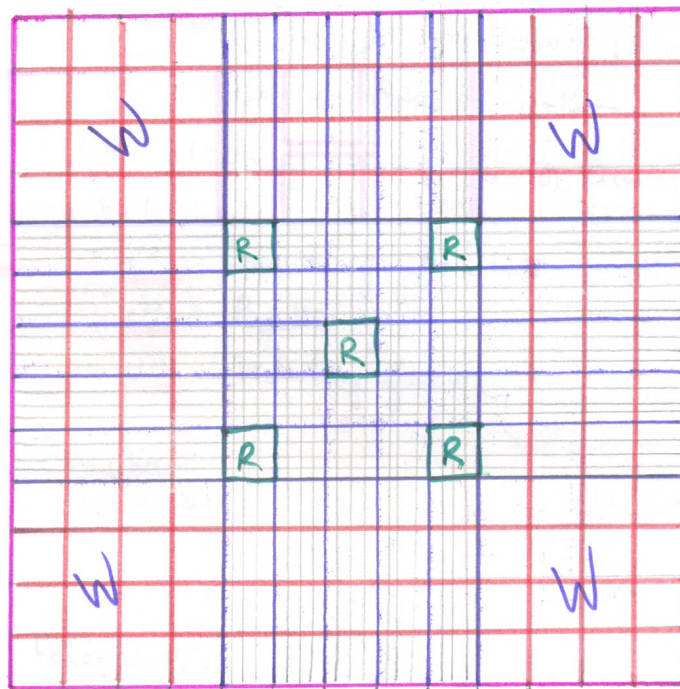
Skin disorders	→ Eczyma, Psoriasis
Respiratory disorders	→ Asthma
Systemic disorders	→ Hay fever, Tropical Eosinophilia

Intestinal parasitic infestations:- Like hook worms, sleeping, sickness, Addison's disease.

Decreased:- Eosinopeuia, Cushing's Syndrome

Increased RBC count:- Polycythemia

- Polycythemia vera
- Lung diseases like asthma, Emphysema
- Congenital heart diseases like patent ductus, Arteriosus.
- Inter ventricular septal defects
- Dehydration
- Congenital vascular disorders like arteria-venous shunt.



NEUBAUER'S COUNTING CHAMBER

Decreased RBC count (Oligocythemia)

- All types of Anaemia
- Malaria
- Toxic effects of certain drugs like chloromycetis
- Irradication of Bone marrow.

**PRACTICAL-II
EXPERIMENT-2****DIFFERENTIAL LEUCOCYTE COUNT**

Aim:- To estimate the differential leucocyte count from the given blood sample.

Procedure:- The blood was taken on the slide to estimate differential leucocyte count from the given sample by taking another slide, the blood smear was prepared. This is to be done for the uniform distribution of leucocyte cells within the given sample. After the preparation of smear

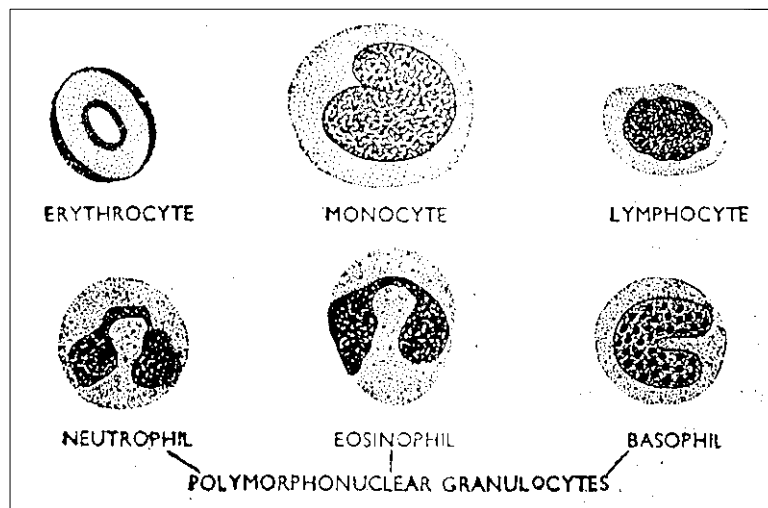


Fig. Various types of cells of the Blood

the slide was kept for a while to get dry. After that Leishman's stain was added in order to stain different types of Leucocyte cells properly. Staining was done for 10-12 mins. After that the slide with the blood smear was washed by means of tap water or distilled water to examine or to observe the slide under the microscope for the above counting.

The following pattern of Leucocyte cells was observed and are as follows:

- (i) Neutrophils (N) = 60
- (ii) Lymphocytes (L) = 30
- (iii) Eosinophils (E) = 4
- (iv) Monocytes (M) = 5
- (v) Basophils (B) = 1

Number of cells present in the given blood sample are represented in the table
(with the code number)

N	N	N	N	E	N	N	L	N	N
N	L	L	N	L	N	L	N	L	N
L	N	N	N	L	L	N	M	N	N
N	L	L	N	L	N	M	N	E	L
L	M	N	N	B	L	N	L	N	N
N	N	L	L	N	L	N	N	L	N
N	L	L	N	M	N	N	N	N	L
E	L	N	L	N	L	N	L	N	N
N	N	L	N	N	E	N	M	N	N
N	N	L	N	N	N	L	N	N	N

Neutrophils (N) = 60%

Lymphocytes (L) = 30%

Eosinophils (E) = 4%

Monocytes (M) = 5%

Basophils (B) = 1%

**PRACTICAL-II
EXPERIMENT-3****WHOLE MOUNTS OF INVERTEBRATE LARVAE**

Aim:- To prepare temporary whole mounts of different larval forms in the given sample which are to be observed under microscope.

Apparatus: Petridish, slides, cover slips, Brush, Pipette, Microscope.

Reagents: Alcohol of different concentrations, water, xylol, and Glycerine.

Procedure:

- (i) Collection
- (ii) Preservation
- (iii) Isolation
- (iv) Identification
- (v) Staining
- (vi) Mounting

Collection:- Plankton samples were collected from the stagnant or pond or pools or lakes by means of a plankton net. Net Mesh size 25-40 mm ID. After filtering required amount of water by means of a net, the residue that is obtained within the net was dispersed in the water, from the plankton tube, the organism spread evenly in the sample.

Preservation:- After the collection of organisms from the water sample they were preserved with the additions of 5% Formalin.

Isolation:- From the sample, Isolation of microscopic organisms was done for observation, then the organism were identified.

Staining:- The organisms were transferred to Eosin stain to stain all the parts for 10 mins. If any excessive stain is observed, the organism was transferred to distilled water.

Mounting:- The organisms by means of fine pointed brush were then kept on the slide for mounting. Glycerin drop was added to prepare temporary mount of the organism.

MYSIS

With the following taxonomic features the mountant was identified as mysis.

1. It is the larval form of Crustacea.
2. The body is divisible into 9-13 segmented cephalothorax and segmented abdomen.
3. The presence of Carapace with a rostral spine
4. The presence of 13 pairs of Cephalothoracic appendages.

5. The presence of 6 pairs of abdominal appendages.
6. The presence of a pair of stalked compound eyes.
7. Presence of Telson, it is elongated laterally compressed and transparent.
8. It is having 3 stages. Mysis-1, Mysis-2, Mysis-3. Each stage duration is 0-1.5 days, 1-2 days & 2.5 days. Total duration is 4.5 days.

ZOEA

With the following Taxonomic features, the mountant was identified as Zoea.

1. The carapace develop as a rostral spine.
2. The head and thorax begins to fuse together to form the Cephalothorax.
3. The presence of well developed 13 pairs of Cephalothoracic appendages.
4. Maudible paired.
5. Eyes are present.
6. It is a larval form of Crustacea.

MEGALOPA

The following taxonomic features were observed in megalopa and was identified.

1. It is the larva of Crustacea belonging to Phylum: Arthropoda.
2. The body is divisible into Cephalothorax and abdomen.
3. Cephalothorax is covered by a broad Carapace.
4. Anteriorly the Carapace produced into median spine.
5. The eyes are stalked and compound.
6. All the appendages are well developed.
7. It is a pelagic larva.

NAUPLIUS

The following are the observed taxonomic features of the temporary mountant and basing on these features it was identified as Nauplius.

1. The body is oval and flat broad anteriorly and narrow posteriorly.
2. Body is segmented, and has 3 pairs of appendages.
3. The first pair is uniramous, pre-oral in position and becomes antennules in the adults.
4. The second pair is Biramous and also the third.
5. Eye is present.
6. At the hind end of the body there is pair of buccal setae.
7. The cuticle is soft.
8. It is the larval form of Crustacea.
9. It is 6 staged larva and each stage lasts for 5-6 hours.

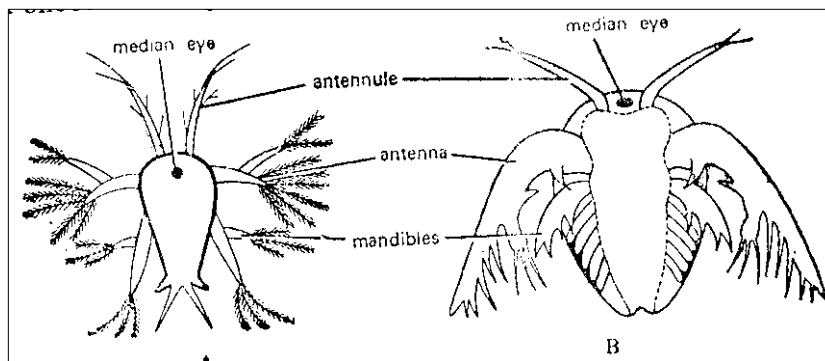


Fig. __ Nauplius larva.
A – Nauplius of *Penaeus*; B-Nauplius of *Apus*.

MYSIS

Classification:

Phylum	Arthropoda	
Class	Crustacea	
Subclass	Malacostraca	
Order	Mysidacea	Carapace covers almost entire thorax; uropods form broad fan-like tail fin.
Genus	<i>Mysis</i>	

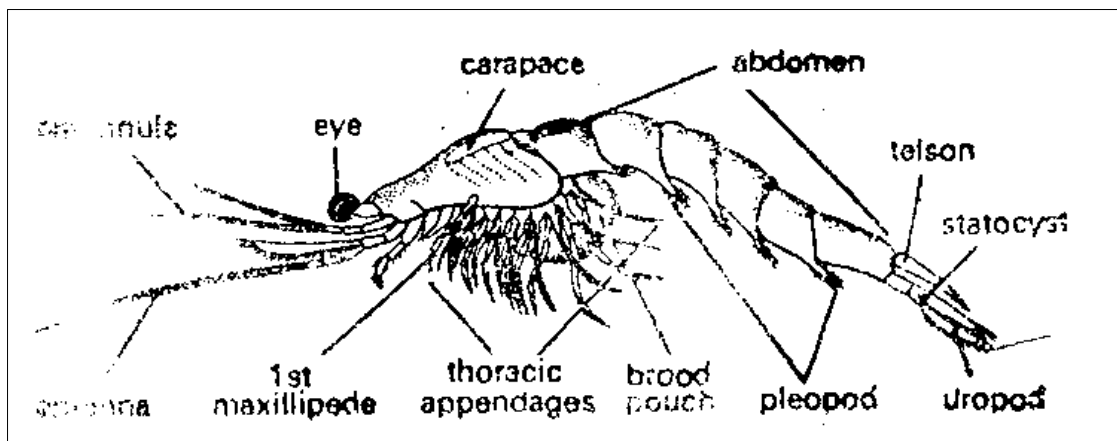


Fig. __ *Mysis*

Characters:

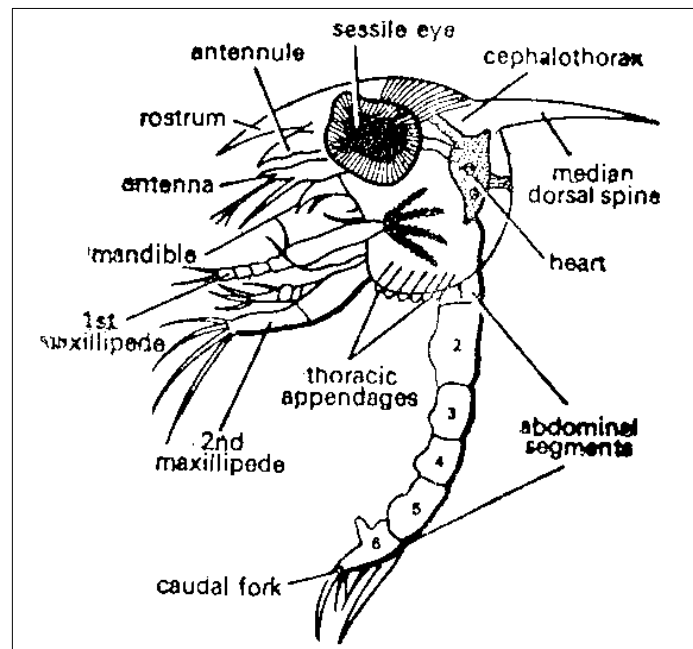
1. *Mysis* is a small transparent, shrimp-like form.
2. Body is bilaterally compressed and elongated measuring from 2-6 mm in length.
3. Carapace covers the entire thorax except the last two segments.
4. Head bears antennules, antennae and a pair of stalked eyes.
5. First pair of thoracic appendages are modified as maxillipedes and the rest are biramous serving as swimming organs.
6. Brood pouch is attached to the posterior thoracic segments.
7. Development takes place within the brood pouch, so there is no larval stage.

Habit and habitat: *Mysis* is a marine pelagic form. It is generally confined to the surface of water.

ZOEA LARVA

Comments:

Zoea larva is the fourth larval stage of the Crustacea. Nauplius changes into metanauplius, metanauplius into protozoea and the latter changes into zoea larva.



1. Body of zoea comprises large unsegmented cephalothorax and long segmented abdomen.
2. Carapace of cephalothorax is produced into long spines of which one is rostral, a median dorsal and two lateral.
3. Compound eyes are paired and movable.
4. Two pairs of maxillipedes are well developed and six pairs of thoracic appendages develop as buds.
5. Abdomen consists of six segments and devoid of appendages but the last segment bears caudal fork.

MEGALOPA LARVA

Comments:

1. Megalopa larva is the larva of crab and it develops from zoea larva through successive moults.
2. It has a broad and crab-like cephalothorax bearing an anterior median spine.
3. Eyes are large and stalked.
4. Antennules are small, while antennae are large.
5. Thoracic appendages are well developed.

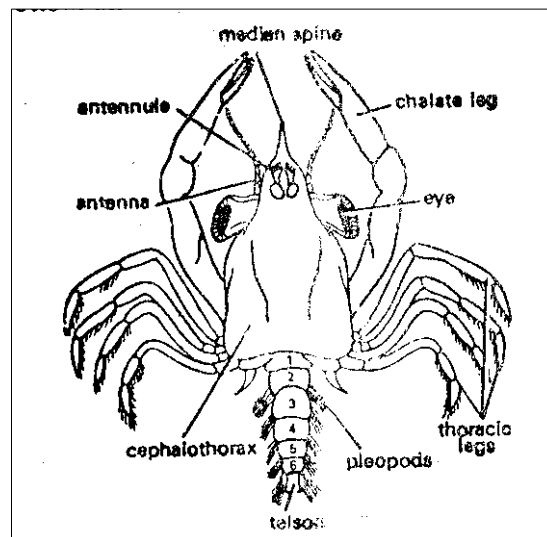


Fig. __ Megalopa larva of crab

6. Abdomen is six segmented bearing biramous pleopods and a telson.
7. Megalopa leads a pelagic life for sometime and later on sinks to the bottom and transforms into adult.

BIPINNARIA LARVA

1. It is the second larva of star-fish. It develops from dipleural larva.
2. It is minute and microscopic. It swims freely on the surface of water.
3. It is bilaterally symmetrical.
4. It has a straight alimentary canal with a mouth at the anterior end and an anus at the posterior end.

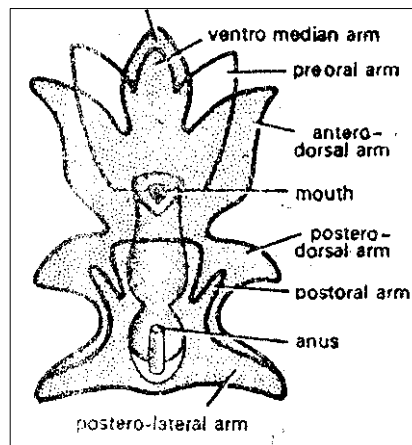


Fig. __ Bipinnaria larva

5. The body has a number of outgrowths called arms. The arms are covered by ciliated bands and are used for locomotion. It has two unpaired arms and 5 pairs of paired arms. They are:
 - (1) Median dorsal arms
 - (2) Median ventral arms
 - (3) Pre-oral arms
 - (4) Post-oral arms
 - (5) Antero dorsal arms
 - (6) Postero dorsal arms
 - (7) Postero lateral arms

**PRACTICAL-II
EXPT. 4****BLOOD GROUP DETERMINATION IN MAN**

Aim:- To determine the blood group of given blood sample.

A – Blood group	= 27%
B – Blood group	= 31%
O – Blood group	= 33.4%
AB – Blood group	= 8.2%
Rh +tive	= 95%
Rh –tive	= 5%

Uses of blood group:

- (i) It prevents complications of mismatched blood transfusion.
- (ii) It helps in improving disputed paternity.
- (iii) In forensic Criminology – Identification of blood at the site of accident helps in identifying the victim.
- (iv) Used for red cell adherence test to differentiate malignancy cases from frank malignancy cases.

Apparatus: Slides, Antigens, Cotton, Spirit, Pricking needle.

Procedure:- Two glass slides are taken. A blood sample of anticoagulated blood is placed on each compartment of the slide.

To the first compartment add Anti-A reagent (Blue colour)

To the second compartment add Anti-B reagent (Yellow colour)

To the third compartment add Anti-D reagent (colourless)

Sera and blood are mixed with different sticks and observed for agglutination.

Inference:

1. In A-blood group, agglutination is seen in Anti-A and no agglutination Antiserum-B.
2. In B-blood group, agglutination is seen in Anti-B serum and no agglutination is seen in Anti-A serum.
3. In AB-blood group agglutination is seen in both anti-A and anti-B seras.
4. In O-blood group, no agglutination is seen in either Anti-A or Anti-B serum.

If there is agglutination in Anti-D sera → Rh +tive

If there is no agglutination in Anti-D sera → Rh -tive

Conditions:- Giving rise to false positive agglutination

- (1) Pan agglutination due to infected blood (unsterile collection or patient suffering from Septicemia).
- (2) Presence of cold agglutination where the temperature is low.

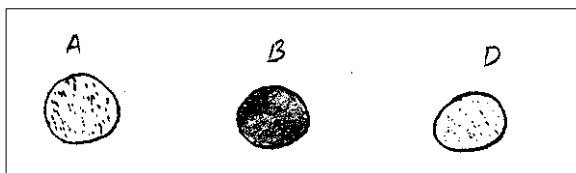
False negative agglutination:

1. Use of very weak antisera.
2. Grouping done on stored blood.

Dangerous Universal Donor: There are people with blood group "O" with a very high concentration or litre of Anti-A and Anti-B antibodies in his blood. Normally when group-O blood is transferred to another person the antibodies present in the donated blood will undergo dilution in the recipients. Circulation will not cause any reaction.

In universal donors, the antibody levels even after dilution will be sufficient enough to cause a haemocytic reaction. Hence, the name universal dangerous donor. They are detected by indirect cross-matching. The antibody levels can be assessed by antibody titration in the stream.

Result: The agglutination is seen in Anti-A and Anti-D serum. So it is called A +ive.
Blood grouping



A +ive Blood group

Anti 'A' – Blue colour

Anti 'B' – Yellow colour

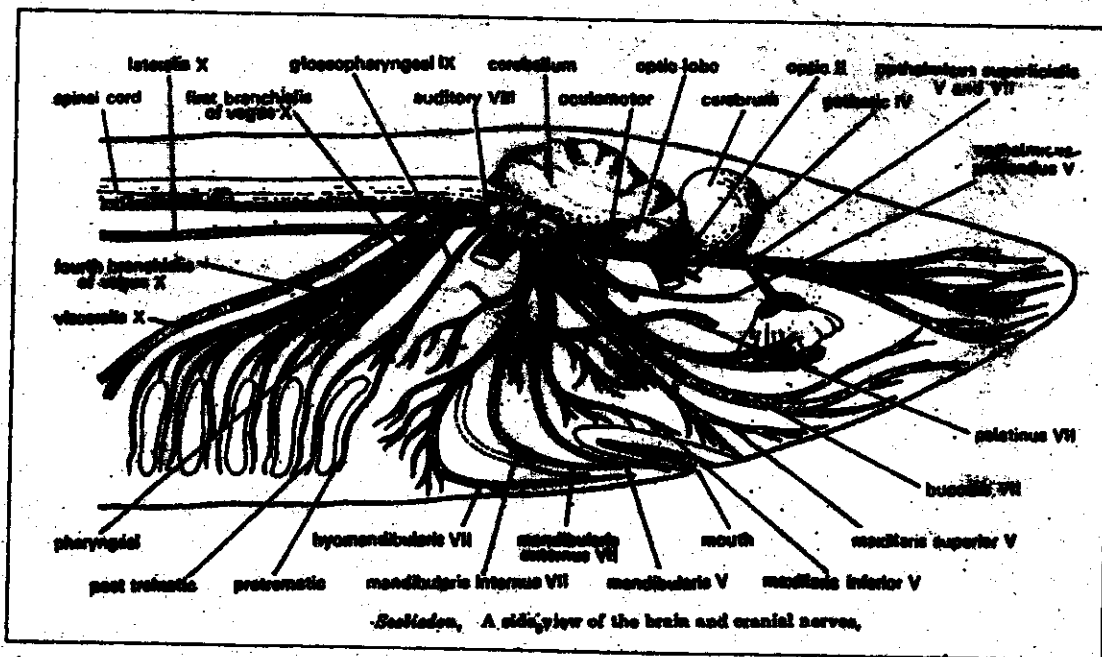
Anti 'D' - Colourless

S.No.	Blood with Anti-A	Blood with Anti-B	Blood with Anti-D	Groups	Rh factor
1	O	●	●	A	Negative
2	●	O	●	B	Negative
3	O	O	●	AB	Negative
4	●	●	●	O	Negative
5	O	●	●	A	Positive
6	●	O	O	B	Positive
7	O	O	O	AB	Positive
8	●	●	O	O	Positive

Blood + Antiserum with agglutination = O

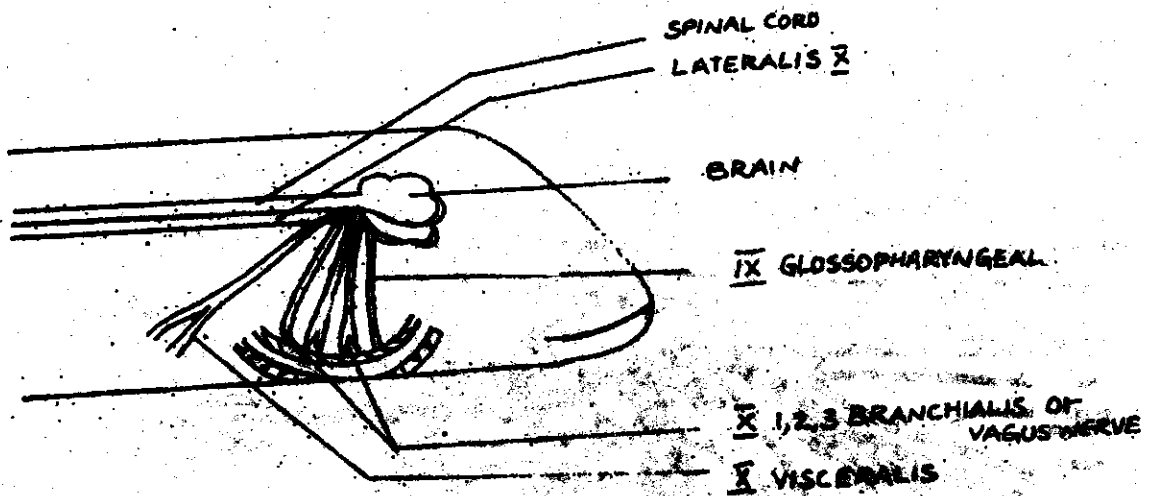
Blood + Antiserum with no agglutination = ●

SHARK - IX & X CRANIAL NERVES

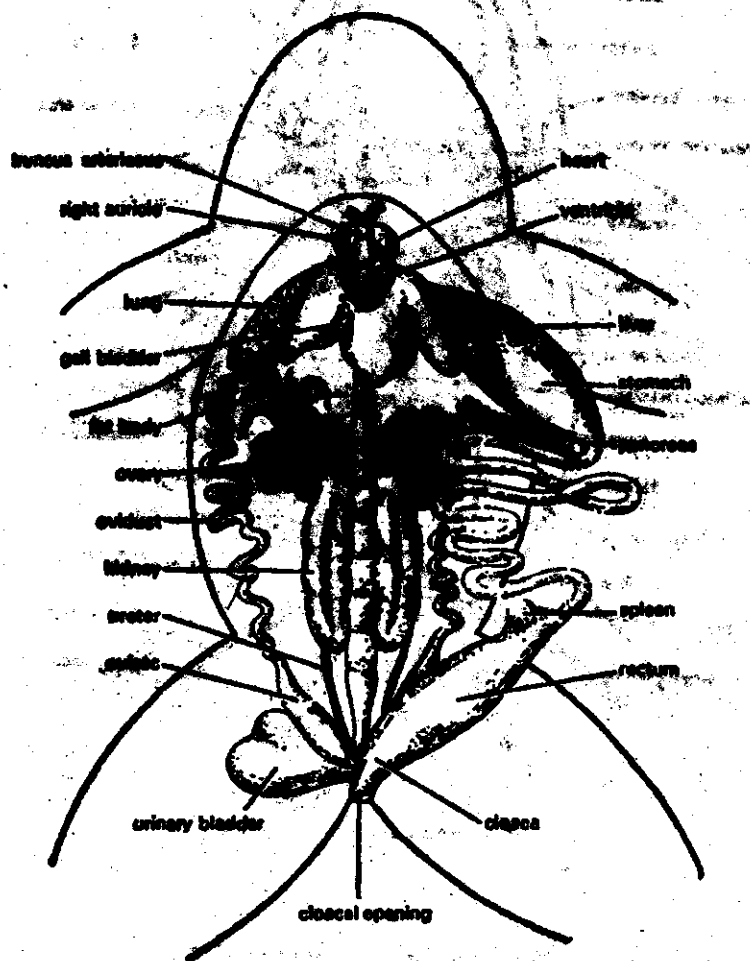


TRICHIURUS - IX & X CRANIAL NERVES

TRICHIURUS - IX & X CRANIAL NERVES

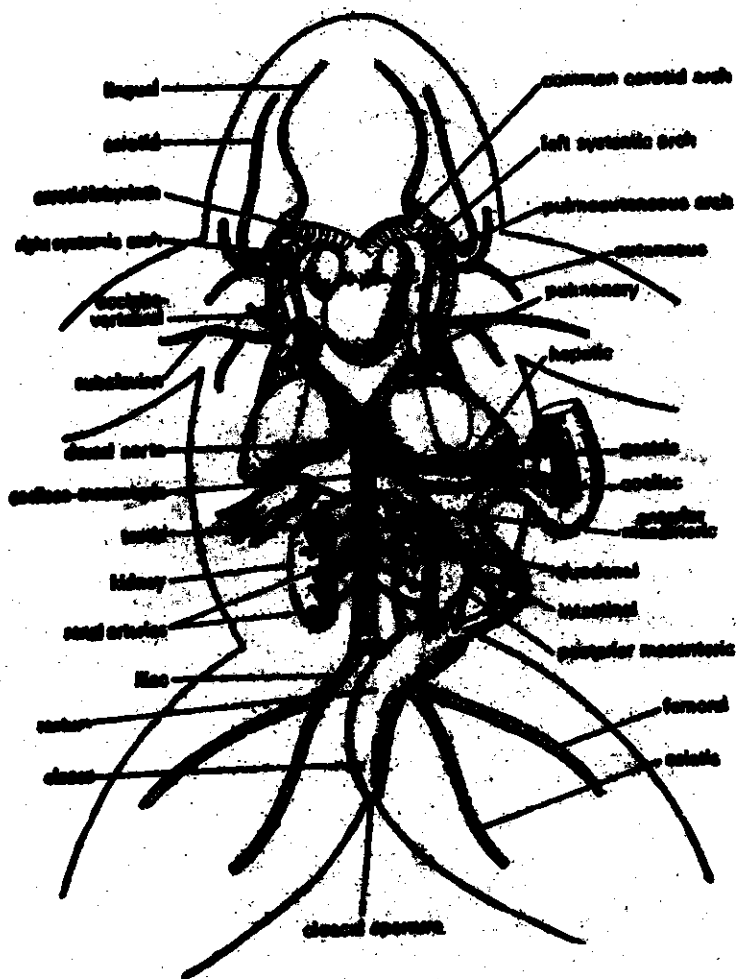


FROG - DIGESTIVE SYSTEM AND VISCERA



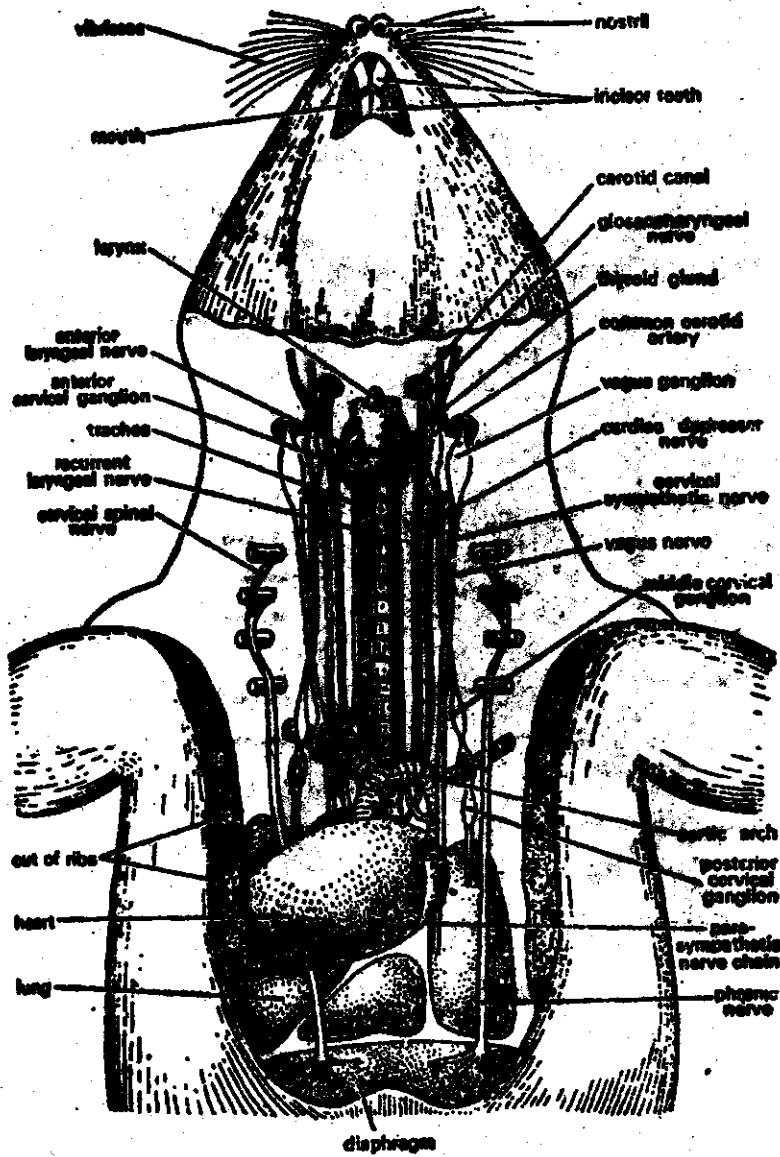
General anatomy of *Rana tigrina*

FROG - ARTERIAL SYSTEM



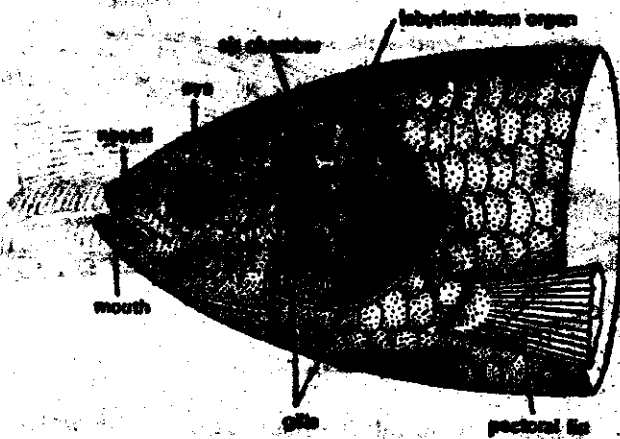
Arterial system of *Rana tigrina*

RAT - NECK NERVES



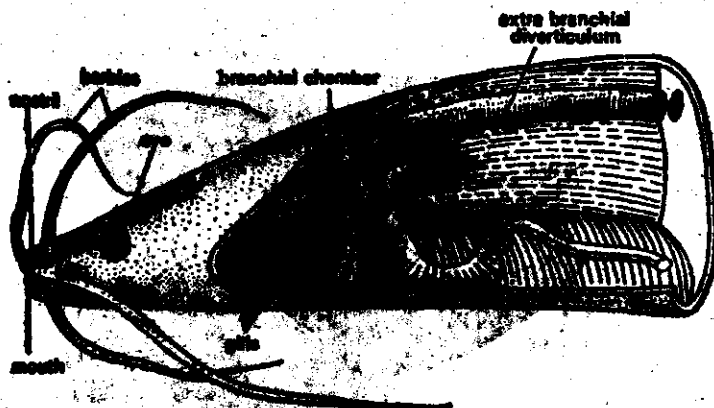
Dissection of neck nerves of *Rattus rattus*.

ANABAS – ACCESSORY RESPIRATORY ORGANS



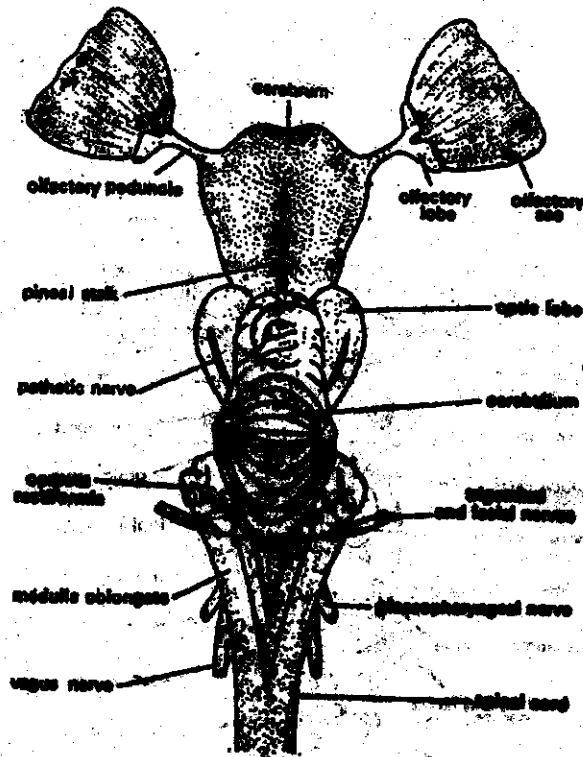
Accessory respiratory organs of *Anabas*

HETEROPNEUSTES – ACCESSORY RESPIRATORY ORGANS



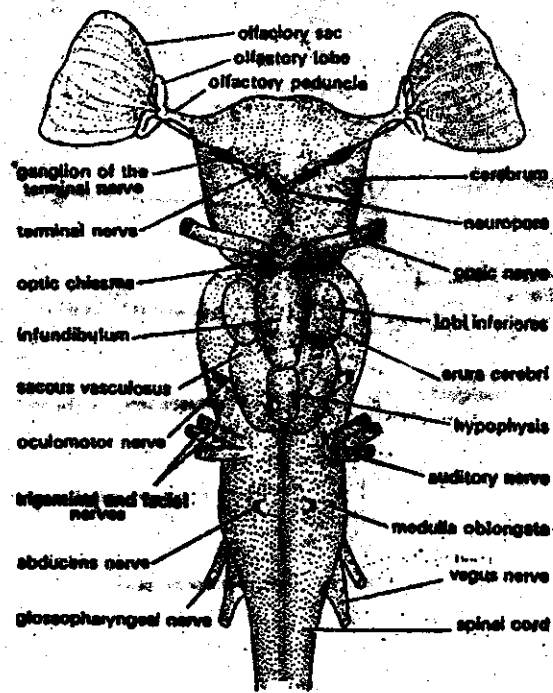
Accessory respiratory organs of *Heteropneustes*.

FISH - BRAIN



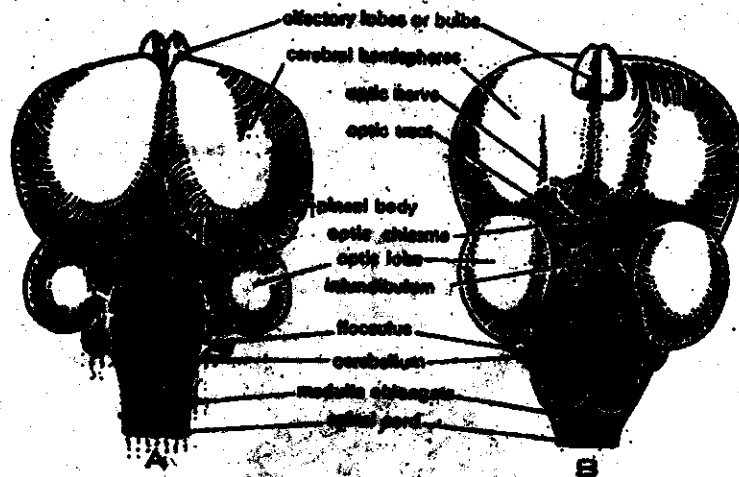
Zoology, 7 Dorsal view of brain.

FISH - BRAIN



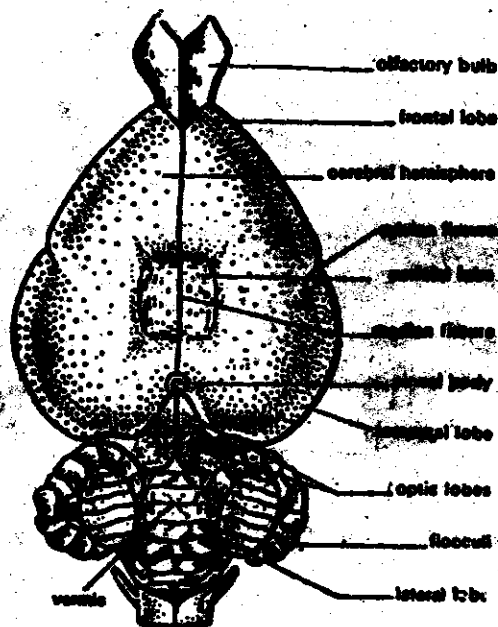
Scottiden., Ventral view of brain

BIRD - BRAIN



Figures - 23(a), A--Dorsal view, B--Ventral view.

MAMMAL - BRAIN

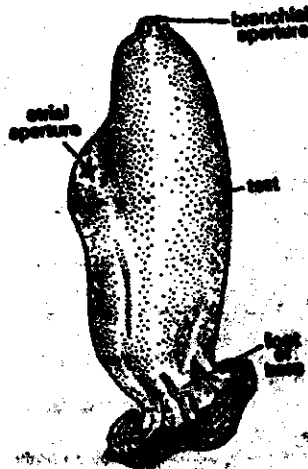


Rabbit, Dorsal view of brain.

PROTOCHORDATA

1. ASCIDIAN

PHYLUM : CHORDATA
CLASS : ASCIDIACEA
ORDER : ENTEROGONA



Characters

1. Ascidian is distributed in cold temperate regions especially in Europe.
2. It is a common marine, solitary and sedentary tunicate.
3. It occurs in large association attached to the rocky shores or wharf piles.
4. The shape of the body is like a short cylinder with a broad base by which it is attached to the rocks.
5. Outer covering of the body is wrinkled brown and translucent and is known as test.
6. The free end bears a large rounded aperture, the branchial aperture and on one side just behind the branchial aperture lies the atrial aperture.
7. Branchial aperture leads into the branchial chamber or pharynx which is perforated by a number of stigmata.
8. Heart is a simple muscular sac, situated near the stomach in the pericardium.
9. Nervous system comprises the single nerve ganglion.
10. Reproduction is sexual. Exhibits retrogressive metamorphosis.
11. Tailed-larva occurs in development.

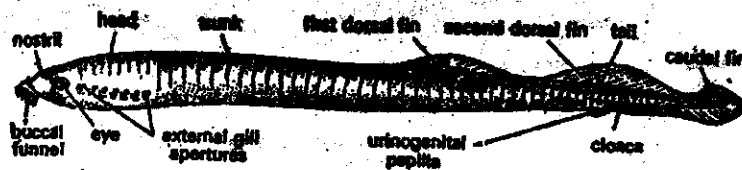
2. PETROMYZON

Classification:

PHYLUM : CHORDATA

CLASS : CYCLOSTOMATA

ORDER : PETROMYZONTIA

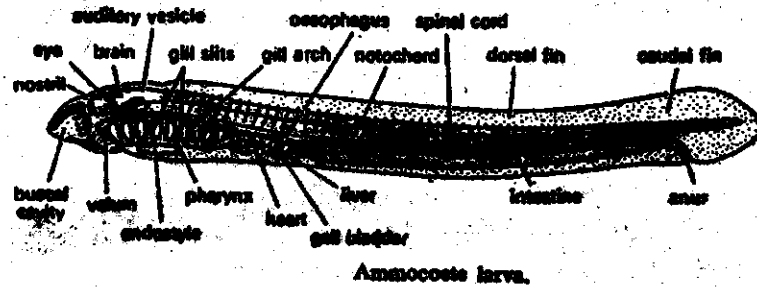


Petromyzon marinus.

Characters:

1. Petromyzon has an almost world wide distribution, being present in both salt and fresh waters of North America, Europe, West Africa, Japan, Chile, Australia, New Zealand and Tasmania.
2. It is commonly known as lamprey or lamper eel.
3. Body is eel-like measuring about 1 metre and differentiated into head, trunk and tail.
4. The surface of the body is smooth and slimy and generally heavily pigmented.
5. Head region is characterized by the great forward development of the upper lip region forming the buccal funnel.
6. Mouth is circular armed with numerous horny teeth.
7. The paired eyes are relatively large and functional.
8. Nostril is single and dorsal.
9. Seven pairs of external gill-apertures are present.
10. Two dorsal fins and one caudal fin, all are supported by cartilaginous rays.
11. Jaws and paired fins are absent.
12. Sexes are separate in adults and there is only single large gonad.
13. It leads an ectoparasitic life on fishes.

3. AMMOCOETE LARVA



Characters:

1. Ammocoete larva has an almost world wide distribution, being present in both salt and fresh waters of North America, Europe, West Africa, Japan, Chili, Australia, New Zealand and Tasmania.
2. It hatches out of the egg of petromyzon.
3. It looks like a minute translucent Amphioxus and about 10 mm long.
4. At the posterior end of the buccal cavity, there is velum which is followed by the pharynx.
5. Seven pairs of gill-slits are present in the pharynx.
6. Endostyle lies along the ventral surface of the pharynx.
7. In the dorsal region of head median nostril, an eye, an auditory vesicle and brain are present.
8. The median fin is continuous along the greater part of the body, forming a continuous dorsal and a caudal fin around the tail.
9. The spinal cord and notochord extend along nearly the entire length of the body.
10. The heart, liver and gall bladder lies posterior to the pharynx.
11. The alimentary canal consists of pharynx, oesophagus and intestine.
12. The larval stage lasts for a long period, of about 3 or 4 years and during this period, it grows and becomes adult.

4. MYXINE

Classification:

PHYLUM : CHORDATA

CLASS : CYCLOSTOMATA

ORDER : MYXINOIDEA



Characters:

1. Myxine has a wide distribution along sea coasts of both Atlantic and Pacific oceans, occurring in the waters of Northern Europe, North Atlantic, America, Chile and Japan etc.
2. It is commonly known as hag fish.
3. It is found buried in the sea bottom.
4. Body is eel-like, measuring about 60 cm in length and differentiated into head, trunk and tail.
5. The surface of the body is soft and smooth without scales.
6. Buccal funnel and jaws are absent.
7. Lateral to the mouth are four pairs of short tentacles supported by skeletal rods.
8. Nostril is single, lies very close to the mouth and opens terminally.
9. Single pineal eye is visible on the top of the head.
10. Six pairs of gills which do not open separately to the outside but open by a single external gill-opening.
11. Single median fin runs from about the middle of the ventral surface extending around the tail region.
12. Large mucous glands are present opening by mucous pores.
13. These animals are parasitic because they are sometimes found within the bodies of their prey, which are fishes of various types.

FISHES

5. NOTOPTERUS

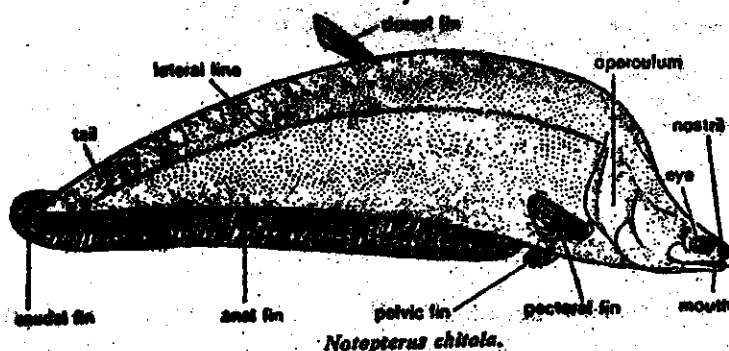
Classification:

PHYLUM : CHORDATA

CLASS : OSTEICHTHYES

SUBCLASS: ACTINOPTERYGII

ORDER : CLUPEIFORMES



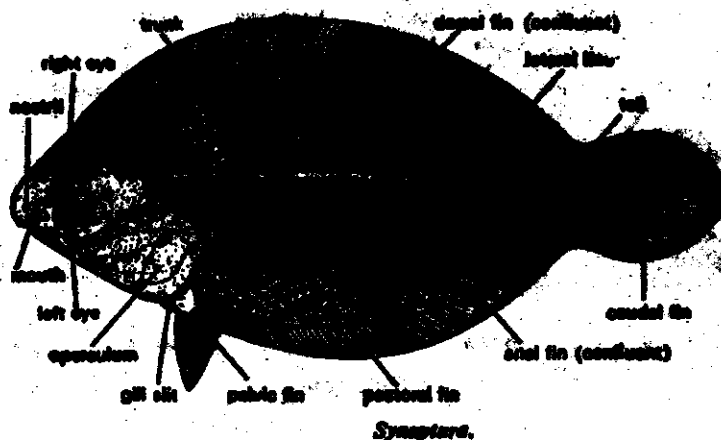
Characters

1. It is commonly known as chital.
2. Notopterus chitala is found exclusively in freshwaters of India.
3. Body is strongly compressed and covered with minute scales.
4. It measures upto a metre in length.
5. The colour is coppery brown or greyish along the back with 15 or 16 silvery transverse bars.
6. Head is small and mouth is large.
7. Snout is obtuse and convex.
8. Dorsal fin is small. Pectoral and pelvic fins are very small.
9. Anal fin is much elongated and confluent with the caudal fin.
10. Air bladder is very large with several divisions.
11. Carnivorous. Food chiefly comprises worms and insects.
12. It is commercially important as food fish, its flesh is said to be uncommonly rich and well flavoured.

6. CYANOGLOSSUS

Classification.

PHYLUM : CHORDATA
 CLASS : OSTEICHTHYES
 SUBCLASS : ACTINOPTERYGII
 ORDER : PLEURONECTIFORMES



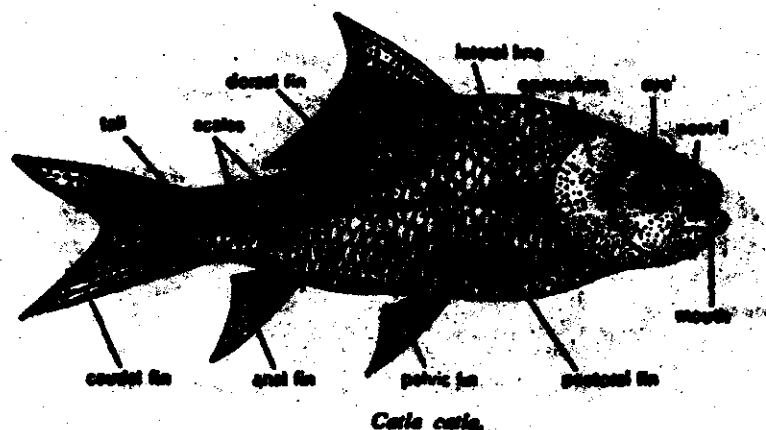
Characters:

1. It is found in Atlantic, Pacific and Indian oceans
2. It is commonly known as flat-fish.
3. Body is thin, laterally compressed and flat.
4. Scales covering the body are usually imbricate.
5. The side of the body bearing the eyes turned upwards being coloured, while the lower side is white.
6. Head is asymmetrical. Both the eyes are situated on the upper side.
7. Dorsal and anal fins are long without spines and confluent with the caudal fin.
8. Caudal fin is well developed.
9. Air bladder is absent.
10. Gills four, a slit behind the fourth, pseudobranchiae are present.
11. Adapted for bottom living.
12. It is economically important as food fish.

7. CATLA CATLA

Classification:

PHYLUM : CHORDATA
CLASS : OSTEICHTHYES
SUBCLASS : ACTINOPTERYGII
ORDER : CYPRINIFORMES



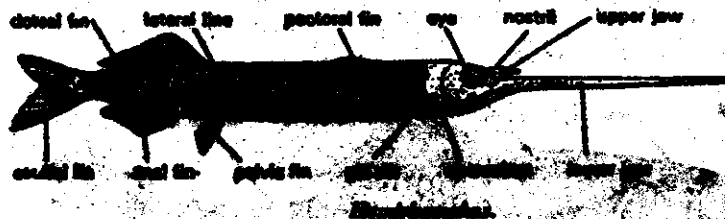
Characters:

1. *Catla catla* is the largest Indian carp and commonly known as **Katla** in Hindi.
2. It is found through out India.
3. Body is elongated broad and stout, measuring more than a metre in length.
4. Colour blackish grey above and silvery on the sides.
5. Scales are pink or coppery in the centre on the dorsal side and whitish below.
6. Dorsal profile of the body is more convex.
7. Head is large having large rounded eyes.
8. Mouth is wide with prominent lips.
9. Dorsal fin is quite large. Caudal fin is bilobed.
10. Air-bladder is usually large and divided into an anterior and posterior part.
11. It is also important as a food fish.

8. HEMIRHAMPHUS

Classification:

PHYLUM : CHORDATA
 CLASS : OSTEICHTHYES
 SUBCLASS : ACTINOPTERYGII
 ORDER : BELONIFORMES



Characters:

1. Body is elongated and sub-cylindrical, measuring upto 30 cm in length.
2. It occurs in tropical and temperate seas.
3. The skin is covered with cycloid scales.
4. Upper jaw is short, more or less triangular in shape.
5. Lower jaw is elongated and prominent.
6. Eyes are lateral in position.
7. Tail is homocercal.
8. It has two bands along each side, one silvery and other black.
9. Gill-opening is wide.
10. It is mainly herbivorous, feeding on green algae.
11. It is used as food fish.

9. LABEO ROHITA

Classification:

PHYLUM : CHORDATA
 CLASS : OSTEICHTHYES
 SUBCLASS : ACTINOPTERYGII
 ORDER : CYPRINIFORMES

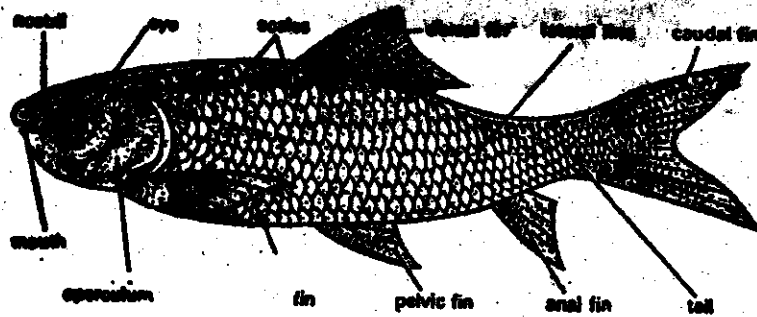


Fig. 100. *Labeo rohita*.

Characters:

1. *Labeo rohita* is found all over Northern and Central India. It is now found in Godavari and Krishna rivers.
2. It is the most famous carp and commonly known as rohu in Hindi.
3. Body is elongated with moderately rounded abdomen, measuring upto 1 metre in length.
4. Colour brownish grey to black above.
5. Scales are large and orange to reddish in colour in the centre.
6. Head is prominent with blunt snout.
7. Mouth is transverse and semi-oval.
8. Lips thick covering the jaws, one or both having an inferior transverse fold.
9. Barbles are absent.
10. Air-bladder is usually large and divided into an anterior and posterior part.
11. It is economically important due to its food value. It is relished very much in food.

10. TORPEDO

Classification:

PHYLUM : CHORDATA

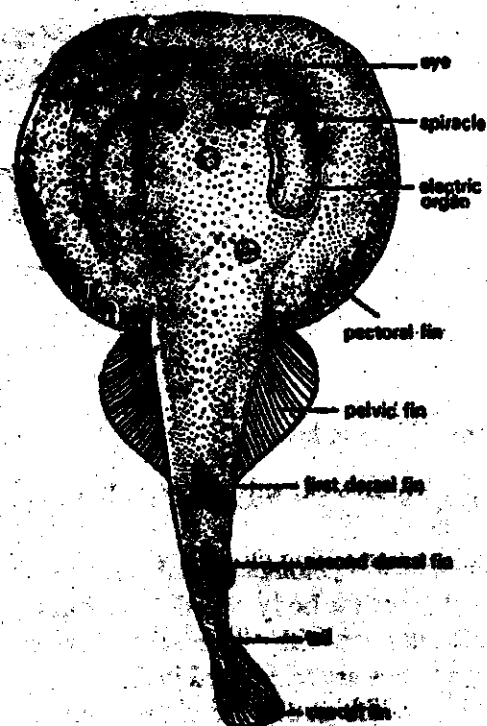
CLASS : CHONDRICHTHYES

SUBCLASS : SELACHII

ORDER : HYPOTREMATA

Characters:

1. Torpedo is found in Mediterranean, Red Sea, Atlantic and Pacific oceans.
2. It is commonly called as electric-ray.
3. Body is dorso-ventrally flattened and disc-shaped which is subcircular.
4. Skin is smooth without scales.
5. Mouth is transverse and ventral.
6. Quadrangular naso-frontal lobe is present.
7. Spiracles are present behind the eyes.
8. Gill-slits are ventral.
9. A pair of large electric organs, one on either side in between the pectoral fins and the head.
10. Electric organs consists of muscle fibres arranged in blocks and serve as batteries.
11. Tail is relatively short with two dorsal fins and a caudal fin.
12. Viviparous.
13. Carnivorous. Food chiefly comprises crustaceans and molluscs.
14. These fishes are capable of giving a heavy electric shock.



Torpedo or Astrapis

AMPHIBIA

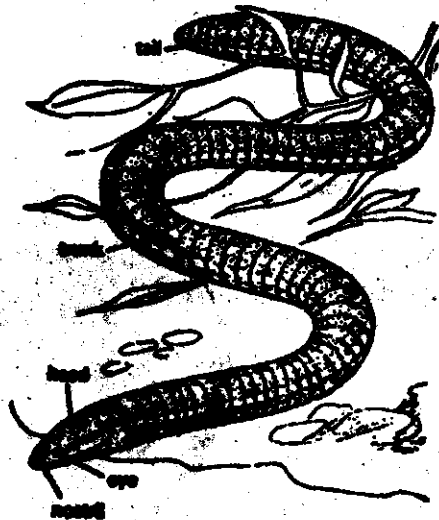
11. ICHTHYOPHIS

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : APODA

*Ichthyophis (Male).***Characters:**

1. *Ichthyophis* extends from the foot hills of Himalayas to Ceylon, the Malay Archipelago and Siam.
2. It is a burrowing elongated and eel-type animal.
3. The colour of the body is dark brown or bluish black with a yellow band along the side.
4. Skin is provided with numerous transverse grooves or wrinkles.
5. Minute scales are embedded in the grooves of skin.
6. Limbs and limb girdles are entirely absent.
7. Tail is short or vestigial.
8. Eyes are minute devoid of lids buried deep in the head.
9. Tympanic membrane and columella are absent.
10. Sexes separate, males possess large copulatory organ provided with hooks.
11. Parental care is very well developed. Female coils herself around the gelatinous egg mass to protect it from ground burrowing animals.

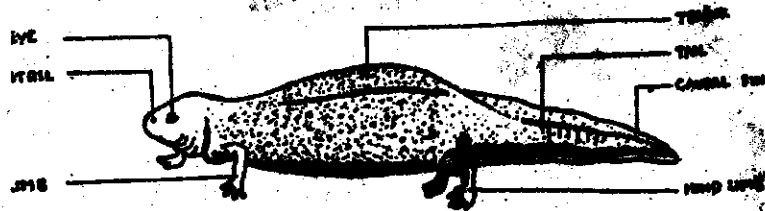
12. TRITURUS

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : URODELA



Characters:

1. *Triturus cristatus* is commonly called as 'European crested newt'.
2. Body is elongated and cylindrical and divided into head, trunk and tail.
3. Skin is soft and slimy without scales.
4. Head is conical and compressed containing wide mouth and small nostrils.
5. Eyes are small with upper and lower eye lids.
6. Tail is elongated thick and provided with dorsal and ventral fins without fin rays.
7. Fore limbs and hind limbs are well developed. The former bear 4 and the latter five toes.
8. Gills are absent. Respiration by skin and lungs.

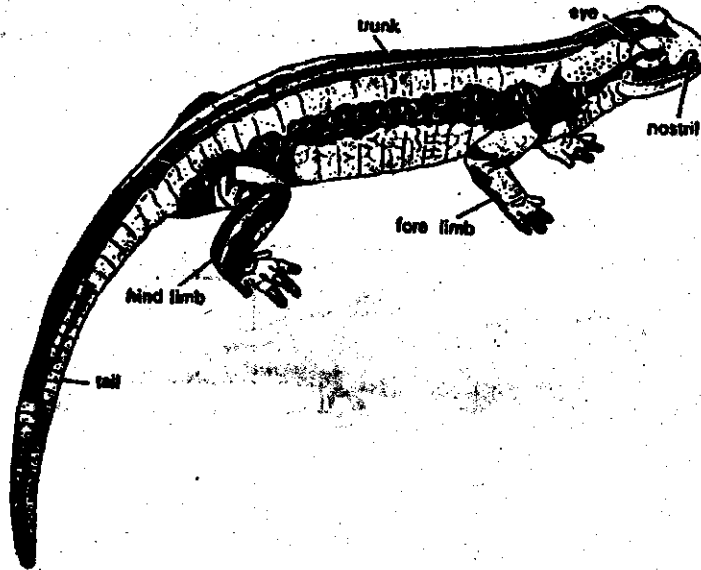
13. SALAMANDRA

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : URODELA



Salamandra atra.

Characters:

1. It is found in Europe and Asia.
2. It is commonly known as European fire salamander and terrestrial in habit.
3. Body is lizard-like in appearance.
4. The colour of the body is black with yellow spots.
5. Limbs are well developed and strong.
6. Tail is cylindrical.
7. Eye lids are movable.
8. Tympanic membrane or middle ear is absent.
9. Paratoid glands are present behind the head.
10. Teeth are present on both the jaws.
11. Vomerine teeth are also present.
12. Vertebrae are opisthocelous.
13. Viviparous.
14. Young-ones born having the external gills and metamorphosis takes place later.

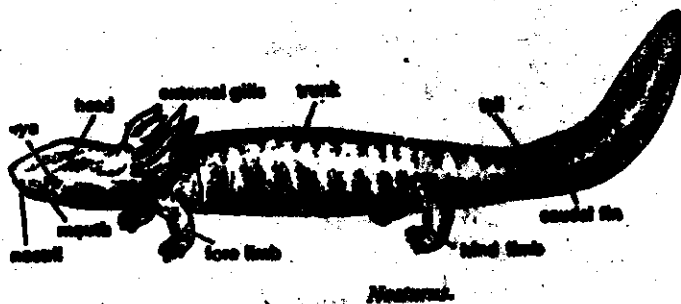
14. NECTURUS

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

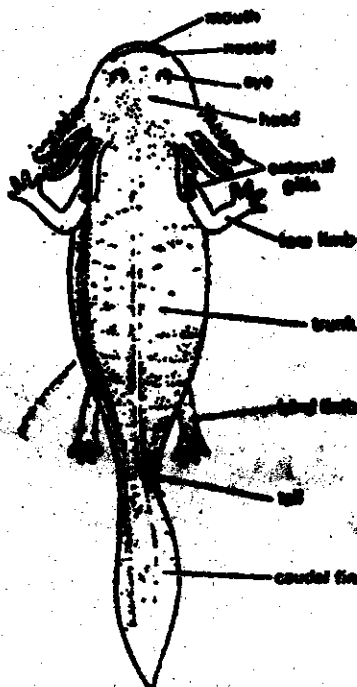
ORDER : URODELA



Characters:

1. Necturus is found in North America and Yugoslavia.
2. It is commonly known as mud-puppy.
3. Body is elongated measuring from 30-42 cm in length.
4. Tail is long and bears a caudal fin.
5. The general colour of the body is rusty brown with blackish spots.
6. It is a typical permanent neotenic larva and exhibits the following larval characters.
 - (i) Three pairs of external gills are present in the adult.
 - (ii) Two pairs of open gill-clefts.
 - (iii) Eyes are lidless.
 - (iv) Lateral line organs are present.
 - (v) Permanently aquatic.
7. Lungs are present.
8. Organs of Jacobson is absent.
9. Attempts have been made to force Necturus to undergo metamorphosis but no success has been achieved.

15. AXOLOTL LARVA



Axolotl larva.

Characters:

1. It is found in the mountain regions of Mexico.
2. It is the larva of *Ambystoma tigrinum*.
3. It possesses three pairs of external gills and a tail having a caudal fin.
4. Axolotl larva exhibits the phenomena of neoteny.
5. Failure to metamorphose because of environmental conditions is called neoteny.
6. When environmental conditions such as low temperature or lack of iodine in water inhibit the action of thyroid gland, the axolotl larva becomes sexually mature and reproduces in the larval state.
7. If the environmental conditions are changed, it is capable of metamorphose.
8. Metamorphosis in Axolotl is induced by injecting thyroid extract or by transferring to water with a higher iodine content.
9. During metamorphosis the gills and tail fin are lost.

16. BUFO

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : ANURA

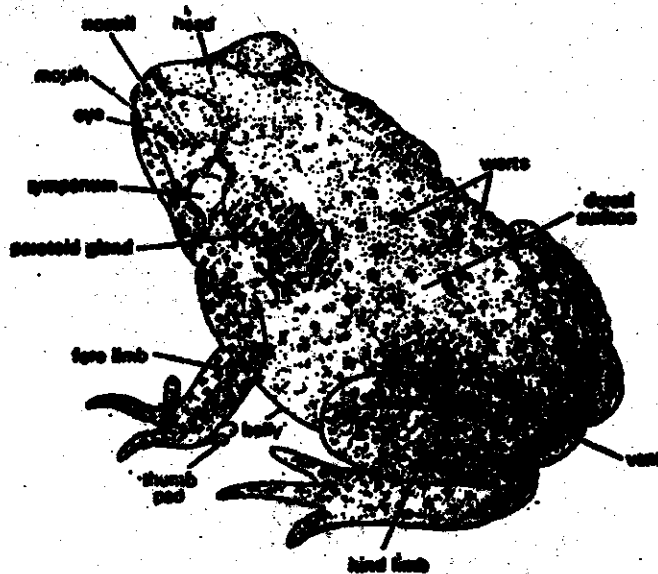


Fig. 126. *Bufo melanostictus*

Characters:

1. **Bufo** is found all over the world except Australia and Madagascar.
2. **Bufo melanostictus** is commonly called as true-toad.
3. Skin is rough, dry and warty on the dorsal surface of the body.
4. Eyes are large and nostrils are very small.
5. Tympanum is very well-developed.
6. Paired parotoid glands are present behind the tympanum. These glands secrete poison fluid which is irritating.
7. Fore limbs bear 4 web less fingers and a thumb pad.
8. Hind limbs have 5 toes with a greatly reduced web.
9. Teeth are entirely absent.
10. Ribs and sternum are absent.
11. Eggs are laid in water in strings.
12. **Bufo** is terrestrial and nocturnal in habit.

13. Carnivorous, feeding on worms, insects and snails, etc.

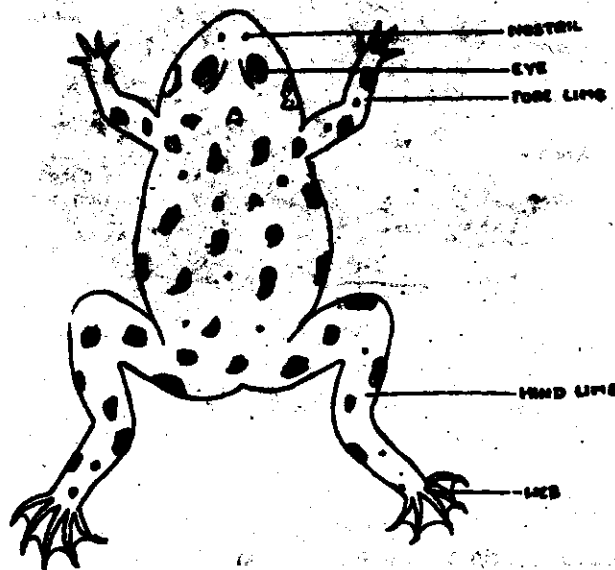
17. XENOPUS

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : ANURA



Characters:

1. It is commonly known as clawed toad.
2. Body is differentiated into head and trunk.
3. It is entirely aquatic.
4. It does not exhibit parental care.
5. Fingers are free but toes are webbed.
6. It has teeth in upper jaw.

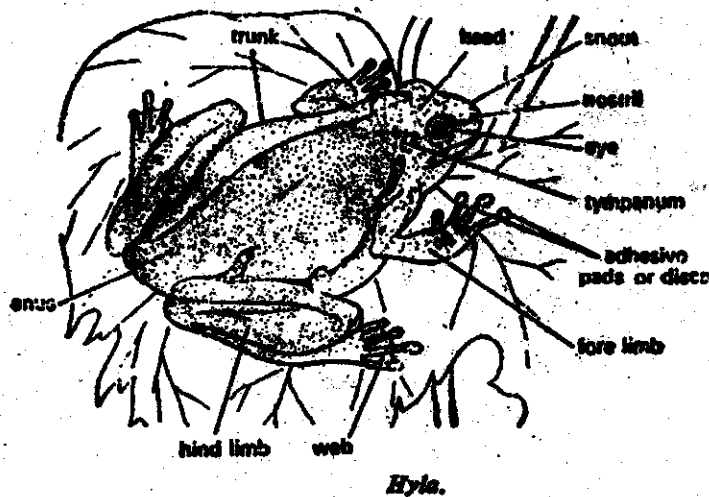
18. HYLAE

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : ANURA



Characters:

1. **Hyla is cosmopolitan in damp forests except in India and Africa.**
2. **It is commonly called as tree-frog due to its arboreal habits.**
3. **Skin is smooth on the dorsal surface but bears papillae -- on the ventral surface.**
4. **Eyes, nostrils and tympanum are well-developed.**
5. **Fingers and toes have adhesive -- pads or discs for sticking on the smooth surfaces.**
6. **Web is poorly developed.**
7. **Teeth are present only in the upper jaw and absent in the lower jaw.**
8. **Vocal sacs are greatly expanded and produce loud voice.**
9. **Vertebrae are procoelous.**
10. **They exhibit mimicry and are remarkably protectively coloured.**
11. **In *Hyla goeldii* the eggs are carried on the back of the female.**

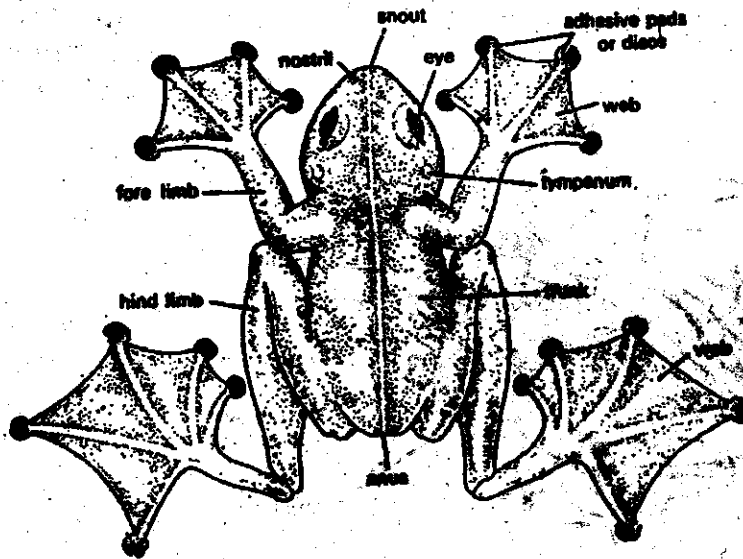
19. RHACOPHORUS

Classification:

PHYLUM : CHORDATA

CLASS : AMPHIBIA

ORDER : ANURA



Rhacophorus.

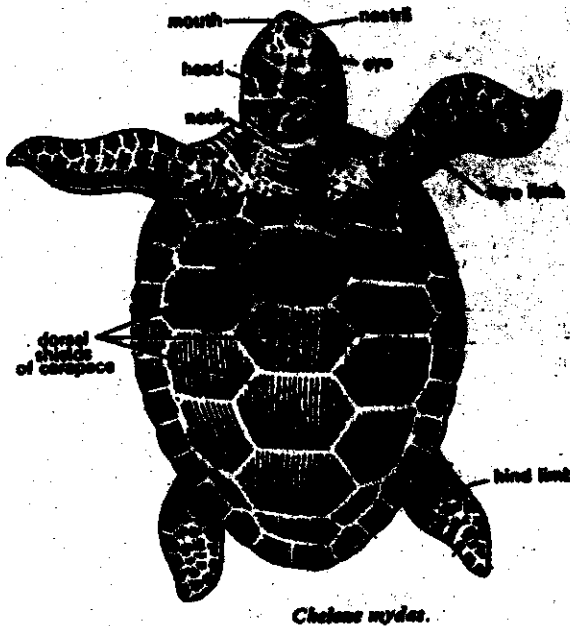
Characters:

1. *Rhacophorus maculatus* and *R. malabaricus* are found in India, while *R. pardalis* is found in the Malaya Archipelago.
2. It is commonly known as flying-frog.
3. The body is slender.
4. Head is broad and nearly conical, bearing eyes, nostrils and tympanum.
5. Limbs are long and thin with large feet.
6. Web develops between the digits of all the four feet.
7. Digits of all the four feet bear rounded adhesive-pads or discs.
8. It lives on trees.
9. Usually large webbed feet are used as palms in gliding from branch to branch or tree to tree.
10. These flying frogs can leap 6-10 metres in the air.
11. It also exhibits parental care by depositing eggs in the nests near water.
12. It has the capacity to change the colour rapidly.

REPTILIA

20. *CHELONE MYDAS*Classification:

PHYLUM : CHORDATA
CLASS : REPTILIA
SUBCLASS : ANAPSIDA
ORDER : CHELONIA

**Characters:**

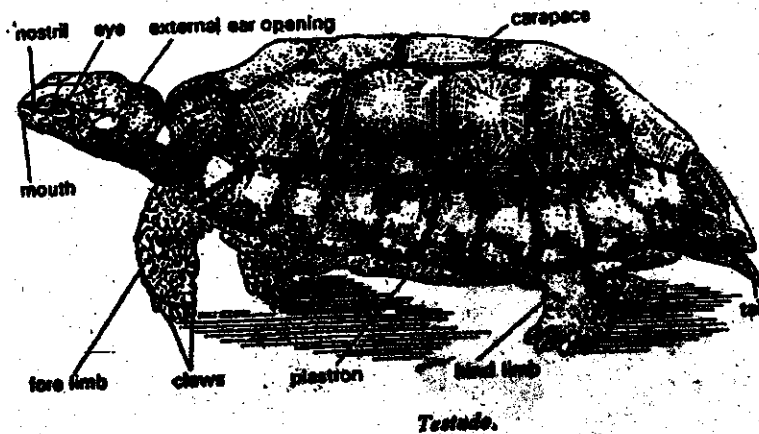
1. *Chelone mydas* is found in the Atlantic Indian and Pacific oceans.
2. It is a marine form commonly called as green turtle.
3. The colour is olive or brown above with yellowish spots and pale yellow below.
4. Body is enclosed in a smooth shell.
5. Dorsal shields are juxtaposed, fitting closely into each other.
6. Four pairs of costal shields.
7. Head is covered with one pair of prefrontal shields, the others are small.
8. Eyes possess eyelids and nictitating membrane.
9. Fore and hind limbs form wing like paddles with only one claw.
10. Tail is short.
11. Head, tail and limbs are retractile inside the carapace.
12. Jaws are not hooked.

13. Herbivorous, feeding mostly on marine algae.

21. TESTUDO

Classification:

PHYLUM : CHORDATA
 CLASS : REPTILIA
 SUBCLASS : ANAPSIDA
 ORDER : CHELONIA



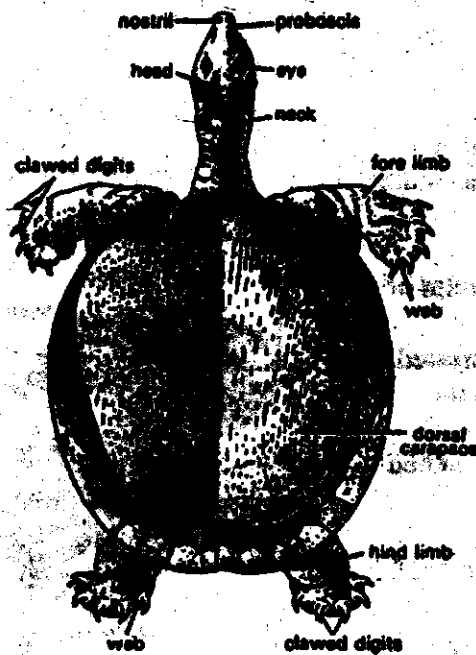
Characters:

1. It is found in India, Ceylon, Africa, Europe and Galapagos islands.
2. It is found in fresh water or in marine or on land.
3. Commonly known as giant land tortoise.
4. Body enclosed in a rigid shell, formed of dorsal carapace and ventral plastron.
5. Plastron slightly concave.
6. Eyes with eye lids & nictitating membrane.
7. Jaws without teeth but covered with horny sheath.
8. Neck, limbs and tail are retractile into the shell.
9. Limbs are pentadactyle and clawed; adapted for walking on land.
10. Toes are unwebbed.
11. It hibernates underground in cold weather.
12. They can live without water for long periods.

22. TRIONYX

Classification:

PHYLUM : CHORDATA
 CLASS : REPTILIA
 SUBCLASS : ANAPSIDA
 ORDER : CHELONIA



Trionyx gangeticus.

Characters:

1. It is found in the muddy bottom of rivers and ponds in India.
2. It is commonly known as tortoise or fresh water terrapin.
3. Body is enclosed in a shell comprising the dorsal carapace and ventral plastron.
4. Shell has no horny scales but a covering of soft skin.
5. Head is triangular having a proboscis.
6. Jaws are devoid of teeth but provided with horny sheaths.
7. Nose forms a short soft proboscis.
8. Limbs are webbed and each limb bears five clawed digits.
9. Head, neck and limbs, retractile into carapace.
10. Carnivorous, feeds mainly on fish, frogs and molluscs.

23. CHAMAELEON

Classification:

PHYLUM : CHORDATA
 CLASS : REPTILIA
 SUBCLASS : DIAPSIDA
 ORDER : SQUAMATA

Characters:

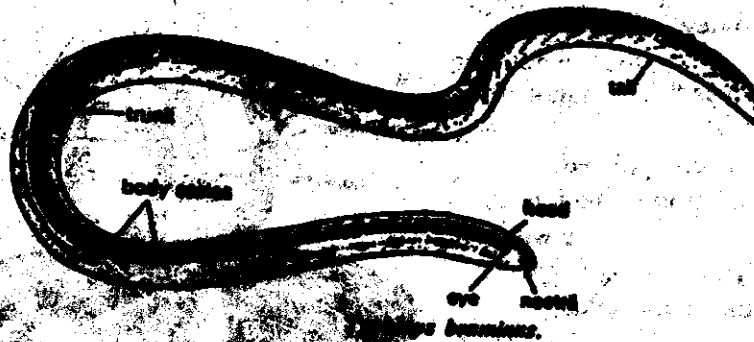
1. Chamaeleons are commonly found in Africa, Madagascar, South Arabia, South India and Ceylon.
2. It is an arboreal lizard.
3. Skin is covered with minute tubercles or granules.
4. Body and head are laterally compressed.
5. Head is usually forming casque with prominent crests and tubercles.
6. Eyes are large but the eye lids are nated into one fold with a small central opening.
7. The right eye and left eye can be moved separately from each other.
8. Tongue is spoon shaped, extremely protrusible and covered with a sticky secretion.
9. Limbs are relatively large and very slender.
10. Tail is long and prehensile.
11. It has a power of changing colour.
12. Teeth are acrodont.
13. Insectivorous.
14. Viviparous.



24. TYPHLOPS

Classification:

PHYLUM : CHORDATA
 CLASS : REPTILIA
 SUBCLASS : DIAPSIDA
 ORDER : SQUAMATA



Characters:

1. Burrowing snake found all over the world.
2. It is commonly called blind snake.
3. Body worm like resembles earthworm in appearance, shining dark brown in colour and uniformly covered with scales of small size.
4. There is no distinction between dorsal and ventral scales.
5. The head is not distinct from the body.
6. The tail is blunt with small point.
7. The eyes are small and more or less covered by scales, hence the name blind snake.
8. Few teeth are present in the upper jaw only.
9. Nasal shields are completely divided into an anterior lower and a posterior upper position.
10. Sebaceous glands are present on the body.
11. Carnivorous, feeding on worms, soft-bodied insects and their larvae.

25. DRACO

Classification:

PHYLUM : CHORDATA

CLASS : REPTILIA

SUBCLASS : DIAPSIDA

ORDER : SQUAMATA

Characters:

1. It is found in India, Malaysia, Borneo, Sumatra, Java etc.
2. It is commonly known as flying dragon or flying lizard.
3. Body is dorso-ventrally compressed.
4. The sides of the body, between the fore and hind limbs, extend as a pair of large wing-like membranes, the patagia, which are supported by 5 or 6 much elongated posterior ribs.
5. These wing-like membranes can be folded up like a fan.
6. Eyes are small with complete eye lids.
7. On the throat are three pointed hooks, a short one on either side and a long one in the middle.
8. Tail is very long and slender.
9. Due to the presence of Patagia, flying lizard is capable of gliding from one branch to another branch.
10. Limbs are pentadactyle, clawed and free from patagia.
11. Flying dragons use their patagia as parachutes.



Draco volans.

26. *HYDROPHIS*

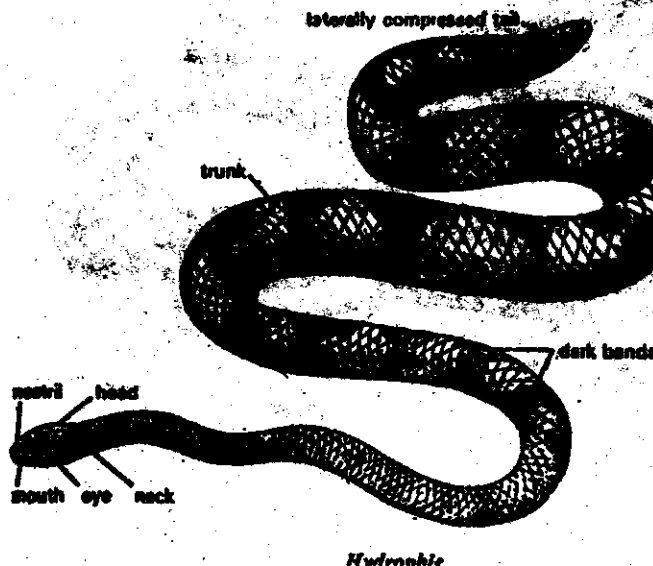
Classification:

PHYLUM : CHORDATA

CLASS : REPTILIA

SUBCLASS : DIAPSIDA

ORDER : SQUAMATA



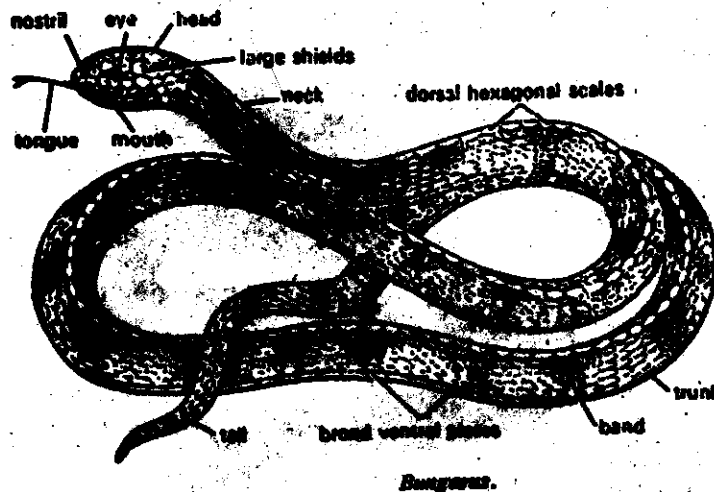
Characters

1. *Hydrophis* occurs in the Bay of Bengal and Malay Archipelago.
2. It is commonly called sea snake.
3. The body is long and laterally compressed posteriorly.
4. Head and neck are very slender.
5. The ventral scales are small.
6. Tail is laterally compressed and acts like paddle in swimming.
7. Eyes are small with rounded pupil.
8. Loreal-shield is absent. One pre-ocular, two post oculars & 7-8 supra labials of which 3rd & 4th are touching the eye.
9. It is deadly poisonous and its venom is neurotoxic.
10. Presence of 14-18 maxillary teeth behind the poison fangs.
11. Carnivorous, feeding on fishes, etc.

27. BUNGARUS

Classification:

PHYLUM : CHORDATA
 CLASS : REPTILIA
 SUBCLASS: DIAPSIDA
 ORDER : SQUAMATA



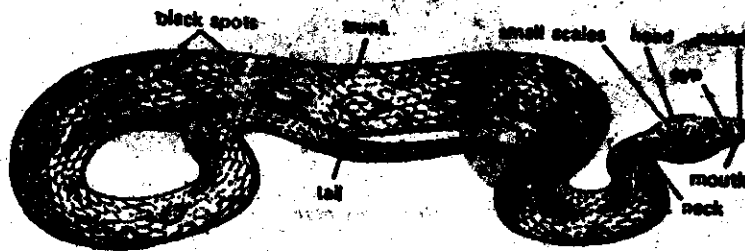
Characters:

1. Bungarus is found in South Eastern Asia, India and Malaya.
2. It is commonly called krait.
3. Body is elongated and slender, measuring about 1 metre in length.
4. The colour of the body is steel-blue with narrow cross bars or white specks dorsally and the underparts are uniform white.
5. Head with normal shields and is not differentiated from neck.
6. Loreals are absent. Two post-oculars, one pre-ocular and seven supra-labials are present.
7. Third and fourth supra-labials are touching the eye.
8. Eyes are of moderate size with narrow pupils.
9. An enlarged chain of dorsal hexagonal scales are present on the dorsal side and ventral scales beyond the anal region are in a single row.
10. Oviparous.
11. Carnivorous, feeding on rats, lizards and snakes.
12. It is nocturnal in habit and lives in cracks in walls or in heaps of bricks etc.
13. Bungarus is poisonous and its venom is neurotoxic.

28. RUSSELLS VIPER

Classification:

PHYLUM : CHORDATA
 CLASS : REPTILIA
 SUBCLASS : DIAPSIDA
 ORDER : SQUAMATA



Viper russellii.

Characters:

1. It is distributed in India, Ceylon, Burma and Siam.
2. Body is elongated and measures upto one and a half metre in length.
3. The general colour is pale brown above with three longitudinal series of black spots and underparts are yellowish white.
4. The scales form about 30 rows on the body.
5. Head is triangular and covered with very small imbricate scales on the upper surface.
6. The eyes are with golden iris and elliptical pupil.
7. Supra-labials are 10-12. Fourth supra-labial is the largest and it does not touch the eye.
8. Viviparous.
9. Carnivorous, feeding mainly on small mammals, eg., mice and rats and also on lizards and birds.
10. It is very poisonous. Venom is haemotoxic.
11. It is found in rocky bushy regions where the colouration on the skin is in keeping with the surroundings.

29. NATRIX

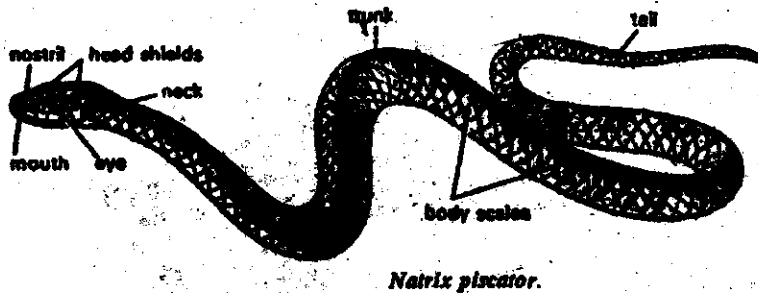
Classification:

PHYLUM : CHORDATA

CLASS : REPTILIA

SUBCLASS : DIAPSIDA

ORDER : SQUAMATA



Characters:

1. Found in America, Africa and India.
2. It is found in fresh water ponds and in paddy fields during rainy season.
3. Body is stout having a flat head.
4. The colour is olive with black spots arranged in the chess board manner.
5. It is commonly called water snake.
6. Eyes are round and seen surrounded by a white circle
7. Tympanum is absent.
8. Scales are keeled and form 19 rows. Ventrals are rounded and subcaudals are paired.
9. Supra labials are 9. 4th and 5th are touching the eye.
10. Non-poisonous snake (fangs are absent)
11. Carnivorous, feed on fishes, frogs and tadpoles etc.

MAMMALIA**30. PTEROPUS****Classification:**

PHYLUM : CHORDATA
 CLASS : MAMMALIA
 SUBCLASS : THERIA
 INFRA CLASS : EUTHERIA
 ORDER : CHIROPTERA

Characters:

1. Pteropus occurs in India, Ceylon, Australia, Africa and Madagascar.
2. Pteropus is commonly known as flying-fox.
3. It is a large bat with a wing-spread over one and a half metre though the body is only about 30 cm in length.
4. The body is covered with brown fur.
5. The snout is long and without nose leaf. The face is like that of a fox in appearance.
6. Eyes are large.
7. Ears are oval and the two edges of the ear are in contact at the base.
8. Tail is absent.
9. The thumb and second digits are clawed.
10. Dental formula is $I \frac{2}{2}, c \frac{1}{1}, pm \frac{3}{3}, m \frac{2}{3}$.
11. Frugivorous, food chiefly consists of figs and guava.
12. Social in habit and move about in droves of considerable size.

