

CONTENTS...

I. <u>HEMICHORDATA</u>	1 - 2
<i>Balanoglossus clavegigerous</i> (1); <i>Tornaria larva</i> (2).	
II. <u>PROTOCHORDATA</u>	3 - 5
<i>Branchiostoma lanceolatum</i> (3). <i>Amphioxus</i> -T.S. Through pharynx (4).	
III. <u>CYCLOSTOMATA</u>	6 - 8
<i>Petromyzon marinus</i> (6); <i>Myxiene glutinosa</i> (7) <i>Ammocoetus Larva</i> (8).	
IV. <u>PISCES</u>	9- 23
<i>Sphyrna zygaena</i> (9) ; <i>Pristis</i> (10) ; <i>Torpedo</i> (11) ; <i>Channa punctatus</i> (12) ; <i>Pleuronectis</i> (13) ; <i>Hippocampus</i> (14) ; <i>Exocoetus</i> (15) ; <i>Echineis</i> (16) ; <i>Labeo rohita</i> (17) ; <i>Catla catla</i> (18) ; <i>Clarius</i> (19) ; <i>Anguilla anguilla</i> (20) ; <i>Protopterus</i> (21) ; <i>Scales in Fishes Placoid scales</i> (22); <i>Cycloid Scales</i> (22) ; <i>Ctenoid scales</i> (23).	
V. <u>AMPHIBIA</u>	24 - 31
<i>Ichthyophis Glutinosa</i> (24); <i>Amblystoma tigrinum</i> (25); <i>Siren</i> (26); <i>Axolotl Larva</i> (27) ; <i>Rhacophorus</i> (28) ; <i>Hyla arborea</i> (29) ; <i>Bufo Melanosticus</i> (30) ; <i>Rana Tigrina</i> (31) .	
VI. <u>REPTELIA</u>	32 - 44
<i>Draco</i> (32); <i>Chameleon</i> (33) ; <i>Gecko</i> (34) ; <i>Uromastix</i> (35) ; <i>Viper russeli</i> (36); <i>Naja naja</i> (37) ; <i>Bungarus coerulens</i> (38) ; <i>Enhydrina valaikadian</i> (39) ; <i>Typhlops vermicuaris</i> (Blind snake) (40) ; <i>Ptyas (Zeminis Mucosus)</i> (41) ; <i>Trionyx</i> (42) ; <i>Testudo elegans</i> (43) ; <i>Crocodilus porosus</i> (44) ;	
VII. <u>AVES</u>	45 - 55
<i>Archaeopteryx</i> (Fossil bird) (45) ; <i>Passer domesticus</i> (47) ; <i>Psittacula Crameri</i> (48); <i>Bubo bubo</i> (49); <i>Alcedo athes</i> (50);	

Columba livia (51); *Corvus Splendens* (House crow) (52);

Pavo cristatus (53); *Feathers* (54);

VIII. MAMMALIA

56 - 62

Ornithorhynchus (56); *Tachyglossus* or *Echidna* (57);

Pteropus (58); *Funambulus palmarum* (59);

Manis (60); *Loris Tradigradus* (61); *Erinaceus* (62).

IX. HISTOLOGY

63 - 71

T. S. *Liver* (63); T.S. *Pancreas* (64); T.S. *Kidney* (65);

T.S. *Stomach* (66) T. S. *Intestine* (67); T.S. *Lung* (68) ;

T.S. *Artery* (69) ; T.S. *Vein* (69);

T. S. *Bone* (70); T.S. *Spinal Cord* (71).

X. OSTEOLOGY

72 - 99

Skull of Rabbit (72); *Lower jaw of Rabbit* (74);

Vertebral Column in Rabbit (75);

Pectoral Girdle of Varanus (82); *Pectoral Girdle of Bird* (83);

Pectoral Girdle of Rabbit (84); *Pelvic Girdle of Varanus* (85);

Pelvic Girdle of Pigeon (86); *Pelvic Girdle of Rabbit* (87);

Varanus ; Forelimb skeleton (88); *Pigeon ; Forelimb skeleton* (90);

Rabbit : Forelimb Skeleton (92) ; *Varanus : Hindlimb Skeleton* (94);

Pigeon : Hindlimb Skeleton (96); *Rabbit : Hindlimb Skeleton* (98) ;

XI. DISSECTIONS

100 - 103

Labeo/Tilapia (100) ; *Fish Digestive system* (101) ;

Fish Brain (101); *Tilapia Weberian apparatus* (102)

V, VII, IX and X cranial nerves (103).

I

PHYLUM : HEMICHORDATA

(1) *Balanoglossus clavogigerous* (Tongue worm)

PHYLUM: HEMICHORDATA

CLASS: ENTEROPNEUSTA

- ❑ Inhabits the marine waters at crusade islands of Tamilnadu in India.
- ❑ A worm like tubicolous, burrowing organism with enterocoelous coelome and pharyngeal gill slits.
- ❑ Body is divided into an anterior proboscis, a middle collar and a long trunk.
- ❑ Body is brittle with a high power of regeneration.
- ❑ Externally, body is covered by mucous layer.
- ❑ Proboscis is a short, conical muscular part helping in making burrow.
- ❑ It bears a proboscis pore and narrows into a fine proboscis stalk posteriorly to connect with collar.
- ❑ Collar is another muscular ring with elevations and pits on the surface.
- ❑ Trunk is further divided into an anterior branchiogenital region having both pharyngeal region with gill slits and a ridge with gonads, a middle hepatic region having hepatic caecae and a posterior part of the trunk is the caudal region bearing anal opening at the end.

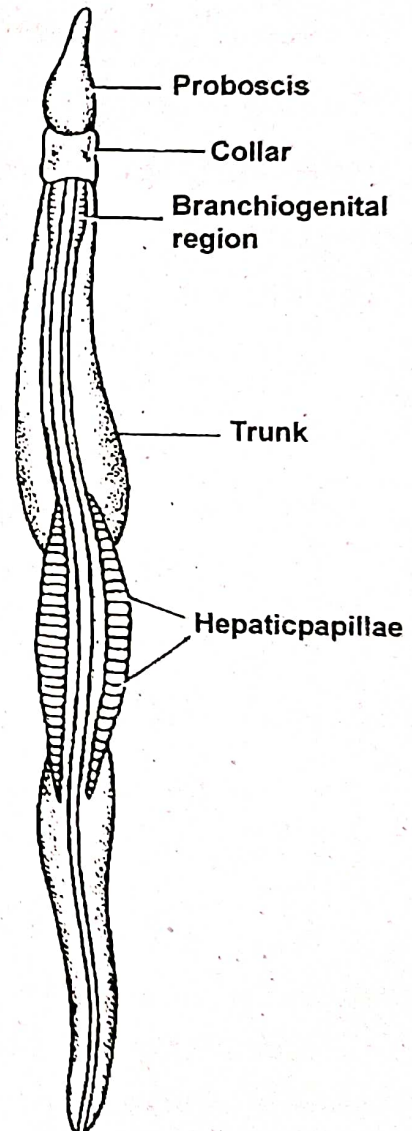


Fig : *Balanoglossus*

Identification points:

Long worm like body divided into proboscis, collar and trunk regions, trunk with branchiogenital, hepatic and caudal regions, genital ridges hanging over the hepatic caecae.

(2) *Tornaria larva*

- Seen in the life cycle of a hemichordate organism, the *Balanoglossus*.
- Has an oval and transparent body measuring about 3mm in size.
- Possess an apical plate with a tuft of cilia and a pair of eye spots.
- Alimentary canal is divided into an oesophagus, stomach and intestine.
- Cilia over the body form into.
- An anterior ciliated band forming folds over the preoral body surface and
- A posterior ciliated band with long cilia or telotroch in the form of a ring in front of anus
- Body cavity or protocoel opens out through a hydropore on the dorsal side
- Heart vesicle lies on the right side of hydropore.

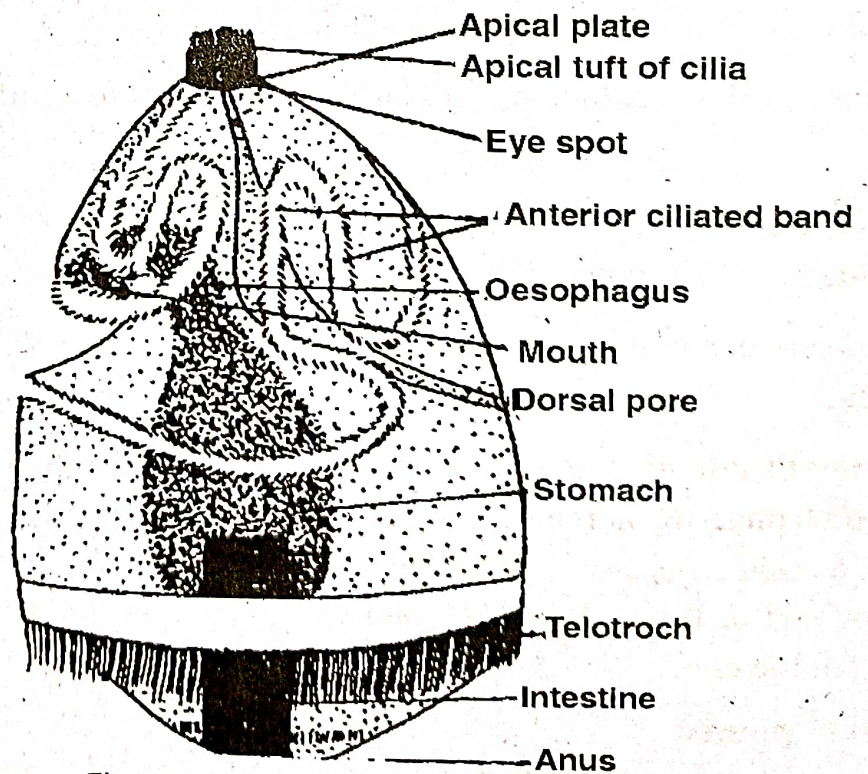


Fig : *Tornaria larva*

II

PROCHORDATA

(3) *Branchiostoma lanceolatum*

GENERAL NAME: AMPHIOXUS

PHYLUM : CHORDATA

SUB-PHY : CEPHALOCHORDATA

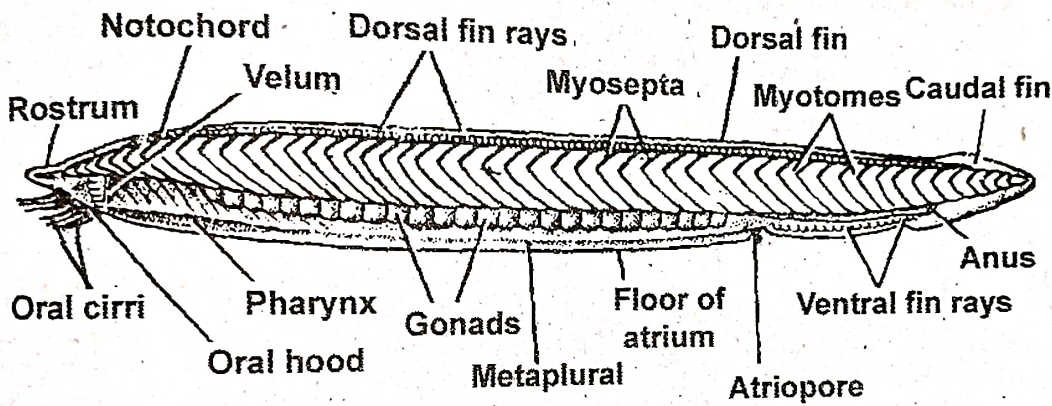


Fig : *Amphioxus*

- Transparent and burrowing fish like organism commonly seen in marine waters.
- Anteroposteriorly elongated body has lancet (pointed) ends.
- Body is laterally compressed with organs arranged on bilateral symmetry.
- Anterior pointed end is the rostrum. Just below to it and towards ventral side is the special tentacular structure called wheel organ.
- On either side of the body, the epidermis droops down into metapleural folds.
- Internally, an anteroposteriorly elongated flexible rod like notochord lies on the mid dorsal side.
- In between the notochord and the dorsal epidermis, lies a dorsal tubular nerve cord.
- Pharynx in the alimentary canal is basket like with a number of gill slits and helps in conducting both nutritive and respiratory functions.
- A number of '<' shaped muscles are present on either side of the trunk helping in locomotion.

- Body has a dorsal, a caudal and a ventral fins in continuation of one another. They also help in locomotion.
- Ventrally, atrial opening lies in between the metaplural folds through which water and other products of excretion goes out.
- 21 pairs of Gonads are present near to the myotomes.
- Unisexual organisms without sexual dimorphism. Development is external and Life cycle indirect involving a free swimming larval form undergoing progressive metamorphosis.

(4) *Amphioxus* - T.S. Through pharynx

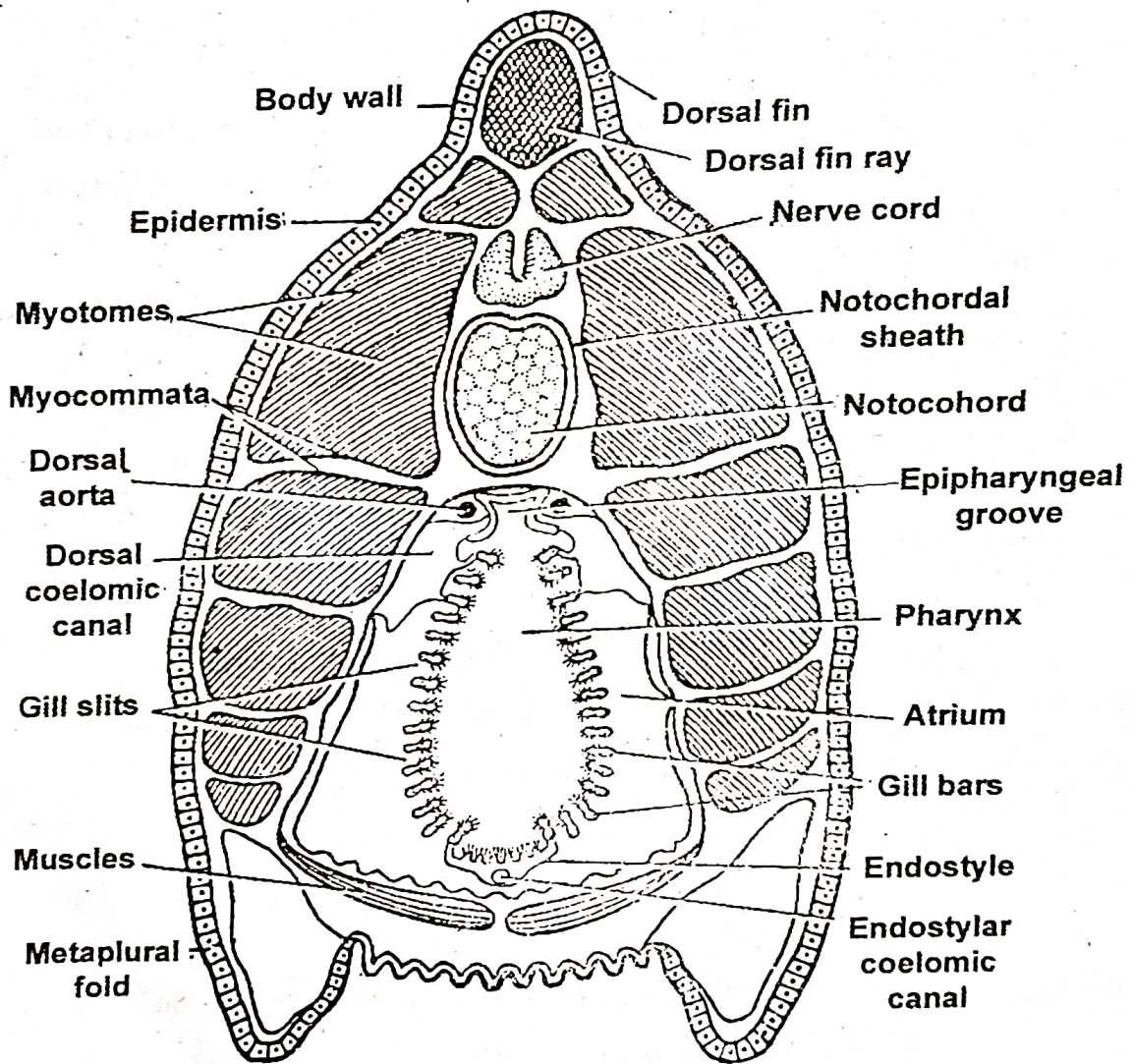


Fig : Amphioxus-T.S.Through pharynx

- In transverse section, amphioxus appears triangular in outline with a pointed dorsal side and a wide ventral side.
- Ventrolaterally, epidermis droops as metaplural folds with loose fold of skin in between.

- Epidermis is composed of a simple columnar epithelium.
- On the mid dorsal side, a dorsal fin with fin rays is seen.
- Muscles are arranged in the form of myotomes extending between dorso- lateral to ventral side of the body.
- Just below the dorsal fin, the sections of the tubular nerve cord, notochord and dorsal blood vessel are seen lying one below the other.
- Notochord is composed of vacuolar tissue surrounded by notochordal sheath.
- Pharynx lying in the space between the myotomes is laterally compressed and possess a number of gill slits.
- On the mid dorsal side of the pharynx lies a supra pharyngeal groove and mid-ventrally, a ciliated endostyle. These ciliated structures identify the food particles and entangles them into the mucous secretions through ciliary mode of feeding (filter feeding mechanism).
- Gonads are present on the ventrolateral sides of the pharynx.
- Atrial cavity encircles the pharynx and gonads on all sides.
- Coelom extends as dorsal coelomic canals on either side of the supra-pharyngeal groove.
- Hepatic diverticulum extends below the pharynx on its right side.
- Cavity present around the intestinal tube is the atrial cavity.
- Ectoderm grows as metaplural folds on the ventral side of the animal.

III CYCLOSTOMATA

(5) *Petromyzon marinus*

GENERAL NAME: LAMPREY

PHYLUM : CHORDATA
 SUB-PHY : VERTEBRATA
 CLASS : AGNATHA
 SUB-CLASS : CYCLOSTOMATA
 ORDER : PETROMYZONTIA

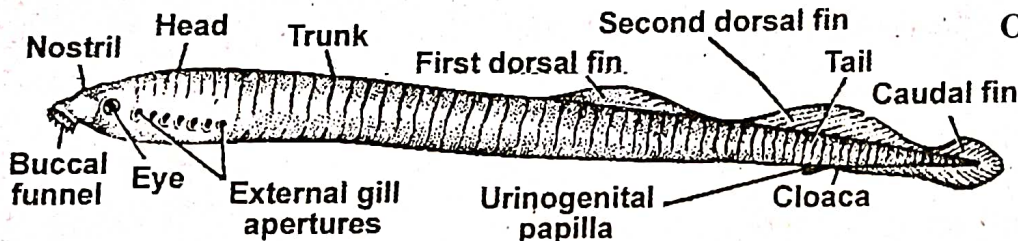


Fig : *Petromyzon marinus*

- It is a long, cylindrical, free swimming marine organism resembling a fish.
- It measures about one meter in length with laterally compressed posterior half of the body.
- Body is divided into a head, trunk and tail.
- External surface of the body is smooth and is surrounded by rich amounts of mucous.
- Body is dark in colour due to high pigmentation and is devoid of scales.
- Anterio-ventral side of the head has a buccal funnel. Its rim bears a powerful sphincter muscle.
- The muscle acts as a sucker and helps in holding to the host firmly.
- Head grows over the funnel as a lid or cap.
- A number of horny teeth are present in the buccal funnel. Teeth are arranged in circles.
- A pair of small lateral eyes present over the head are functional.
- A single nasal opening is present at the mid dorsal side of the body.
- Seven pairs of gill slits are present on either side of the pharynx. Pharynx with gill slits appears as a pharyngeal basket.
- The dorsal, ventral and caudal fins are unpaired, undivided and are supported by cartilagenous fin rays.
- These fishes are devoid of jaws and paired fins.
- Unisexual organisms with a single gonad. Fertilization is external.
- These fishes lead ectoparasitic life over other large sized fishes.
- Life history includes a free swimming Ammocoetus larva.

(6) *Myxine glutinosa*

GENERAL NAME: HAG FISH

PRACTICALS

PHYLUM: CHORDATA

SUB-PHY: VERTEBRATA

CLASS: AGNATHA

SUB-CLASS: CYCLOSTOMATA

ORDER: MYXINOIDEA

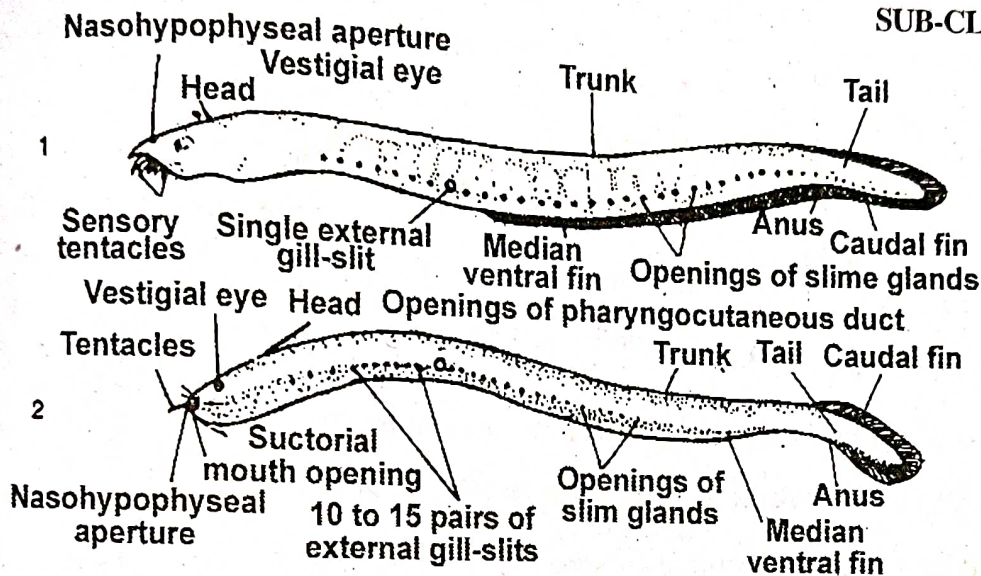


Fig : *Myxine glutinosa*

- ❑ It is a universally distributed nocturnal organism living at the sea bottoms.
- ❑ Body is ribbon like because of laterally compressed body.
- ❑ It makes burrows into the muscles of larger fishes and leads parasitic life. Though the host is entire to the outside, it becomes hollow because of its presence.
- ❑ External surface is smooth and scaleless. It is surrounded by heavy quantities of mucous.
- ❑ Mouth at the antero-posterior end bears a pair of soft lips.
- ❑ Neither buccal funnel nor the horny teeth are present in the adult organism.
- ❑ Mouth is surrounded by four pairs of smooth tentacles supported by gill bars.
- ❑ A single dorsal nasal opening near to the mouth, a pair of vestigial lateral eyes, undivided dorsal, caudal and ventral unpaired fins, mucous openings along the ventrolateral sides of the body, and posterior ventrally located anal opening are the salient external features.
- ❑ Internally, six pairs of gill slits on the sides of the pharynx, bisexual nature of the gonad having anterior ovary and posterior testis are the special features.

(7) *Ammocoetus Larva*

PHYLUM: CHORDATA
 SUB.PHY: VERTEBRATA
 CLASS: AGNATHA

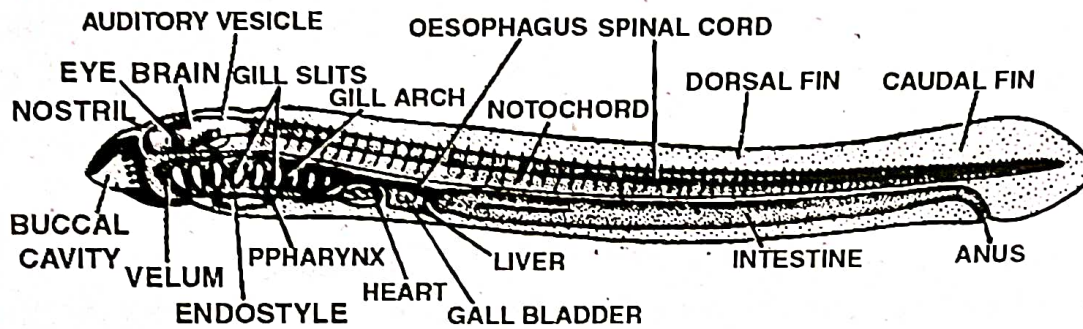


Fig : *Ammocoetus Larva*

- Free swimming larval form in the life history of *Petromyzon marinus*.
- Body measuring about 10mm resemble amphioxus in its appearance.
- Mouth is surrounded by lips and a number of sensory tentacles. Teeth and tongue are absent.
- Velum present at the posterior end of buccal cavity opens into the pharynx.
- Pharynx has seven pairs of gill slits for respiration.
- Ventral side of the pharynx has an endostyle.
- Presence of dorsal tubular nerve cord, antero-median eye, dorsal nasal opening, auditory primordium, and brain are the important features of the larva.
- Heart vesicle, liver lobe and gall bladder are formed at the postero-ventral side of the pharynx.
- Digestive system is a simple tube with pharynx, oesophagus, intestine and associated glands.
- Food is composed of microorganisms strained through the cilia of the gill-slits.
- Larval life extends to 3-4 years and undergo metamorphosis to transform into the adult.

IV

PISCES

(8) *Sphyrna zygaena*

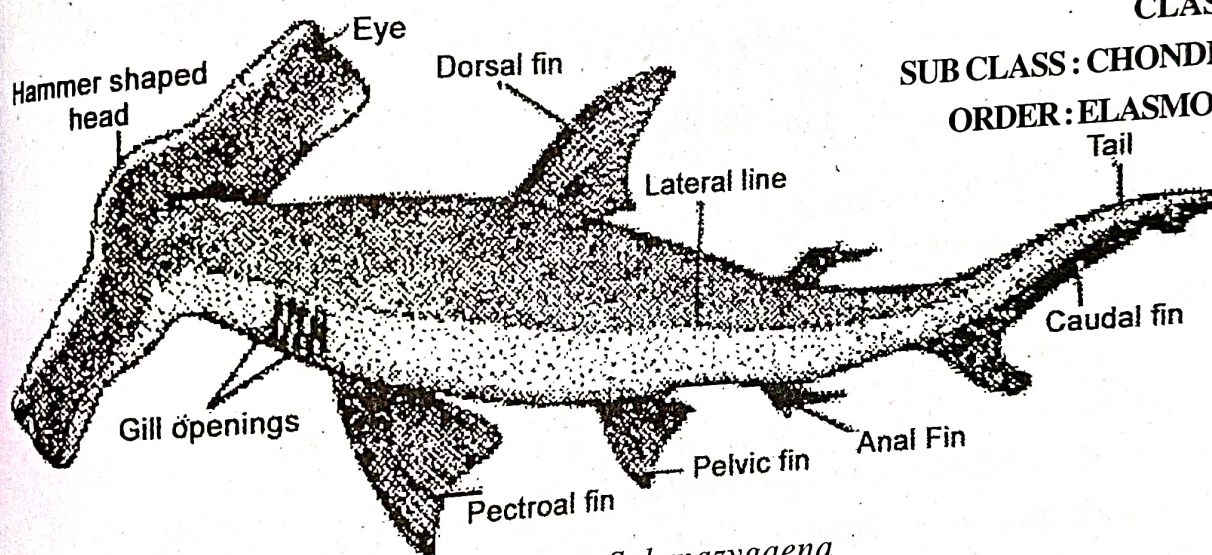
GENERAL NAME: HAMMERHEADED FISH

PHYLUM: CHORDATA

CLASS: PISCES

SUB CLASS: CHONDRICHTHYS

ORDER: ELASMOBRANCHII

Fig : *Sphyrna zygaena*

- ❑ This fish is worldwide in distribution and is seen in Indian marine waters.
- ❑ It tolerates much cooler waters and swims in upper waters of the sea.
- ❑ It is a marine fish having cartilaginous skeleton and smooth un-scaled body.
- ❑ Body can grow to a length of 12 to 13 feet.
- ❑ It colors olive green or brownish gray above and white below.
- ❑ Head is broadly arched and hammer-shaped, lacking indentation at midline (smooth)
- ❑ Pelvic fins with straight to slightly concave rear margins
- ❑ Underbody of posterior portion may have numerous small dark spots on lighter-shaded areas
- ❑ Interdorsal ridge is absent.
- ❑ Placoid scales and present in the skin.
- ❑ Five pairs of gill shits are present on the antero lateral sides of the theory.

(9) *Pristis*

GENERAL NAME: SAWFISH

PHYLUM: CHORDATA, SUB-PHYLUM: VERTEBRATA/CRANIA

SUPER-CLASS: GNATHOSTOMATA, SERIES/GROUP: PISC

CLASS: ELASMOBRANCHII/CHONDRICHTHY

SUB-CLASS: SELACHII, SUPER ORDER: HYPOTREMATA, ORDER: EUSELAC

- Free living marine form commonly occurring in temperate and tropical seas.
- Extensively found along the coasts of Mediterranean sea, America, India and China.
- Grows to a size of 3 to 6 m and possess laterally compressed body.
- Head is flattened dorsoventrally with an elongated rostrum with pointed and sharp teeth.
- Toothed knife like rostrum is used for protection against predators.
- Head bears a pair of lateral eyes at the base of rostrum.
- A pair of branchial openings are present on either side of the pharyngeal region.
- Water entering through mouth goes out through the branchial openings.
- Mouth is ventral on the head. Jaws are toothed besides having a pair of barbels are present.
- Tail is provided with heterocercal tail fin.
- Body has paired pectoral, pelvic fins besides a dorsal, a ventral and an adipose fin.
- This fish is a predator leading viviparous life.
- Oil extracted from the liver of this fish has medicinal value and hence is economically important.

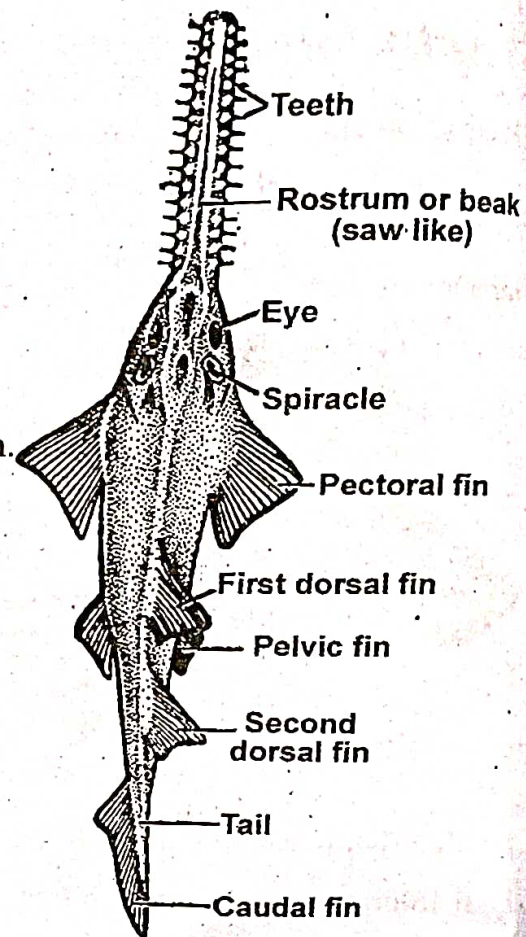


Fig : *Pristis*

(10) *Torpedo*

GENERAL NAME: ELECTRIC FISH

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPERCLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES

CLASS: ELASMOBRANCHII/CHONDRICHTHYES

ORDER: EUSELACHII

- A common deep water living carnivorous fish seen on the sea bottoms of Mediterranean sea, Red sea, Indian ocean, Pacific and Atlantic oceans.
- Body is compressed dorso ventrally with an anterior half moon shaped disc like head.
- The anterior disc is supported internally by a cartilagenous endoskeleton.
- Body is covered by smooth and unscaled skin.
- Paired eyes and respiratory openings are present on the dorsal side.
- Mouth is a wide transverse opening on the anteroventral side of the head.
- A pair of electric organs are present at the base of the eyes on either side of the body. These electric organs are formed by the modification of abductor, mandibular and retractor muscles.
- They are innervated by the branches of seventh, ninth and tenth cranial nerves. The hexagonal units of these electric organs are loaded with mucous and release current to protect themselves from the predators. Their dorsal surface acts as a positive pole and ventral side as a negative pole.
- At the lower margin of the disc lies a pair of pectoral fins.
- A pair of pelvic fins are present just behind the pectoral fins. Tail is short and has a tail fin.
- A pair of dorsal fins are present on the dorsal side of the trunk.

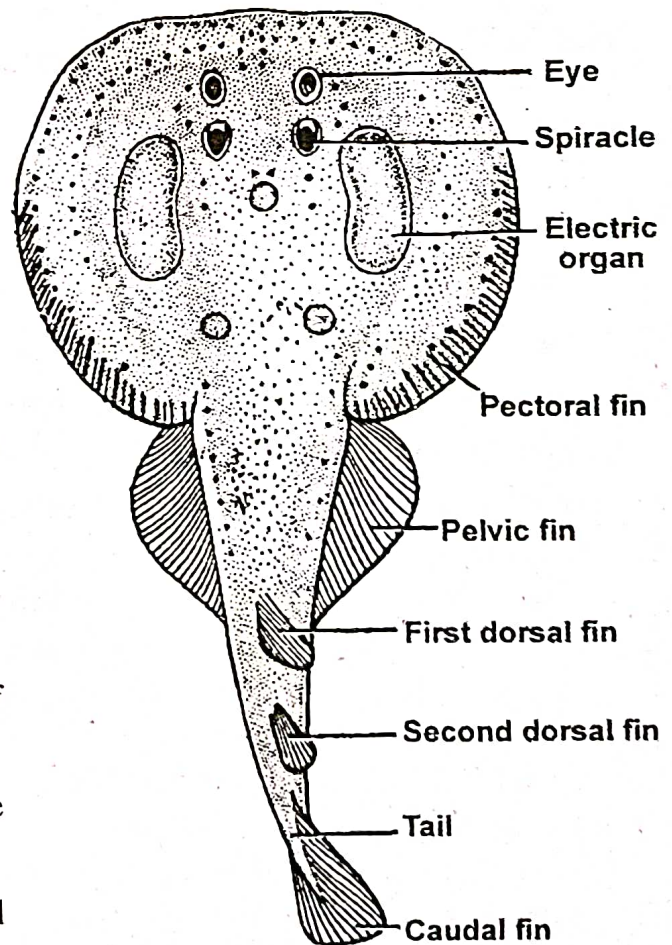


Fig : Electric Fish

(11) *Channa punctatus*

GENERAL NAME: SNAKEHEAD FISH

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPER-CLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES

CLASS: OSTEICHTHYES

SUB-CLASS: ACTINOPTERYGII

SUPER ORDER: TELEOSTEI

ORDER: MUGILIFORMES

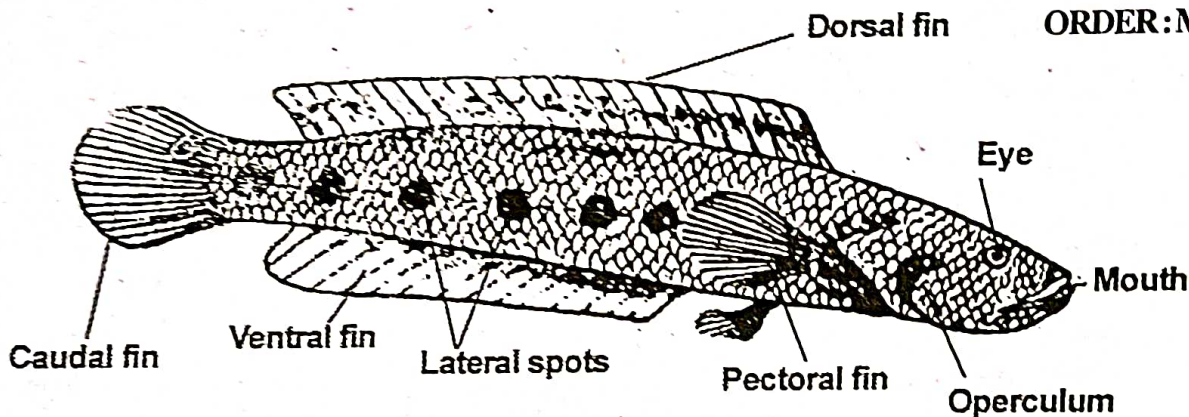


Fig : Snake Head Fish

- Fresh water organisms having food value.
- These are extensively used in research work.
- They are commonly seen in between the rocks of stagnant water pools.
- Body is long and serpentine. The entire body is covered by mucous secretions and hence slimy to touch.
- Head is dorsoventrally flattened and bears a terminal wide mouth.
- The organisms possess accessory respiratory organs. Hence they can live even outside the water. They are considered as live fishes.
- Oviparous organisms producing large number of eggs during breeding seasons.
- These can be grown along with other fishes in artificial ponds.
- Skin is embedded with cycloid scales.
- Dorsal and ventral fins extend all along the body from anterior to the posterior end.
- The organisms possess accessory respiratory organs. Hence they can live even outside the water. They are considered as live fishes.
- Oviparous organisms producing large number of eggs during breeding seasons.
- These can be grown along with other fishes in artificial ponds.

(12) *Pleuronectis*

GENERAL NAME: FLAT FISH

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPER-CLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES

CLASS: OSTEICHTHYES

SUB-CLASS: ACTINOPTERYGII

SUPER ORDER: TELEOSTEI

ORDER: PLURONECTIFORMES

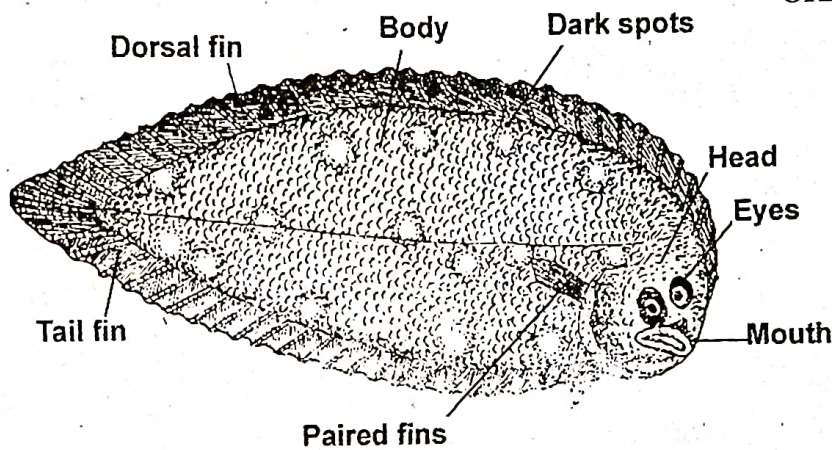


Fig : Flat Fish

- An attractive flatfish with dark bands on the body.
- Commonly seen in deep water zones.
- Body is assymmetrically compressed.
- Anterior end of the cranium is also assymetrical, hence the lateral eyes come to lie on the left side of the head. Left side of the body is the upper visible surface.
- Body is covered by either cycloid or ctenoid scales arranged in imbricate fashion.
- Anterior end of the head is projected as snout. Mouth is also seen from the upper surface is a small slit. Jaws are toothed and bear chistle-shaped teeth.
- Organisms move by the undulations of the body.
- Unpaired dorsal, ventral and caudal fins are continuous with each other.
- Pectoral and pelvic fins are arranged almost at the anterior end.
- Air bladder is hydrostatic and helps in regulating the internal pressure with the external water force.
- Operculum is large and leaf like covering the gills near the head and behind the eyes.
- These fishes are used as food fishes.

(13) *Hippocampus*

GENERAL NAME: SEA HORSE

PHYLUM: CHORDATA
 SUB PHYLUM: VERTEBRATA/CRANIATA
 SUPER-CLASS: GNATHOSTOMATA
 SERIES/GROUP: PISCES
 CLASS: OSTEICHTHYES
 SUB-CLASS: ACTINOPTERYGII
 SUPER ORDER: TELEOSTEIL
 ORDER: SOLENECHTHYES

- It is a flying fish moving speedily over water surface to a short distance. This fish is very common in the salt waters of Indian ocean, Pacific ocean and Atlantic.
- This fish having no similarity with the fish, has a special shape and it moves slowly, elegantly and in vertical lines with the help of its tail in temperate sea waters.
- Head at the anterior end resembles the head of the horse.
- Head has an elongated snout or rostrum with a terminal mouth opening.

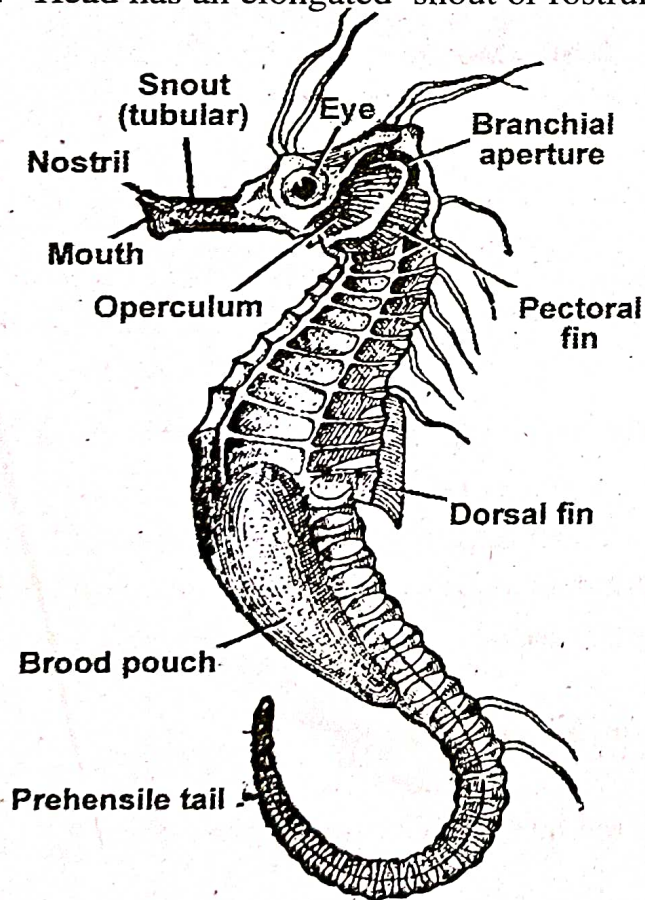


Fig : Sea Horse

- Anterior margin of the head is like a crown giving it the shape of the horse head and its neck.
- Special appearance is imparted to the head because of the presence of two supra orbital spines just above the eyes located just behind the snout.
- Pectoral fins are located at the junction of the head and the neck.
- Gills are covered by the operculum.
- Body armature is composed of bony ossicles formed by the transformation of the scales over the body.
- Dorsal fin is enlarged on one side while the caudal and ventral fins are absent.
- Pelvic fins are transparent.
- Males have a brood pouch just opposite to the dorsal fin at the junction of the trunk and tail.
- Brood pouch is useful for protecting the eggs till they hatch and develop into young ones.
- Tail is prehensile and helps in the slow and vertical locomotion of the organism.

(14) *Exocoetus*

GENERAL NAME: FLYING FISH

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPER-CLASS: GNATHOSTOMATA

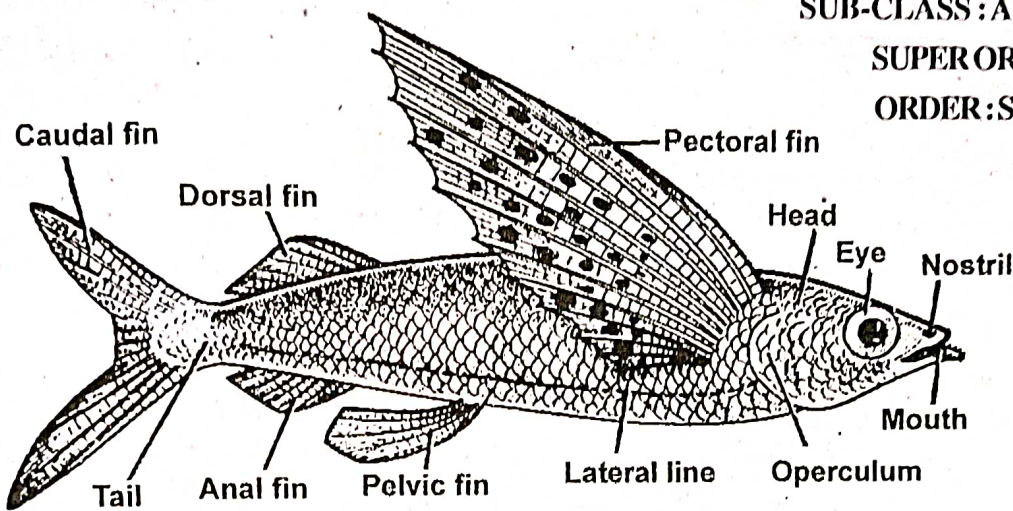
SERIES/GROUP: PISCES

CLASS: OSTEICHTHYES

SUB-CLASS: ACTINOPTERYGII

SUPER ORDER: TELEOSTEI

ORDER: SENENTOGNATHII

*Fig : Flying fish*

- It is a flying fish moving speedily over water surface to a short distances. This fish is very common in the salt waters of Indian ocean, Pacific ocean and Atlantic.
- Body is long and laterally compressed with a homocercal tail fin.
- Head at its anteroventral side possess a small mouth supported by toothed jaws.
- Eyes are conspicuous on either side of the head.
- Body is covered by cycloid scales. Dorsal and ventral fins are supported by fin rays.
- Gills are covered by a bony operculum.
- Among the paired fins, the anterior pectoral fins are enlarged into wing like structures for jumping over the surface of water for shorter distances.
- In some species, the ventral lobe of the caudal fin is strong and create much pressure needed for locomotion.
- Pelvic fins are also enlarged into wings for flying over water surface.
- These fishes have nutritious value.

(15) *Echineis*

GENERAL NAME: SUCKER FISH

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPER-CLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES

CLASS: OSTEICHTHYES

SUB-CLASS: ACTINOPTERYGII

SUPERORDER: TELEOSTEI

ORDER: DISCOCEPHALI

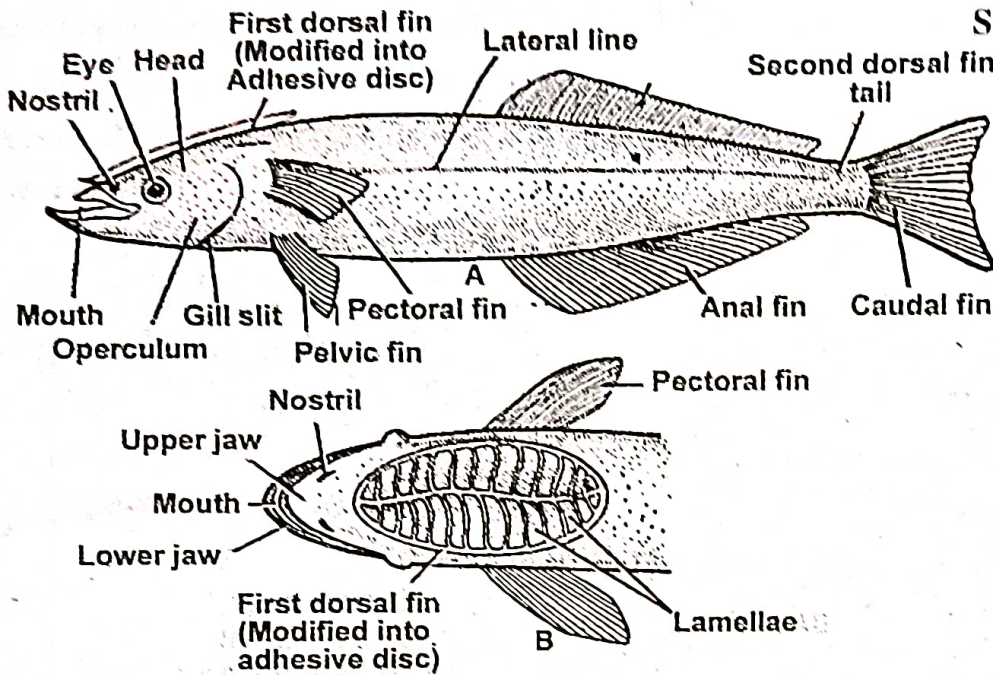


Fig : Sucker fish

- This fish inhabits the tropical sea water areas and moves by attaching to the surface of larger fishes, logs of wood, surface of whales, boats and ships .
- Lengthy body is laterally compressed and is covered by small microscopic scales.
- Eyes are small and are lateral on the head and it has a pair of terminal nostrils.
- Mouth is a wide opening at the antero-dorsal side of the head.
- Operculum is located at the junction of the head and trunk. A pair of pectoral fins are near the operculum. Pelvic fins are also located at the same region on the ventral side.
- Among unpaired dorsal and ventral fins, the anterior dorsal fin is modified into a dorsal sucker supported by powerful muscles. Posterior dorsal, caudal and ventral fins are continuous.
- Tail fin is of homocercal type.
- Air bladder is absent but the epi-clavicle is reduced.
- These fishes move from place to place by attaching with the surface of the larger fishes, logs but they are not parasites.

(16) *Labeo rohita*

GENERAL NAME: ROHU

PRACTICALS

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPER-CLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES

CLASS: OSTEICHTHYES

SUB-CLASS: ACTINOPTERYGII

SUPER ORDER: TELEOSTEI

ORDER: OSTARIOPHYSI

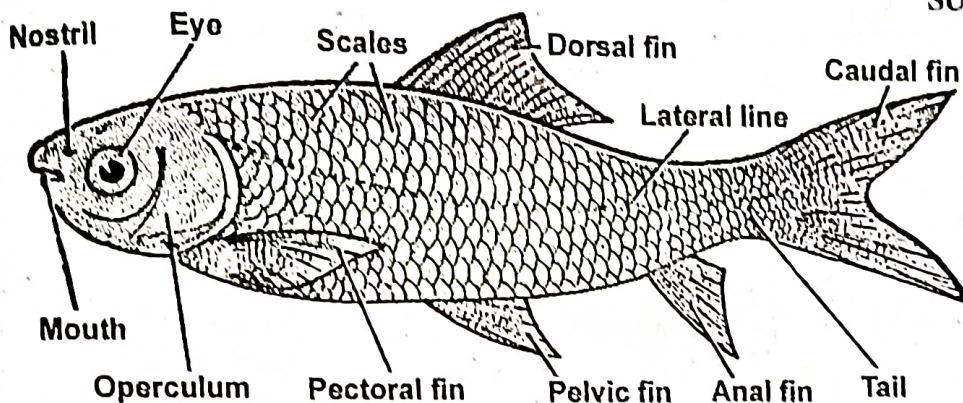


Fig : Rohita

- Universally distributed fresh water fish inhabiting the waters of temperate and tropical regions.
- Commonly lives at the water bottoms and leads herbivorous life. Rarely leads carnivorous life.
- It's meat is having nutritious value and hence the fish is having high economic value.
- Fish grows to about one meter and weighs about 4-5 kg.
- Body is spindle shaped and laterally compressed.
- Gray coloured body is covered by cycloid scales.
- Body is divided into a head, trunk and tail. Neck is absent.
- Both paired (pectoral and pelvic) and unpaired (dorsal, caudal and ventral) fins are supported by cartilaginous fin rays and they help in locomotion. Tail fin is of homocercal type.
- Head has a dorsoventrally flattened snout. Mouth is surrounded by slender and fleshy lips.
- Eyes are lateral and prominent and nostrils are antero-terminal.
- A pair of long cirri arise from the upper lip.
- Gills and gill chamber are covered by operculum.
- Lateral line sense organs are prominent and are seen on the lateral sides of the body.
- Ampullae of Lorenzini, located in the lateral line open out through small openings.

(17) *Catla catla*

GENERAL NAME: CATLA

PHYLUM: CHORDATA

SUB-PHYLUM: VERTEBRATA/CRANIATA

SUPER-CLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES

CLASS: OSTEICHTHYES

SUB-CLASS: ACTINOPTERYGII

SUPER ORDER: TELEOSTEI

ORDER: OSTARIOPHYSI

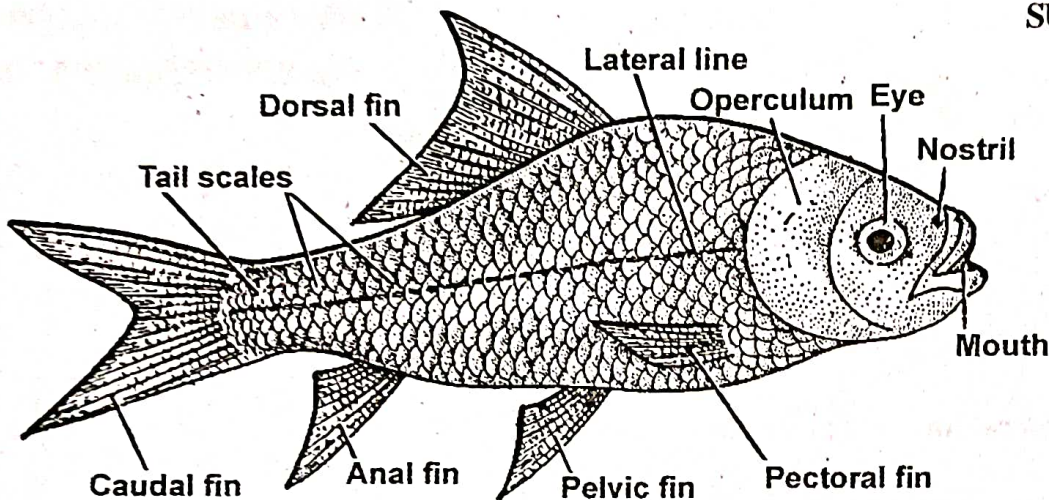


Fig : *Catla*

- It is the major fresh water carp cultured in the natural and artificial ponds in India, Burma, Pakistan and Bangladesh.
- These fishes feed on zooplankton, algal cells, water plants, rotifers and small crustaceans.
- Head is prominent and large with antero-dorsal mouth surrounded by unfolded lips.
- Trunk is wide and stout. It grows to the maximum size and attains sexual maturity in two years. Body is covered by cycloid scales. Eyes are prominent and nostrils are small.
- Dorsal fin is supported by 14-16 fin rays.
- Tail fin is of homocercal type.
- It can even reproduce by induced breeding.
- Oviparous organisms with external fertilization and direct development.
- Economically important fish having high nutritious value and market demand.

(18) *Clarius*

GENERAL NAME: CLIMBING PERCH

PHYLUM : CHORDATA

SUB-PHYLUM : VERTEBRATA/CRANIATA

SUPER-CLASS : GNATHOSTOMATA

SERIES/GROUP : PISCES

CLASS : OSTEICHTHYES

SUB-CLASS : ACTINOPTERYGII

SUPER ORDER : TELEOSTEI

ORDER : OSTARIOPHYSI.

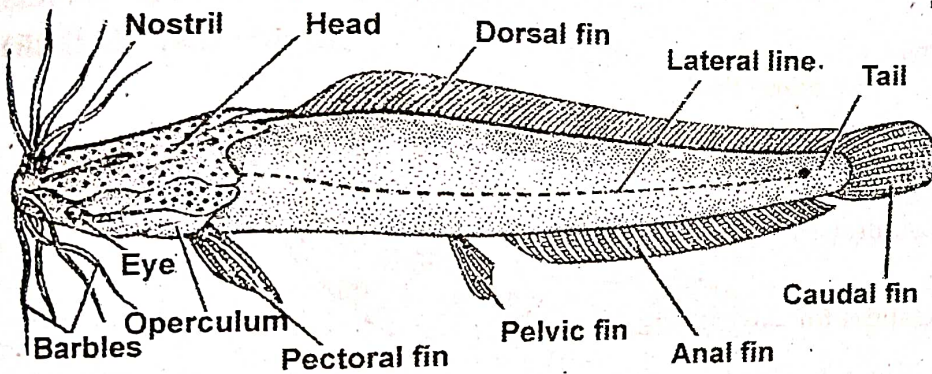


Fig : Climbing perch

- It is a long fish seen living in the fresh water and brackish water ponds of India, Africa, Western and South Asian countries.
- Body is laterally compressed with a pair of lateral eyes, a pair of terminal nostrils, four pairs of long cirri, accessory respiratory structures in the gill chambers, spiny pectoral fins, dorsal and caudal fins along the free margins of the body circular lobe like diphyercal tail fin, gray coloured body, lateral lines supported by bony plates.
- This predacious fish grows to a size of about 45cm.
- Its meat is having food value and hence the fish is economically important.
- Scaleless skin is soft and smooth in texture.
- Air bladder is of physostomous type having connection with the lungs.
- Internal ear consists of Weberian oscicles.

(19) *Anguilla anguilla*

GENERAL NAME: EEL FISH

PHYLUM : CHORDATA

SUB-PHYLUM : VERTEBRATA/CRANIATA

SUPER-CLASS : GNATHOSTOMATA

SERIES/GROUP : PISCES

CLASS : OSTEICHTHYES

SUB-CLASS : ACTINOPTERYGII

SUPER ORDER : TELEOSTEI

ORDER : ANGUILLIFORMES

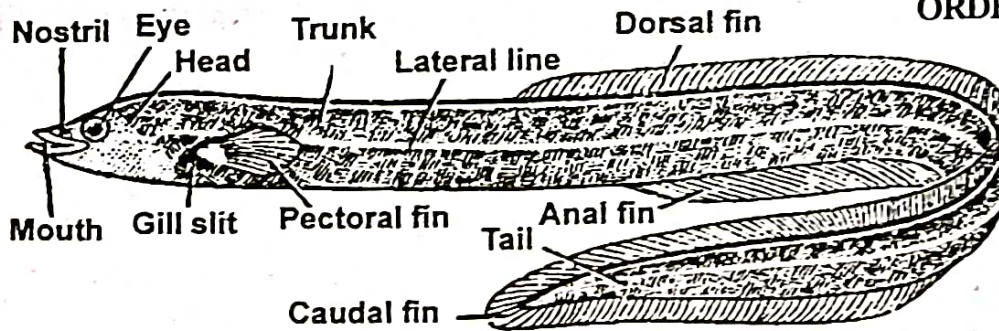


Fig : Eel fish

- Snake like fish having world wide distribution and inhabits marine water.
- It grows to a length of 1-2 meters. Slender and long body is laterally compressed. Anteriorly the body is pointed while the rest of the body is ribbon like.
- Mouth is antero dorsal.
- Gills in the pharyngeal region are covered by an operculum.
- Dorsal, caudal and ventral fins are thin and continuous along the margins of the body.
- Microscopic scales are present over the body and are arranged in special fashion.
- Air bladder is physostomous and opens into the pharynx through glottis but has no special role in aerial respiration.
- Paired pectoral fins are near the operculum but the pelvic fins are absent.
- This fish migrates into the sea for breeding and hence migration is of catadromous type.
- Life history includes leptocephalus larva commonly known as eel elver. These larvae after leading life for some time in sea water and move to Indian rivers.
- Cranium is cartilagenous and jaws are without maxillae. Lower jaw is with mandibular plates.
Jaw suspensorium is of autostylic type

(20) *Protopterus*

GENERAL NAME: AFRICAN LUNG FISH

PHYLUM: CHORDATA

SUB PHYLUM: VERTEBRATA/CRANIATA

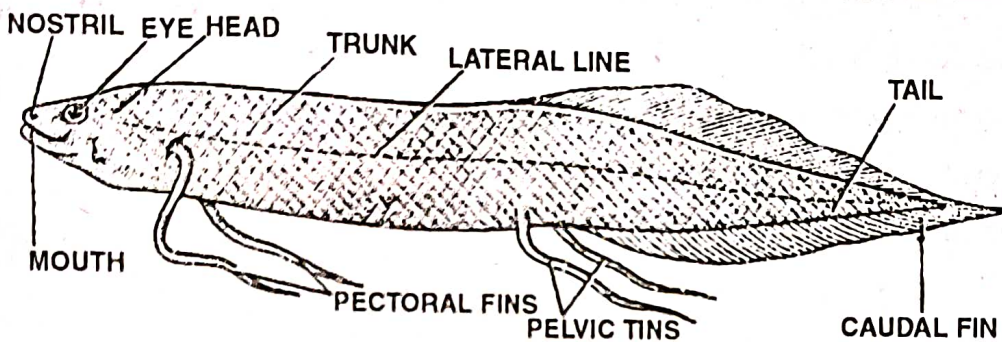
SUPER-CLASS: GNATHOSTOMATA

SERIES/GROUP: PISCES. CLASS: OSTEICHTHYES

SUB CLASS: ACTINOPTERYGII

SUPER ORDER: TELEOSTEI

ORDER: LEPIDOSIRENIFORMES

*Fig : African Lung fish*

- It is an eel fish leading burrowing life in the marshy soils and river bottoms.
- It is very common in Africa, Congo, and Nile rivers.
- They aestivate during summers and their burrows are lined by mucous layer.
- These air breathing dipnoi fishes frequently come out for aerial respiration.
- Head and trunk are almost continuous without a clear demarcation.
- Head bears a pair of lateral eyes, a pair of nostrils and an antroventral mouth.
- Dorsal and caudal fins are continuous and tail fin is undivided.
- Pectoral and Pelvic fins are slender, long and thread like structures.
- Pharyngeal region bears five pairs of gill slits supported by six pairs of gill arches and covered by operculum.

Scales in fishes

Scales are the protective exoskeletal structures formed from the dermis of the skin in fishes. These are of three types:

(21) Placoid scales

- Scales are small granular and microscopic.
- They are embedded in the skin.
- Scales provide rough texture to the body.
- Each scales has a rhomboidal basal plate and a tridentate spine.
- Spines are backwardly directed.
- Basal plate has a central pulp opening.
- Blood vessels enter the scales through pulp opening.
- They are produced in the dermis.

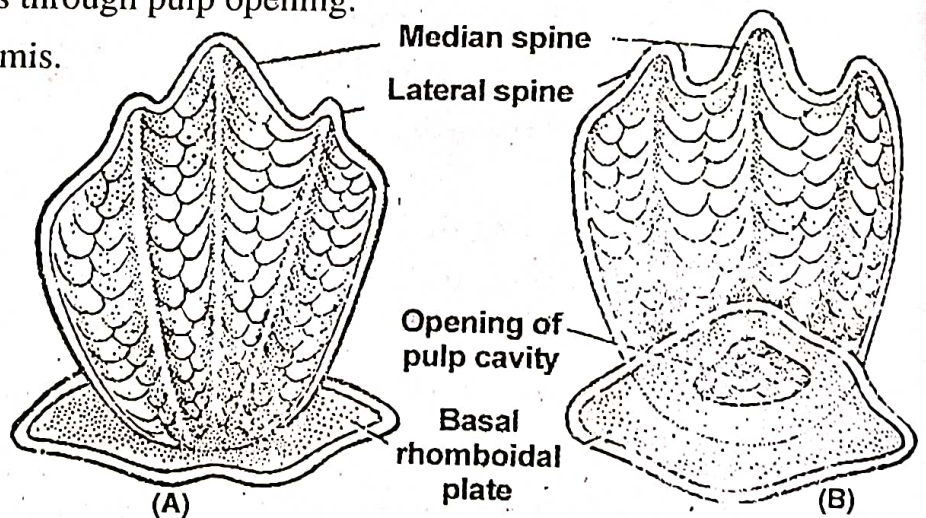


Fig : Placoid scales

(22) Cycloid scales

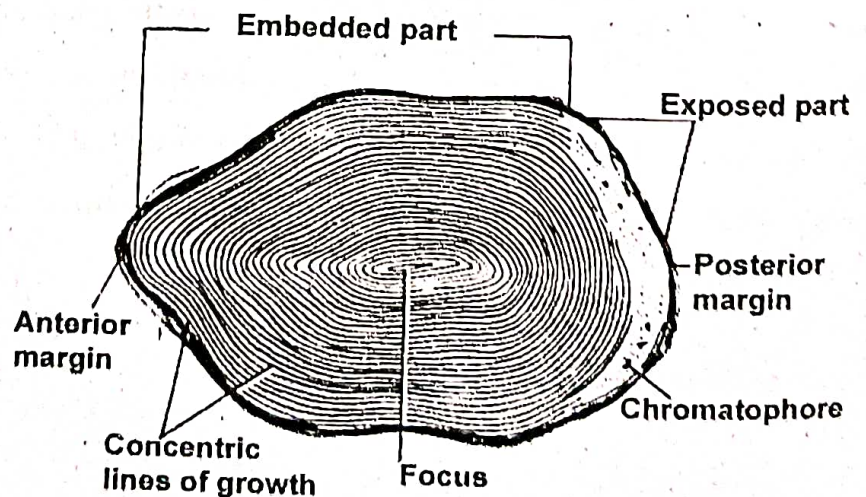


Fig : Cycloid scales

- These scales are present in bony fishes like Carps and Dipnoi fishes
- Scales are thin and circular in outline.
- Anterior part of the scale is embedded in the skin while the posterior part is exposed and overlaps the scale present posterior to it.
- Each scale has a central focus and a number of concentric lines namely the lines of growth. They help in knowing the age of the fish.
- Scales protect the fish from external injuries and infections.

(23) *Ctenoid scales*

- Scales protect the fish from external injuries and infections.
- These scales cover the body of bony fishes like Anabas.
- The posterior free part of one scale covers the anterior embedded part of the next scale.
- The imbricate arrangement of the horny scales over the body not only provides flexibility and smoothness but also protects the fish from all the external injuries and infections.
- They resemble the cycloid scales in all respects except for the presence of the horny teeth along the wavy posterior margin.
- Anterior margin is conical and is free on one side.
- Scales have chromatophores which give colour to the body.

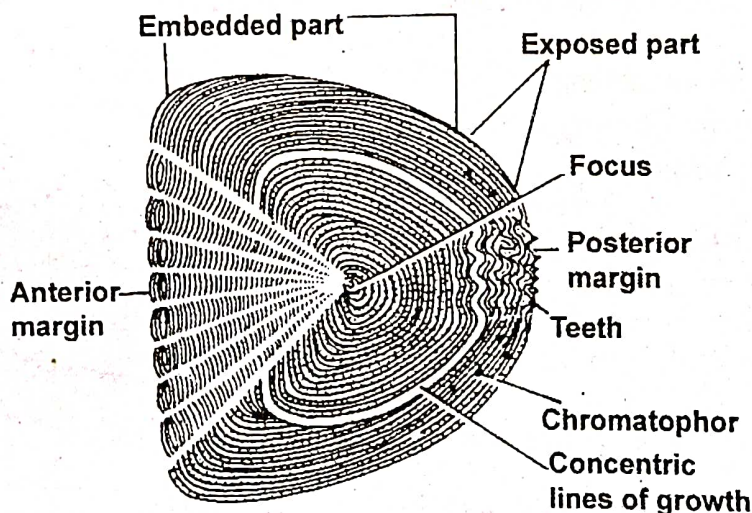


Fig : *Ctenoid scales*


V
AMPHIBIA

(24) *Ichthyophis glutinosa*

GENERAL NAME : LIMBLESS AMPHIBIAN OR CICILIAN

PHYLUM : CHORDATA

SUB-PHY. : VERTEBRATA

SUPER-CLASS : GNATHOSTOMATA

CLASS : AMPHIBIA, ORDER : APODA/GYMNOPHIANA

- 1 These are the dark coloured burrowing organisms commonly seen in moist soils.
- 1 Elongated, serpentine and worm like body is divided into a head and trunk.
- 1 Skin is provided with small placoid scales and allergy producing squirt glands.
- 1 Body surface shows annulations.
- 1 Eyes are small and covered by a fold of skin.
- 1 A short tentacle is present in between the eye and nostril.
- 1 Both limbs and girdles are absent.
- 1 Vertebrae are of amphicoelous type.
- 1 Respiratory system consists of a long trachea and lungs for terrestrial respiration. Left lung is reduced.
- 1 Anus is at the junction of the trunk and tail on the ventral side of the body.
- 1 Cloaca comes out as male genital organ during breeding seasons.
- 1 Fertilization is internal but development is external.
- 1 Females curl around the yolkly eggs and take care of them till they hatch out into larval forms.
- 1 Presence of a tri-chambered heart, urinogenital system and eversible cloaca are the advanced features of these organisms.
- 1 Scaly skin, reduced eyes, absence of limbs and girdles are the primitive features of these amphibians.

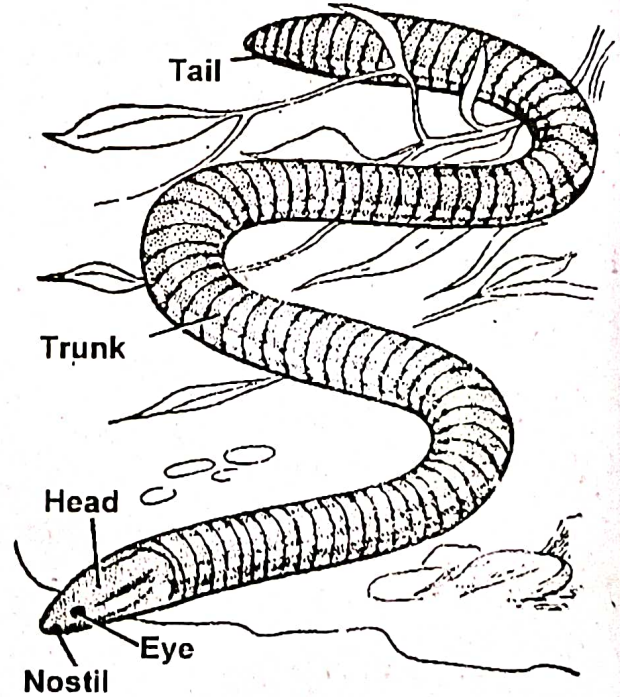


Fig : Limbless Amphibian or Cicilian

(25) *Amblystoma tigrinum*

GENERAL NAME : TIGER SALAMANDER.

PHYLUM : CHORDATA

SUB-PHY. : VERTEBRATA

SUPER-CLASS : GNATHOSTOMATA

CLASS : AMPHIBIA

ORDER : URODELA OR CAUDATA

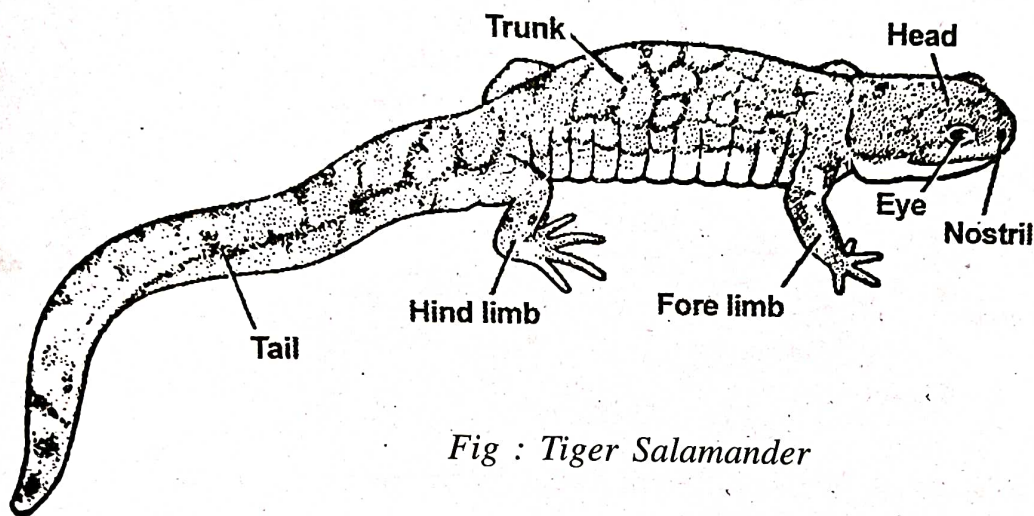


Fig : Tiger Salamander

- It is a tailed amphibian with lizard like appearance and deep coloured patches over the body.
- Body is divisible into a head, a neck, a trunk and a tail.
- Skin is not provided with scales. Tympanic cavity and auditory ossicles are also absent.
- Fore limbs and hind limbs are weak. Both gills and fins are absent on the body.
- Eyes are small on the head.
- Skin is wrinkled and is provided with poisonous paratoid glands.
- Vertebrae are of amphicoelous type. Fertilization is internal.
- Development includes a free swimming neotenic larval form called Axolotl larva.
- Larvae are capable of reproducing by sexual means even before they undergo metamorphosis. Such a condition is called neoteny or paedogenesis.

(26) *Siren*

GENERAL NAME: MUDEEL.

PHYLUM : CHORDATA

SUB-PHY.: VERTEBRATA

SUPER-CLASS : GNATHOSTOMATA

CLASS : AMPHIBIA

ORDER : URODELA OR CAUDATA

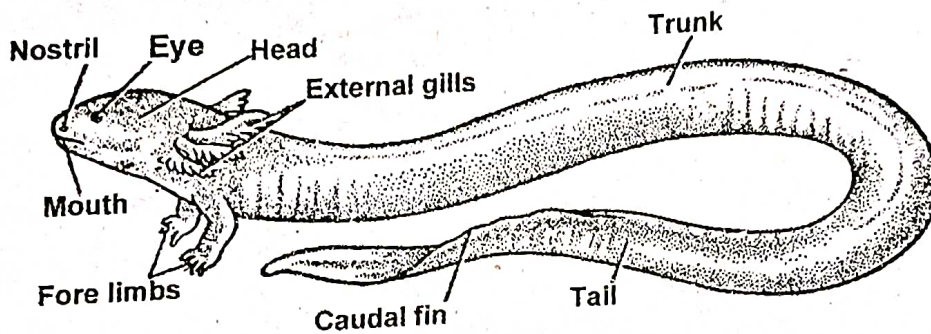


Fig : Mud Eel

- It is a common tailed amphibian in different places of America.
- It lives in marshy soils and water leading burrowing life.
- Body resembles a snake and possesses three pairs of external gills and a pair of gill slits besides a pair of fore limbs.
- Fore limbs are weak and hind limbs are absent.
- Tail is provided with a fin and helps in locomotion.
- Eyes are degenerative and functionless.
- Head is made of horny material.
- Oviparous organisms having external fertilization and development.
- Larvae have prolonged larval life. Yet times, adult characters appear in the larval form itself.

(27) Axolotl larva

GENERAL NAME : NEOTENOUS LARVA

PHYLUM : CHORDATA
 SUB-PHY. : VERTEBRATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : AMPHIBIA
 ORDER : URODELA OR CAUDATA

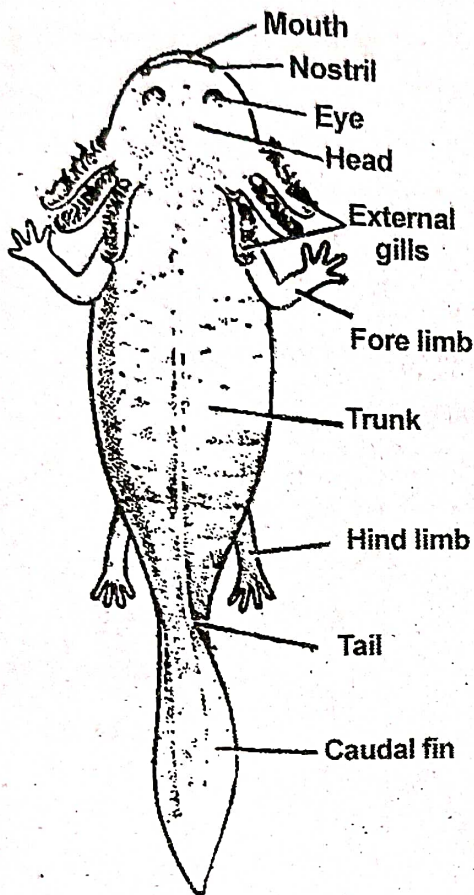


Fig : Neotenus Larva

- ❑ This is the larval form in the life history of salamander.
- ❑ Body is long and dorsoventrally flattened.
- ❑ The wide head is provided with small pair of lateral eyes and a terminal mouth.
- ❑ Forelimbs and hind limbs are weak and are not useful in locomotion.
- ❑ Tail is finned and helps in locomotion.
- ❑ Three pairs of external gills and four pairs of gill slits are present near the neck.
- ❑ Larva can reproduce sexually even without undergoing metamorphosis. Such a phenomenon is called neoteny or paedogenesis.

(28) *Rhacophorus*

GENERAL NAME: FLYING FROG

PHYLUM: CHORDATA
 SUB. PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: AMPHIBIA
 ORDER: ANURA OR SALIENTIA

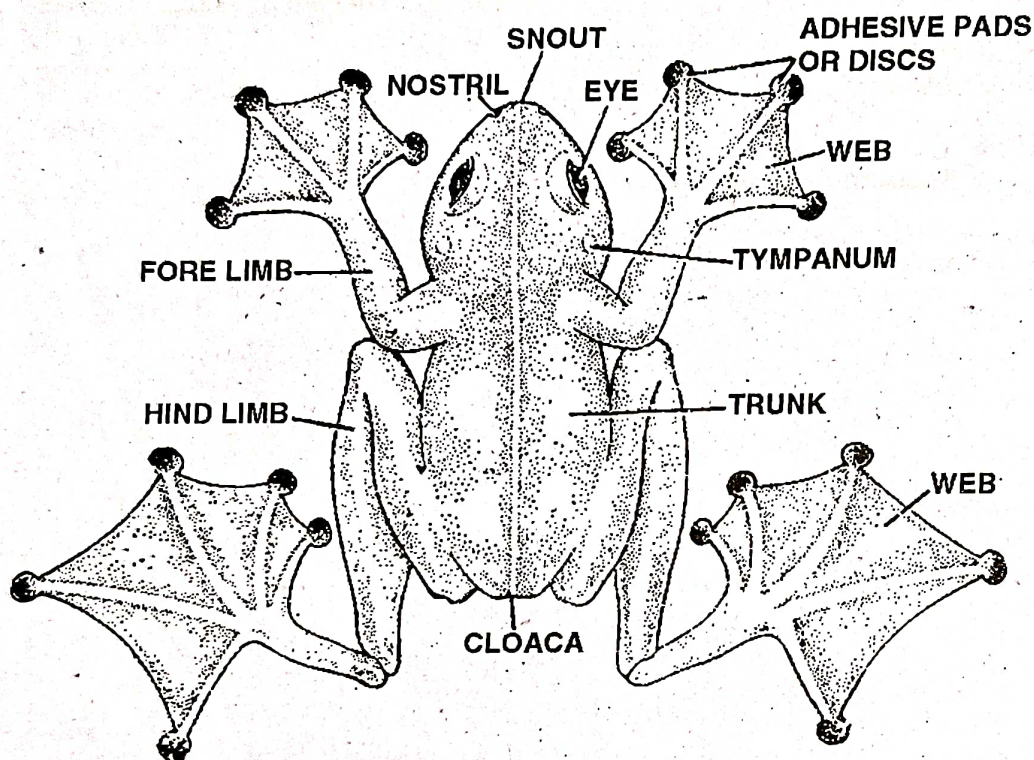


Fig : Flying Frog

- It is a small frog living on tree tops.
- It can mimic the environment and hence mix up with the surroundings.
- Body is divided into a head and trunk, Neck and tail are absent.
- Eyes are conspicuous on the dorsal side of the head.
- Snout is half moon shaped.
- Limbs are weak with adhesive pads at the end of the fingers for grip over the substratum.
- Web is extensively formed between the fingers and hence forms into patagium during leaping over the tree tops. It hops over the trees from branch to branch.
- The limbs appear to be wing like during hopping.

(29) *Hyla Arborea*

GENERAL NAME: TREE TOAD

PHYLUM: CHORDATA
 SUB-PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: AMPHIBIA
 ORDER: ANURA OR SALIENTIA

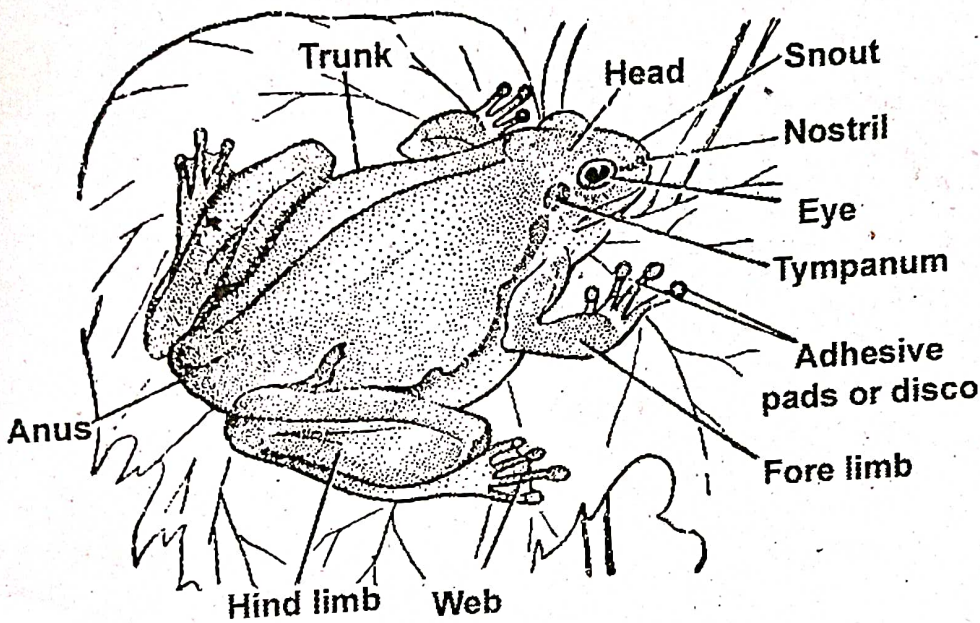


Fig : Tree Toad

- Light green coloured, smooth gelatinous skinned lean and light bodied frog living on the trunks and logs of wood.
- Limbs are considerably long compared to that of frog.
- Fingers end in adhesive pads to help in getting firm grip on the substratum.
- Ventral surface of the body is granular with hydroscopic glands producing mucous.
- Upper jaw is toothed but lower jaw is edentate (without teeth).
- Nocturnal organisms move quickly over the trunks by leaping.
- Thin web between the fingers help in leaping in air.
- Eyes are conspicuous with transverse pupil.
- Fertilization is external.
- Males possess vocal sacs producing a peculiar sound.

(30) *Bufo Melanosticus*

GENERAL NAME: TOAD

PHYLUM : CHORDATA.

SUB. PHY. : VERTEBRATA.

SUPER-CLASS: GNATHOSTOMATA.

CLASS : AMPHIBIA.

ORDER : ANURA OR SALIENTIA.

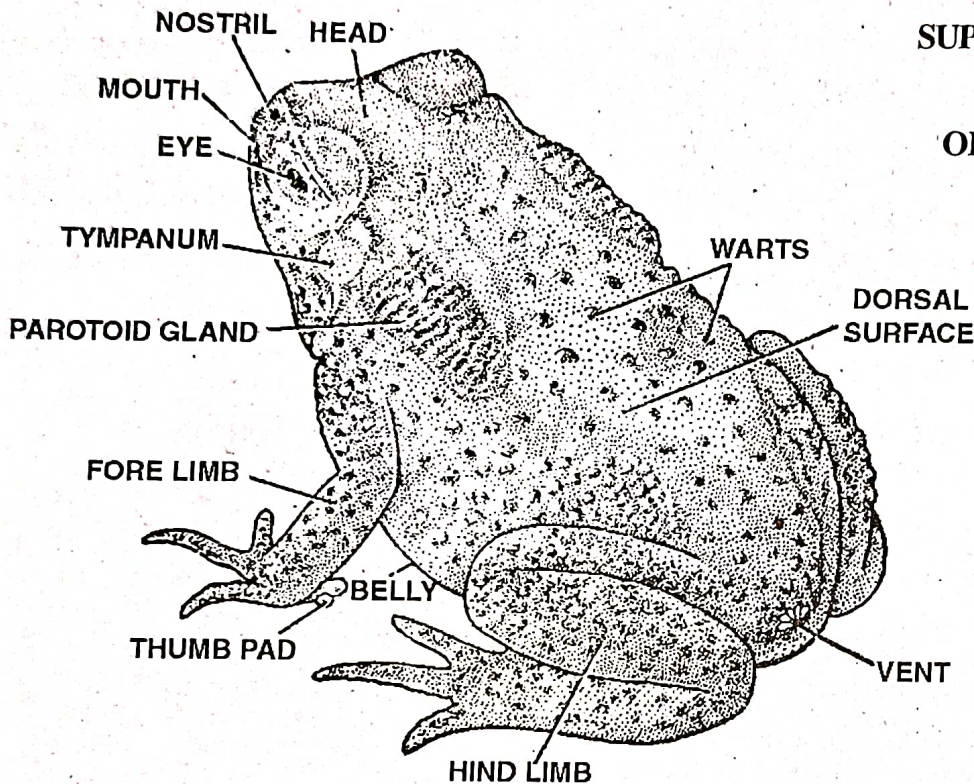


Fig : Toad

- It resembles the normal frog except that it spends most of the time on land.
- It is a nocturnal and carnivorous organism seen near the lights.
- Skin is dry, rough and warty in nature.
- A pair of poison secreting paratoid glands are present just behind the eyes.
- Poison produced from the glands help in protecting the organism from predators.
- Absence of teeth on Jaws (edentate jaws), vocal sacs in males and sternum in the pectoral girdle are the main features of the toad.
- Vertebrae are procoelous and liver is bilobed.
- Forelimbs have four fingers while the hind limbs possess five toes.
- Males are larger than the females. Eggs are without yolk and are released in chains.
- The important components of the poison like digitalin and bufonin are used to cure chronic cardiac diseases. Hence these frogs are economically important.

(31) *Rana Tigrina*

GENERAL NAME: COMMON FROG

PHYLUM: CHORDATA.
 SUB. PHY.: VERTEBRATA.
 SUPER-CLASS: GNATHOSTOMATA.
 CLASS: AMPHIBIA.
 ORDER: ANURA/SALIENTIA.

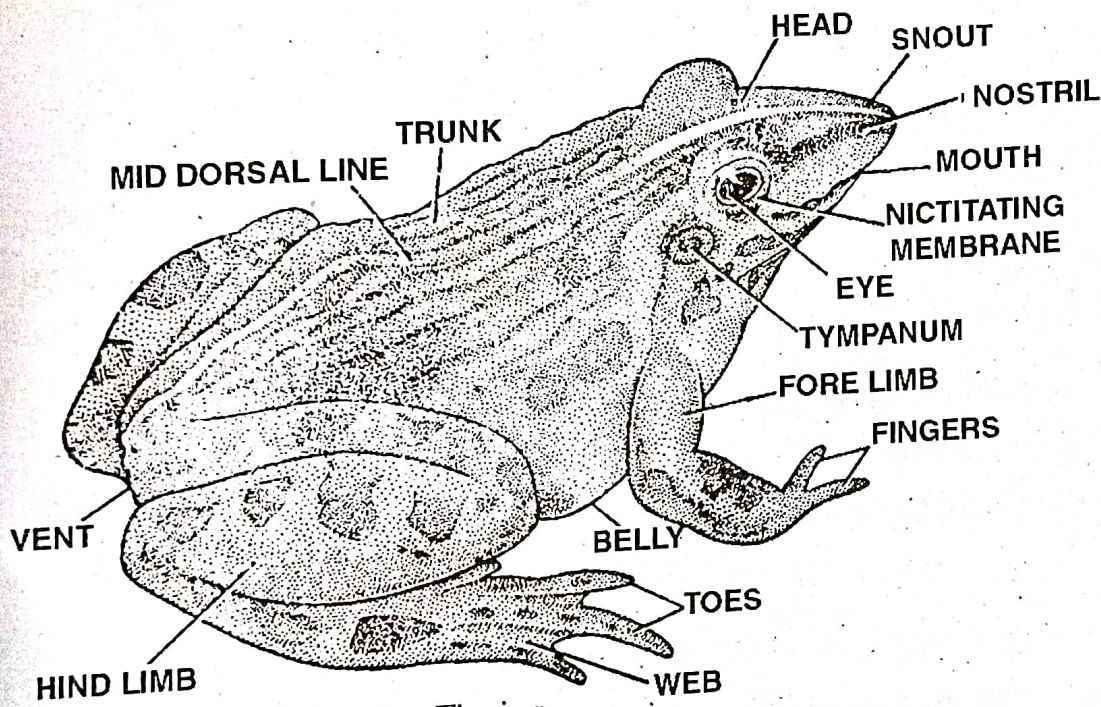


Fig : *Rana Tigrina*

- ❑ It is the common water frog living mostly in water and comes to land for feeding during nights.
- ❑ It stays along the banks of the ponds during day and comes out during night to feed on insects.
- ❑ Body is divided into a head and trunk. Neck and tail are absent.
- ❑ Mouth is a wide opening at the antero-ventral side of the head. A pair of conspicuous eyes, a pair of nostrils and a pair of tympanums are present on the dorsal side of the head.
- ❑ Entire body surface is loaded with mucous glands and hence the body is slimy to touch.
- ❑ Limbs are pentadactyl. Forelimbs are short while the hind limbs are long thus bringing about leaping type of movement.
- ❑ Sexually dimorphic. Males possess a pair of amplexury pads in the fore limbs and a pair of vocal sacs for producing croaking sound.
- ❑ Jaws are toothed. Tongue is bifid to help in feeding and aerial respiration.
- ❑ Oviparous organisms laying eggs in water.
- ❑ Life history is indirect and includes a free swimming tadpole larva.

VI REPTILIA

(32) *Draco*

GENERAL NAME: FLYING LIZARD

PHYLUM: CHORDATA, SUB. PHY.: VERTEBRATA

SUPER-CLASS: GNATHOSTOMATA

CLASS: REPTILIA, ORDER: SQUAMATA

SUBORDER: LECERTELIA

- It is a tree lizard seen in the forest regions.
- Body is dorsoventrally flattened, thin and light.
- Limbs are pentadactyl and fingers end in powerful claws.
- Skin is dry and scaly. Scales are ectodermal in origin. Skin is devoid of glands.
- Skin extends as an extensive patagium in between fore and hind limbs.
- Patagia are supported by five soft rib like bones. These lizards can fly in air using the patagia as wings. During rest, the patagia are much folded. Patagia are attractively coloured.
- Sexually dimorphic forms.
- Gular pouch is present just beneath the neck. This pouch is larger in males. Spines in these pouches help in holding the leaves.
- Eyes are small but conspicuous. Head is triangular while the dentition is heterodont.
- Tongue is short and thick.
- Vertebrae are procoelous.
- Tail is long, soft and whip like.

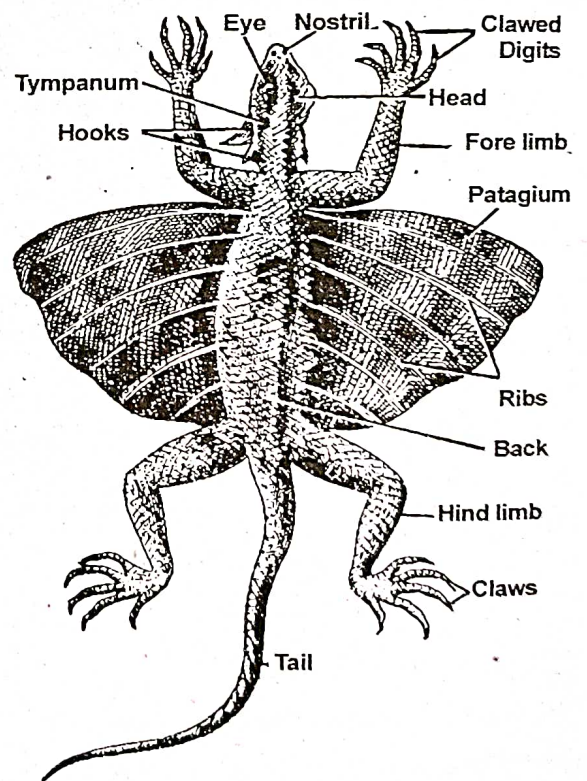


Fig : *Draco*

(33) Chameleon

PHYLUM: CHORDATA
 SUB-PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: REPTILIA
 ORDER: SQUAMATA
 SUB-ORDER: LECERTELIA

- ❑ An arboreal lizard having the capacity to change its colour in relation to the surroundings.
- ❑ Mimicry is its prime feature.
- ❑ Insectivorous organism moving very slowly in between the leaves on the tree branches.
- ❑ Skin is rough, dry and is embedded with granular scales.
- ❑ Body is laterally compressed with a dorsal crest.
- ❑ Body is divided into a head, a neck, a trunk and a tail.
- ❑ Eyes are conspicuous and independent of the movement. Vision is monocular.
- ❑ Tongue is long, sticky and helps in feeding.
- ❑ Dentition is acrodont.
- ❑ Vertebrae are procoelous. Skull is fused to the first vertebra.
- ❑ A number of air sacs are formed from the lungs internally.
- ❑ Fingers in the limbs fuse to form into two bundles. In forelimbs, the inner three and outer two fuse to form two bundles. In hind limbs, the inner two and outer three unite in the same fashion. These are used to grasp the tree branches.
- ❑ Presence of a crown or a hood is the characteristic feature of this organism.
- ❑ Tail is prehensile and helps in twisting around the branches.

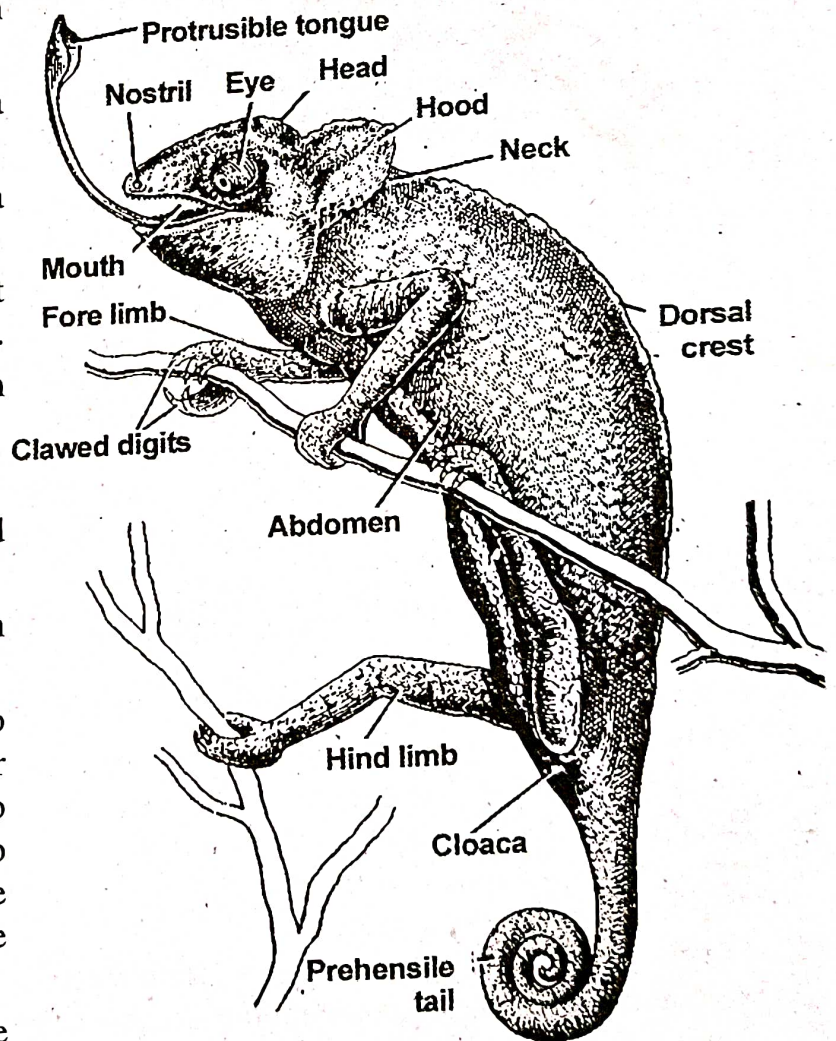


Fig : Chameleon

(34) Gecko

GENERAL NAME: COMMON WALL LIZARD.

PHYLUM: CHORDATA.
 SUB. PHY.: VERTEBRATA.
 SUPER-CLASS: GNATHOSTOMATA.
 CLASS: REPTILIA
 ORDER: SQUAMATA
 SUB ORDER: LECERTELIA

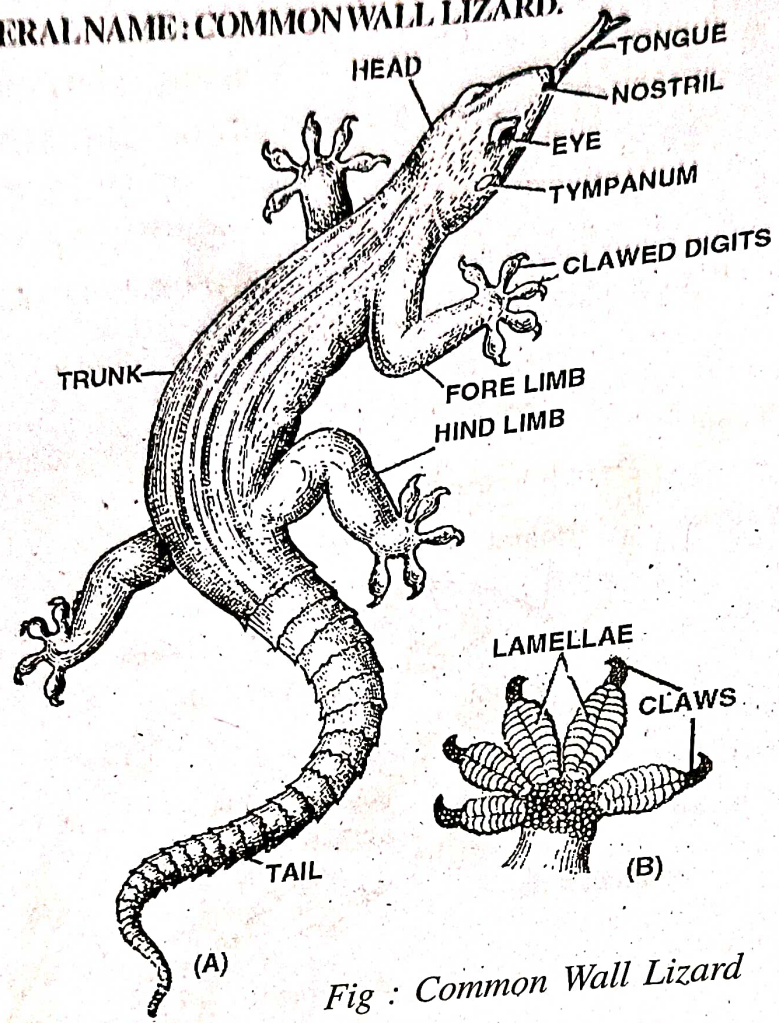


Fig : Common Wall Lizard

- ☐ It inhabits the human habitations and is very common in all most all the houses and godowns.
- ☐ It is seen actively moving on the walls and rarely falling from tops producing sound.
- ☐ Body is divided into a head, neck, trunk and tail. Tail can regenerate when lost.
- ☐ Body is dry and skin is scaly but non-glandular.
- ☐ Head is small and elongated into an ellipse.
- ☐ Eyes are conspicuous, black and granular.
- ☐ Trunk and tail are elongated.
- ☐ Limbs are pentadactyl and fingers are clawed.
- ☐ Adhesive pads present beneath the fingers help in getting firm grip over the substratum.
- ☐ They are insectivorous.
- ☐ Oviparous amniotes with cold blooded nature.
- ☐ Males possess a pair of copulatory organs near the cloaca, a transverse opening at the original of tail.

(35) *Uromastix*

GENERAL NAME: DESERT LIZARD.

PHYLUM : CHORDATA
 SUB. PHY. : VERTEBRATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : REPTILIA
 ORDER : SQUAMATA
 SUB-ORDER : LECERTELIA

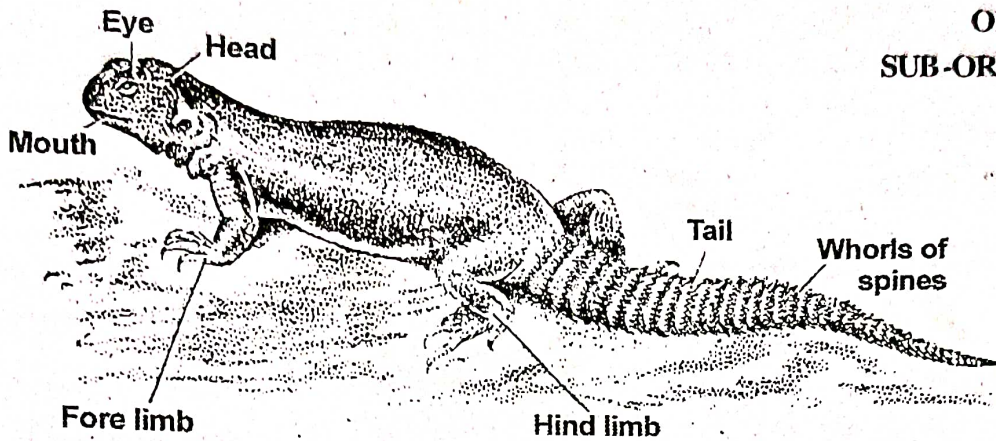


Fig : Desert Lizard

- It is a common lizard seen in sandy areas and deserts.
- It resembles the wall lizard except for the presence of spinous tuft over the tail.
- Body is divided into a head, neck, trunk and tail. Cloaca is a transverse slit at the junction of the trunk and tail.
- Tail can regenerate when lost.
- Skin is dry, rough and covered by ectodermal scales.
- It can withstand higher temperatures of the environment and is poikilothermous in nature.
- Skull is of diapsid type and jaws are toothed.
- It generally feeds on insects and frogs.
- Oviparous organisms.

(36) *Viper russeli*

GENERAL NAME: RUSSEL'S VIPER

PHYLUM: CHORDATA
 SUB. PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: REPTILIA
 ORDER: SQUAMATA
 SUB-ORDER: OPHIDIA

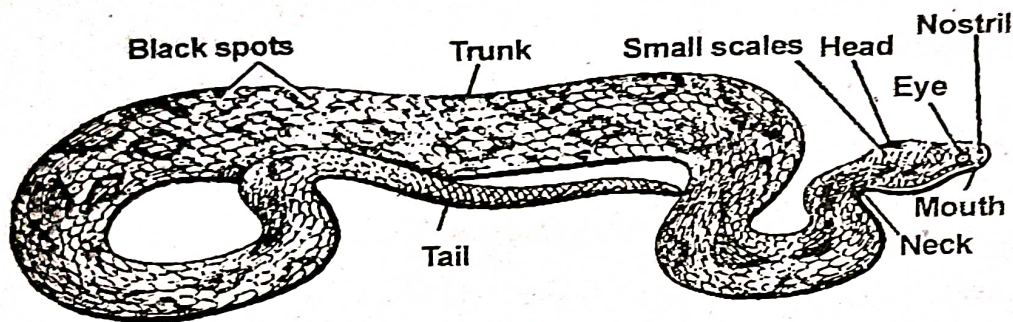


Fig : Russel's Viper

- It is commonly called as a chain viper growing to a length of 3- 5.5 ft. Body is long and stout.
- Head is triangular and is covered by ovoid scales.
- Eyes are conspicuous with a vertical pupil inside.
- Ventral scales are wide and cover the entire ventral surface.
- Head has a dorsal spot in between the two eyes.
- Nostrils are large and hence produce hissing sound.
- Three rows of coloured rings are present over the body arranged in the form of chains.
- Sub caudals are divided.
- Nocturnal organism feeding mostly on rats.
- Fangs are pointed and inject cardiotoxins into the body during the bite.
- Poison is highly dangerous and affects blood vascular system.
- Oviparous organisms.

(37) *Naja naja*

GENERAL NAME: COBRA

PHYLUM: CHORDATA
 SUB-PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: REPTILIA
 ORDER: SQUAMATA
 SUB ORDER: OPHIDIA

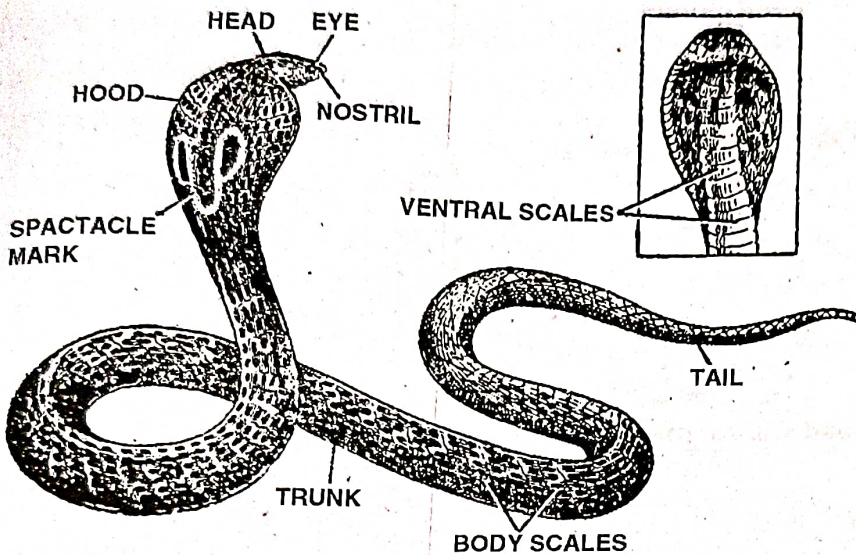
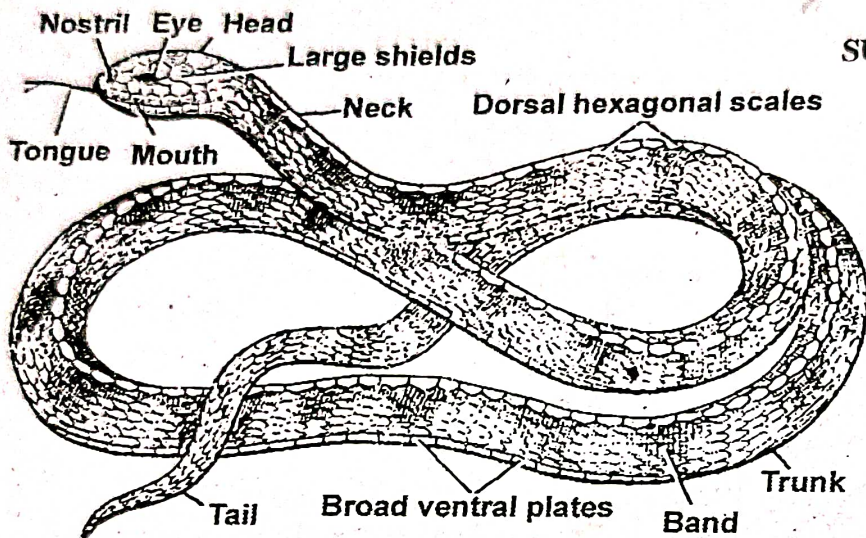


Fig : Cobra

- A South Indian active and common poisonous snake living in forests, bushes, shrubs and crevices.
- Body measures about 5-6 feet and is coloured light brown or yellowish green with coloured spots.
- Anteriorly, the head is covered by plates.
- Ribs in the neck region can expand to form the hood with spectacle on the dorsal side and two black scars on the ventral side.
- Tongue is protrusive and bifid.
- Jaws are toothed of which maxillary teeth modify to form poisonous fangs to inject poison in to the prey.
- Third supra labial touches the nostril and eye.
- A small triangular wedge or keel scale is present in between the fourth and fifth sub-labial scales.
- Ventrals are wide and sub caudals are divided.
- Oviparous organisms feeding on rats and frogs.
- Very active snake raising its anterior body to unfold the hood and produce hissing sound.
- Poison is powerful and acts on nervous system. Hence it is a neurotoxin.

(38) *Bungarus coeruleus*

GENERAL NAME: KRAIT



PHYLUM : CHORDATA
 SUB.PHY. : VERTEBRATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : REPTILIA
 ORDER : SQUAMATA
 SUB-ORDER : OPHIDIA

Fig : Krait

- It is a poisonous snake whose poison is four times powerful than that of cobra.
- Body measures about 4-6 feet and is coloured shiny black or gray with white cross bands on the dorsal side. These bands are light in colour towards anterior half and dark towards posterior half.
- Mid dorsal scales are hexagonal and ventrals are wide extending the entire ventral side.
- Sub caudals are entire and tail is tapering.
- Head is covered by plates. Fourth sub labial is large. Ventral side is light white in colour.
- Nocturnal in habit and always move in pairs.
- It bites when disturbed.

(39) *Enhydrina valaikadian*

GENERAL NAME: SEA SNAKE

PHYLUM: CHORDATA
 SUB-PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: REPTILIA
 ORDER: SQUAMATA
 SUB-ORDER: OPHIDIA

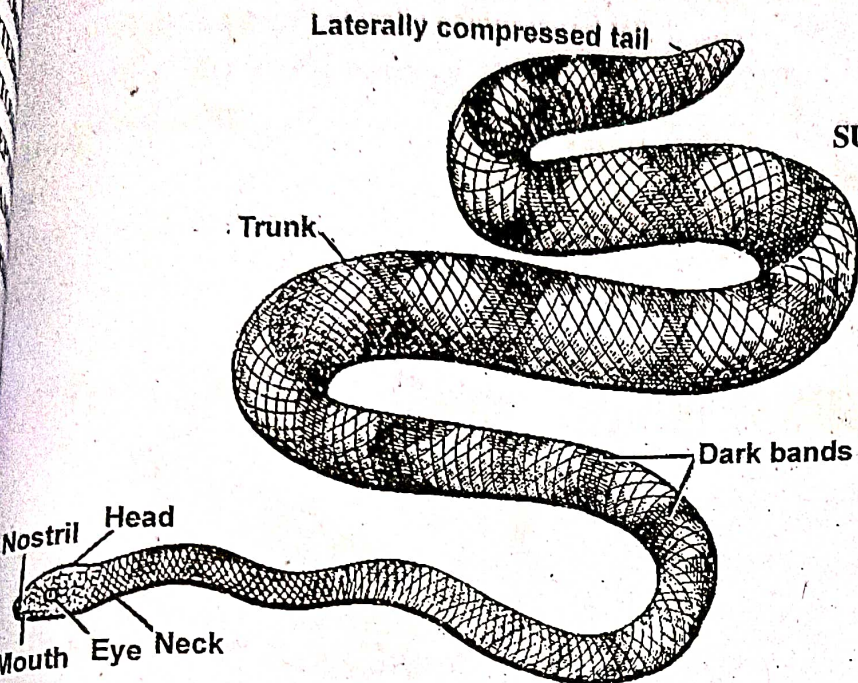


Fig : Sea snake

- It is a short actively moving snake living in seawater and along the sea coast.
- Body is covered by dark coloured granular scales both on dorsal and ventral sides.
- Head is covered by shields.
- Nostrils are small at the top of the snout on the dorsal side of the head.
- Tail is laterally flattened to form into a leaf/oar like one helping in swimming in water.
- Eyes are small and the snake feeds on fish and other small aquatic vertebrates.
- It generally never bites except when disturbed.
- Its poison is eight times poisonous than that of the cobra.
- Viviparous organisms giving birth to the young ones.

(40) *Typhlops vermicularis* (Blind Snake)

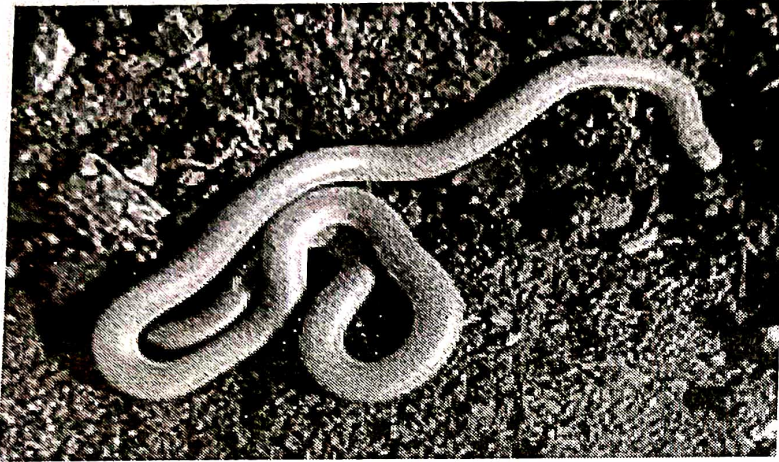


Fig : Blind snake

SUB-PHY.: VERTEBRATA
CLASS: REPTILIA
SUB-CLASS: SQUAMATA
ORDER: OPHIDIA

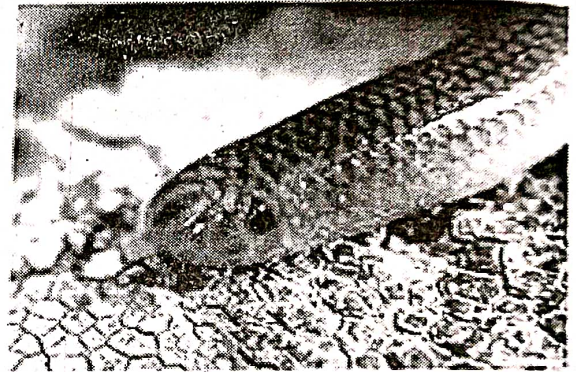


Fig : Typhlops snake

DISTINGUISHING CHARACTERISTICS:

- It is a borrowing blind snake seen in Europe and Asia.
- It is included under endangered list
- This snake moves very actively in the soils.
- Worm like body resembling the common earthworm.
- Body is un-segmented and is covered by small granular ectodermal scales.
- Tongue is protractible and bifid.
- Head is round with a pair of lateral small and black eyes.
- It is also covered by small tiny scales.
- A non poisonous one rarely seen in human habitats
- Oviparous animal laying eggs in between the crevices and stones.

(41) *Ptyas (Zemini Mucosus)*

GENERAL NAME: RAT SNAKE

PHYLUM: CHORDATA
 SUB. PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: REPTILIA
 ORDER: SQUAMATA
 SUB-ORDER: OPHIDIA

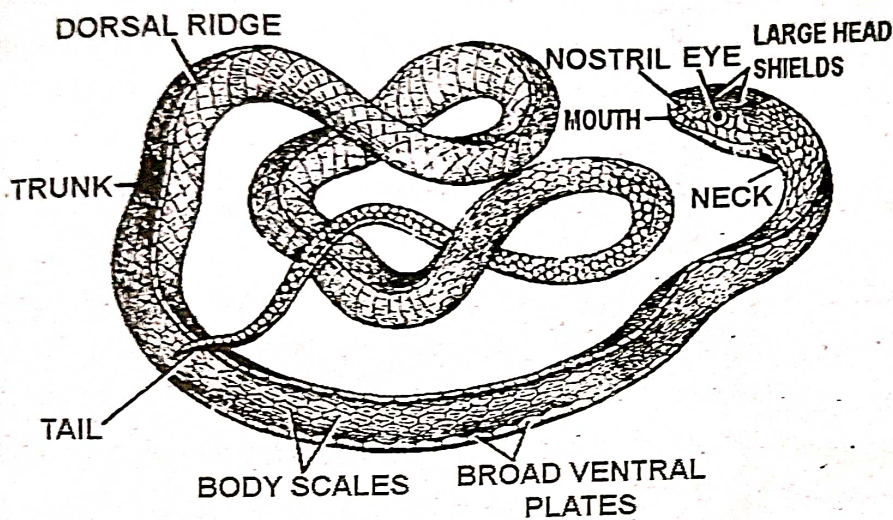


Fig : Rat Snake

- A long actively creeping nonpoisonous snake measuring about 5- 7 feet in length.
- It is commonly seen in the fields, bushes, burrows, grass lands and crevices.
- Body is covered by small scales on the dorsal side and wide ventrals limited to the mid ventral part of the body.
- Body is coloured thick green or yellow.
- Whip like tail helping in attacking the prey and it is prehensile.
- Supralabials, sub labials and caudals possess black margins.
- It can swim in water and climb the trees.
- It feeds on small frogs, lizards, rats etc.,
- It can jump and rise to attack the prey when disturbed.

(42) *Trionyx*

GENERAL NAME: LEATHERY TURTLE

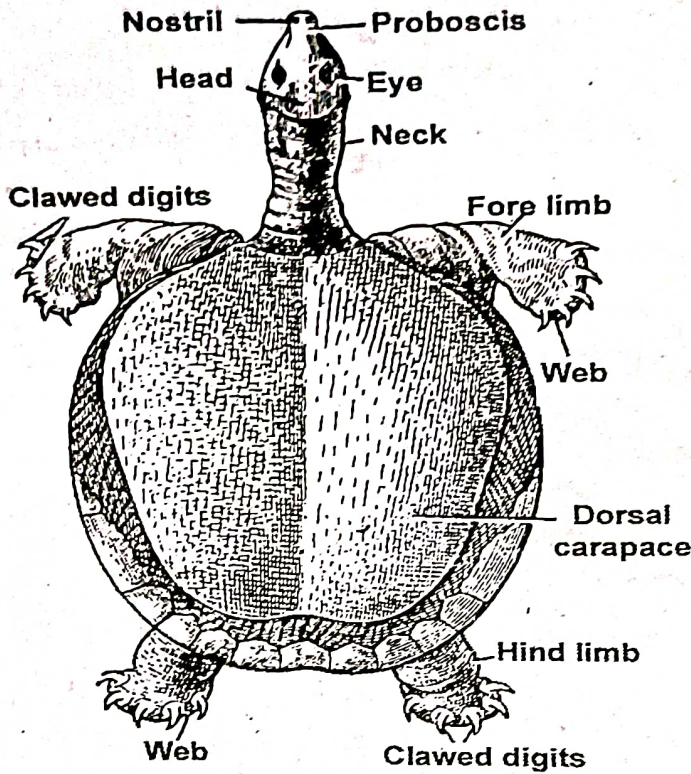


Fig : Leathery Turtle

PHYLUM : CHORDATA
 SUB-PHY. : VERTEBRATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : REPTILIA
 ORDER : CHELONIA

- It is a common fresh water terrapin inhabiting Indian rivers.
- Body is dorsoventrally flattened and hence is flat in appearance.
- Body is protected by a shell covered by a thick and soft skin fold.
- Head is an elongated one with a pointed anterior end bearing a pair of nostrils at its terminus.
- Mouth is antero-ventral and is surrounded by fleshy lips.
- Nine dorsal vertebrae of the carapace are fused with each other.
- The dorsal shell plates unite to form the carapace which is fused with the ribs.
- Laterally, the carapace has eight lateral coastal plates surrounded by a circle of marginal plates.
- A pair of epiplastrons, a central entoplastron, paired hyo and hypo plastrons, a single posterior plastron contribute for the formation of the plastron on the ventral side.
- The fusion lines or sutures are clearly visible on the ventral side of the plastron.
- Vertebrae of the tail and neck are freely movable.
- Feet are like oars and help in swimming. The inner three fingers of the feet are clawed

TC 71E NEW-PFA (2019)

(43) *Testudo elegans*

GENERAL NAME: GIANT OR TERRESTRIAL TORTOISE

PHYLUM: CHORDATA
 SUB-PHY.: VERTEBRATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: REPTILIA
 ORDER: CHELONIA

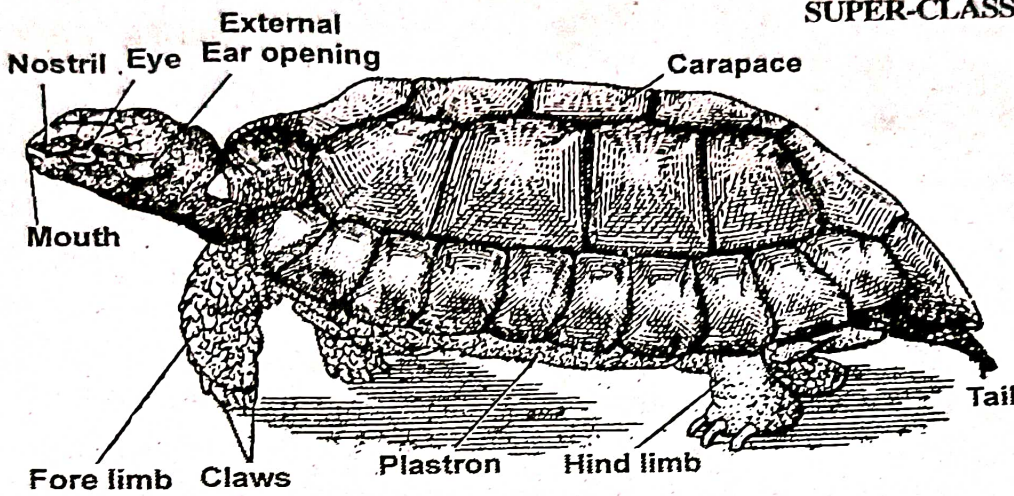


Fig : Giant or terrestrial Tortoise

- It is a large sized organism inhabiting fresh water, marine and terrestrial environments.
- It feeds on worms and insects.
- Jaws are edentate and skull is of anapsid type.
- It hibernates during winters.
- The body is protected by a hard shell made of dorsal carapace and ventral plastron.
- Carapace is composed of a number of coloured hexagonal plates.
- The shell is also covered by a thin fold of skin.
- Dorsal side is convex and the ventral side is almost flat.
- Head, limbs and tail are movable and can retreat into the shell when disturbed.
- Oviparous organisms laying eggs in pits made in the sand.
- Limbs are modified for walking on land.
- Uricotelic organisms excreting uric acid.

(44) *Crocodilus porosus*

GENERAL NAME: CROCODILE

PHYLUM : CHORDATA
 SUB-PHY. : VERTEBRATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : REPTILIA
 ORDER : CROCODYLIA

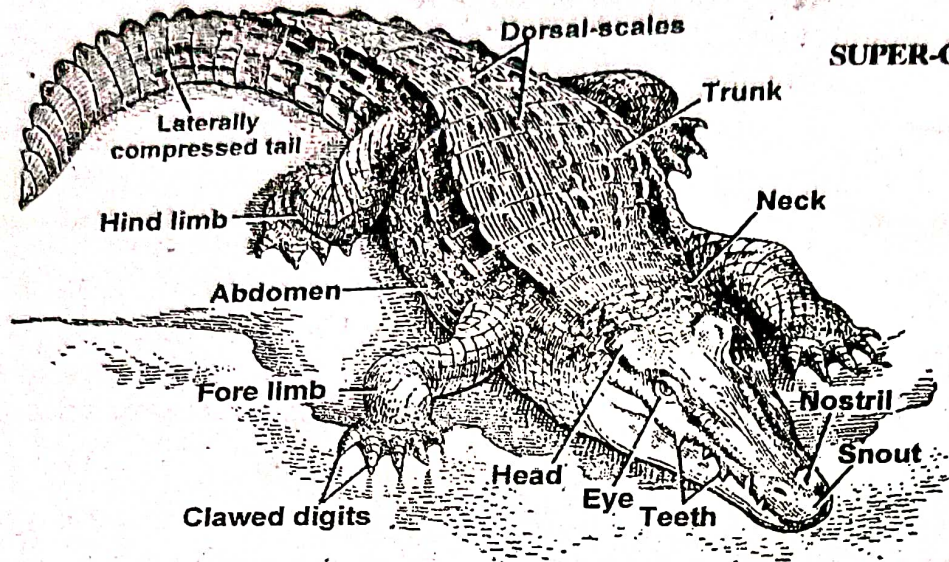


Fig : Crocodile

- It is a common crocodile inhabiting the lakes, rivers and fresh water areas of African and Asian countries.
- Strong and heavy/robust body measuring about 12-13 feet in length. Body is divided into a head, a neck, a trunk and a tail.
- Fore and hind limbs are pentadactyl and clawed. Webbed feet are used in swimming.
- Leathery skin forming the external covering is warty on dorsal side and highly protective.
- Head is an elongated half moon shaped one with terminally placed nostrils and a wide mouth.
- Jaws possess thecodont and pointed, sharp homodont teeth.
- First tooth fits into a pit and fifth one into a notch.
- Ear openings are covered by skin.
- Tongue is used in food collection.
- Four chambered heart leading to a complete double circulation.
- Cold blooded organisms having diaphragm in between the thoracic and abdominal cavities.
- Urinary bladder is absent and hence release the excretory products as and when they are formed.
- It can feed on larger organisms.
- Oviparous organisms showing parental care during embryonic development.

VII

AVES

45) Archaeopteryx (Fossil bird)

PHYLUM : CHORDATA
 SUPER-CLASS : ARCHAEOORNITHYES
 CLASS : AVES
 ORDER : ARCHAEOPTERYGIFORMES

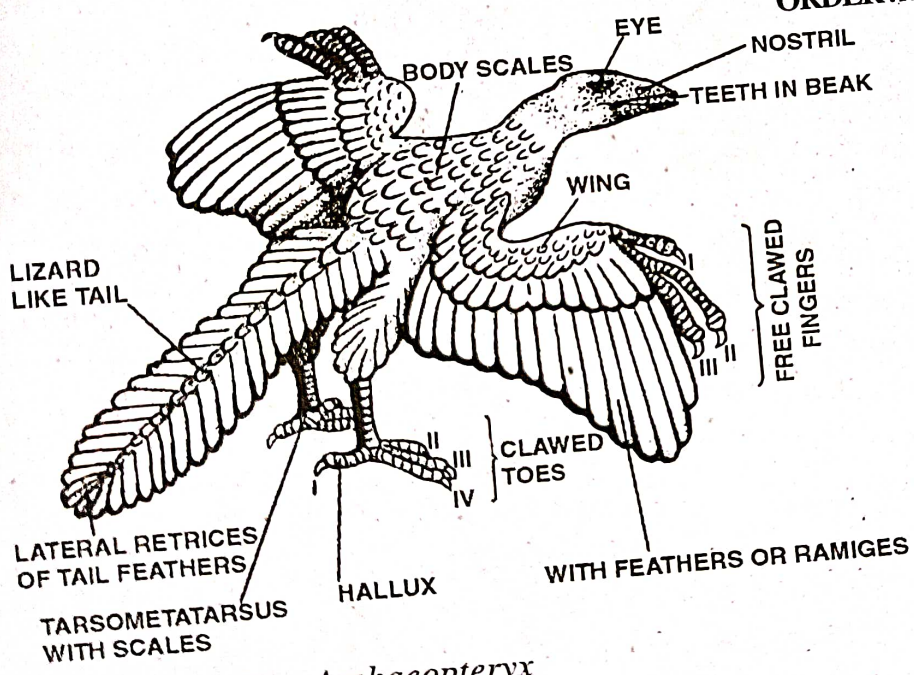


Fig : Archaeopteryx

- The fossils of the bird were obtained from the lithographic lime stones of Bavaria.
- Primitive birds of upper Jurassic period.
- Lived about 155 million years ago and now became extinct.
- Wings are primitive with little power of flight.
- Small cerebellum is seen on the posterior part of the brain.
- Skull with teeth on both the jaws.
- Vertebrae are amphicoelous.

(46) *Passer domesticus* (house sparrow)

GENERAL NAME : HOUSE SPARROW

PHYLUM : CHORDATA, SUB-PHY.: VERTEBRATA
 SUPER-CLASS : GNATHOSTOMATA, CLASS : AVER
 ORDER : PROSERIFORMES

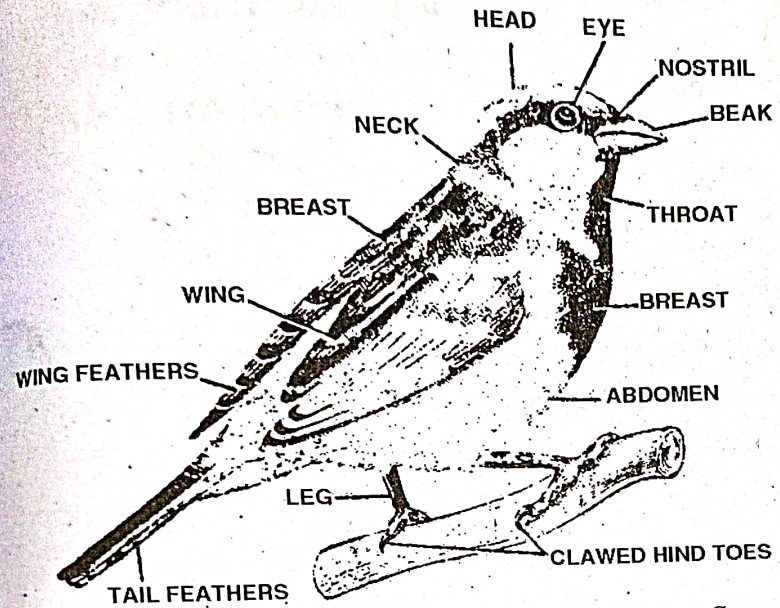


Fig : House Sparrow

- A small bird measuring about 16 cm (6.3 in) and weighing around 24–39.5 g is found in most parts of the world viz., the Mediterranean region, and much of Asia.
- Females and young birds are coloured pale brown and grey, and males have brighter black, white, and brown markings.
- Its intentional or accidental introductions to many regions, including parts of Australia, Africa, and the Americas, make it the most widely distributed wild bird.
- The house sparrow is strongly associated with human habitations, and can live in urban or rural settings.
- Though found in widely varied habitats and climates, it typically avoids extensive wood lands, grasslands, and deserts away from human development.
- They feed mostly on the seeds of grains and weeds, but it is an opportunistic eater and commonly eats insects and many other foods.
- Its predators include domestic cats, hawks, owls, and many other predatory birds and mammals.
- Because of its numbers, ubiquity and its association with human settlements, the house sparrow is culturally prominent.
- Though it is widespread and abundant, its numbers have declined in some areas. The animal's conservation status is listed as least concern on the IUCN Red List.

(47) *Psittacula krameri*

GENERAL NAME: PARROT

PHYLUM: CHORDATA
 SUB-PHY: VERTEBRATA/CRANIATA
 SUPER-CLASS: GNATHOSTOMATA
 CLASS: AVES
 ORDER: PSITTACIFORMES

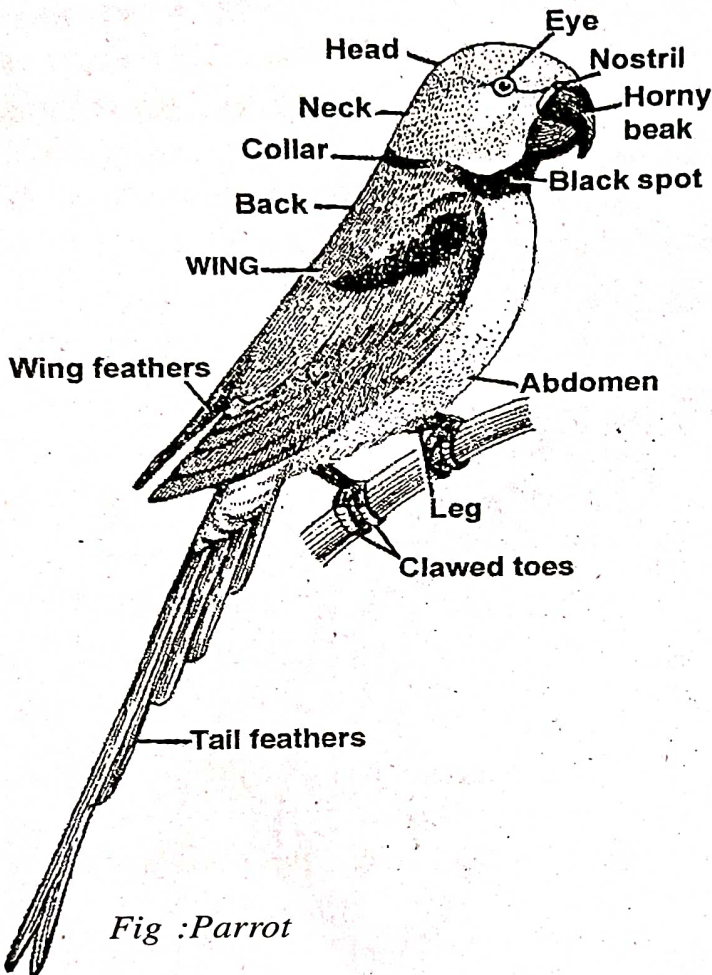


Fig : Parrot

- It is a pet bird having universal distribution and living in stem pits and crevices of the walls.
- It is abundantly seen in India, Ceylone, America and Africa.
- Body is covered by attractive green feathers.
- Short, hooked, beak is bright reddish in colour.
- Jaws are toothless. Upper jaw is bigger than the lower one and is longer with a pointed curved tip. This can move on the frontal bone.
- Tail feathers are longer than the Contours and wing feathers.
- It is a pure herbivore feeding on fruits, seeds and vegetables.
- In the hind limb second and third fingers are forwardly directed while the first and fourth are backwardly directed to facilitate grip over the substratum.
- Syrynix is well adapted for producing sweet sound and even it can speak upon training.
- Males have a pink girdle at the neck region and a black spot near the throat.

(48) *Bubo bubo*

GENERAL NAME: HORN OWL.

PHYLUM: CHORDATA
 SUB-PHY: VERTEBRATA/CRANIATA
 SUPER-CLASS: GNATHOSTOMATA.
 CLASS: AVES
 SUPER-CLASS: NEORNITHES
 ORDER: STREIGIFORMES

- ❑ Universally distributed nocturnal bird inhabiting forests, gardens and dense vegetations.
- ❑ It feeds on small birds, rats, Lizards and other organisms.
- ❑ It can stand erect on its hind legs.
- ❑ Head bears a pair of conspicuous golden eyes, hook like beak, a pair of long horn like feathers.
- ❑ Head and body are covered by smooth and tender feathers.
- ❑ Heavy body is guarded by thick brown coloured feathers having spots.
- ❑ Behind the eyes, external auditory meatus is a large opening behind the eyes on the head.
- ❑ They protect the crops from the attack of rodents by feeding on them. Hence they have economic significance.
- ❑ In day time, they live in bushes and amongst the tree branches.

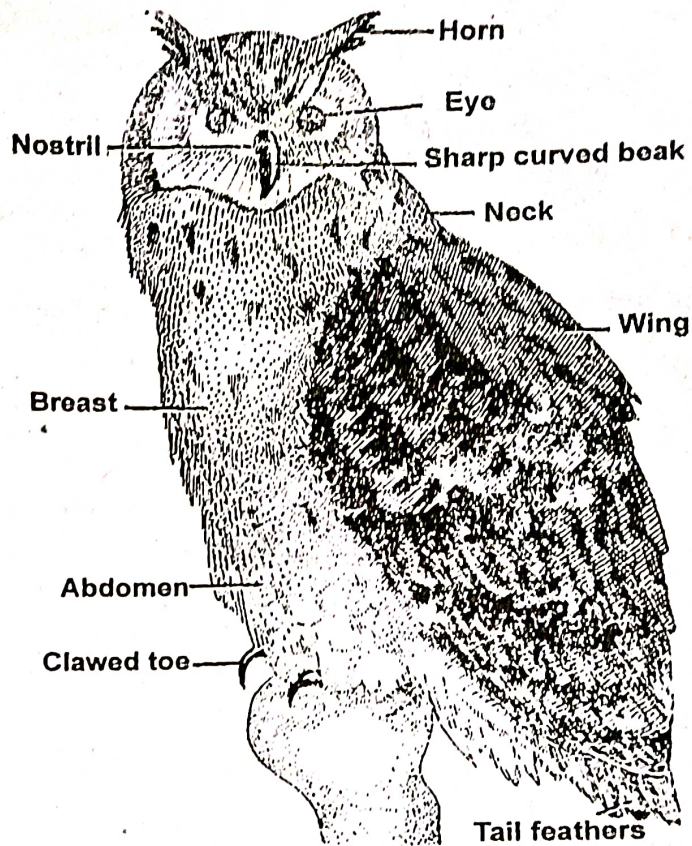


Fig :Horn owl

(49) *Alcedo atthes*

GENERAL NAME: KINGFISHER

PHYLUM : CHORDATA
SUB.PHY : VERTEBRATA/CRANIATA
SUPER-CLASS : GNATHOSTOMATA
CLASS : AVES
SUPER-CLASS : NEORNITHES
ORDER : CORACIFORMES

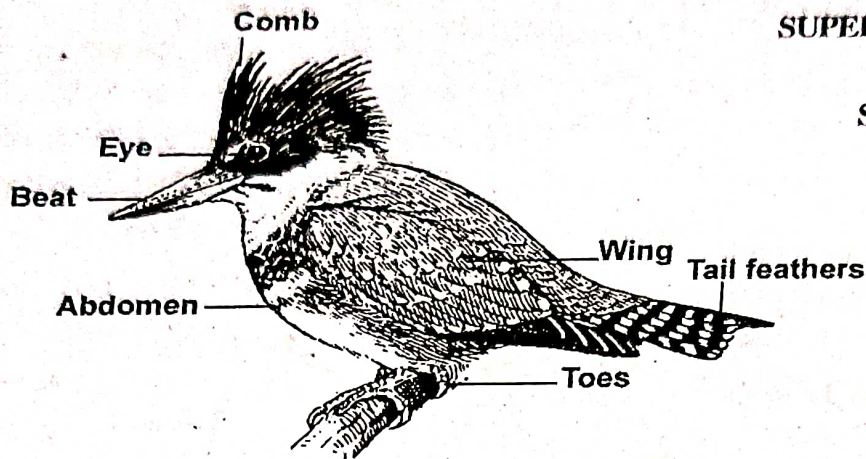


Fig : King fisher

- A small bird living along the banks of water areas.
- Hind limbs have three or four fingers fused at their base.
- Beak is formed of strong jaws.
- Light body covered by deep coloured feathers.
- Feet have three forwardly directed and one backwardly directed fingers. Such feet help in holding the branches with a firm grip.
- They live on the surface of water and feed on fishes, frogs etc.

(50) *Columba livia* (Pigeon)

GENERAL NAME: PIGEON

PHYLUM : CHORDATA
 SUB.PHY : VERTEBRATA/CRANIATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : AVES
 SUPER-CLASS : NEORNITHES
 ORDER : COLUMBIFORMES

- ❑ The species most commonly referred to as pigeon is the feral rock pigeon, common in many cities.
- ❑ They are of very common occurrence but the greatest variety is in the Indomalaya and Australasia ecozones.
- ❑ Pigeons are stout-bodied birds with short necks, and short, slender bills with fleshy ceres.
- ❑ Body is covered by dry and flexible skin studded by gray and black colored feathers.
- ❑ Head bears a pair of black eyes with powerful vision.
- ❑ A pair of small ear openings can be seen just behind the eyes leading to auditory meatus.
- ❑ Beak is hard and helps in feeding on seeds, fruits, and plants.
- ❑ Legs are short and covered with scales. Toes are clawed.
- ❑ Pigeons build relatively flimsy nests in trees using sticks and other debris.
- ❑ They lay one or two eggs at a time, and both parents care for the young, which leave the nest after seven to twenty-eight days.
- ❑ Unlike most birds, both sexes of pigeons produce crop milk to feed to their young, secreted by a sloughing of fluid-filled cells from the lining of the crop.
- ❑ Young pigeons are called squabs.

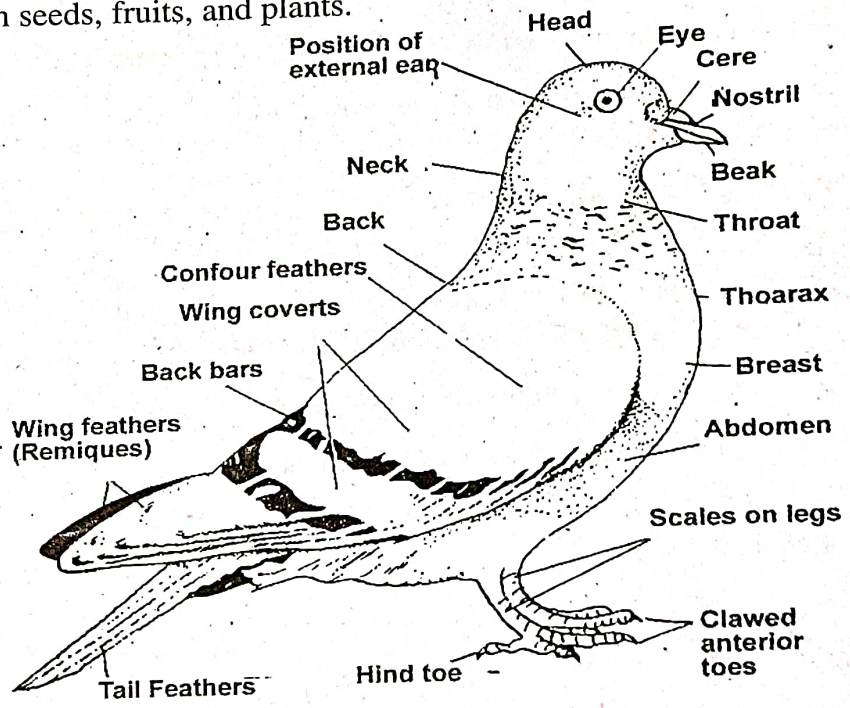


Fig : Pigeon

(51) *Corvus splendens* (House crow)

GENERAL NAME: HOUSE CROW

PHYLUM : CHORDATA

SUB.PHY : VERTEBRATA / CRANIATA

SUPER-CLASS : GNATHOSTOMATA

CLASS : AVES

SUPER-CLASS : NEORNITHES

ORDER : PROSERIFORMES

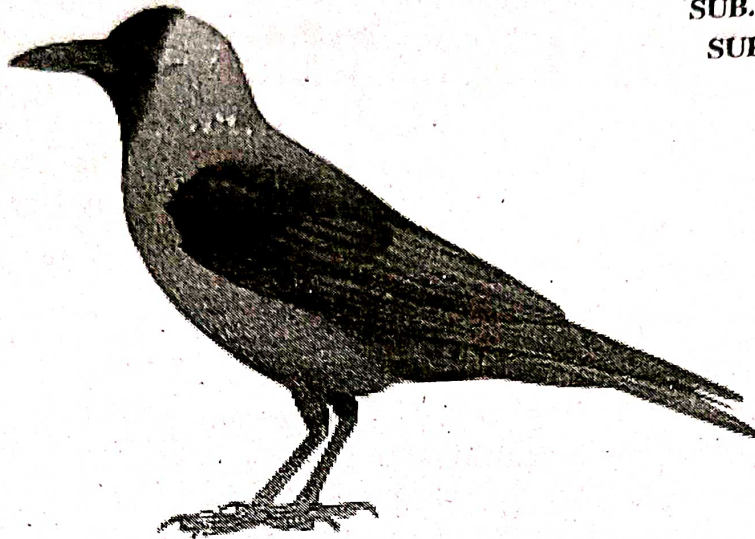


Fig : House Crow

- The crow also known as the Indian, greynecked, Ceylon or Colombo crow.
- It is a common bird of the crow family that is of Asian origin but now found in many parts of the world.
- The forehead, crown, throat and upper breast are a richly glossed black, whilst the neck and breast are a lighter grey-brown in colour.
- The wings, tail and legs are black. There are regional variations in the thickness of the bill and the depth of colour in areas of the plumage.
- They live abnormally long and are monogamous throughout their long lives. They were thought to predict rain and reveal ambushes.

(52) *Pavo cristatus* (peacock)

GENERAL NAME: PEACOCK

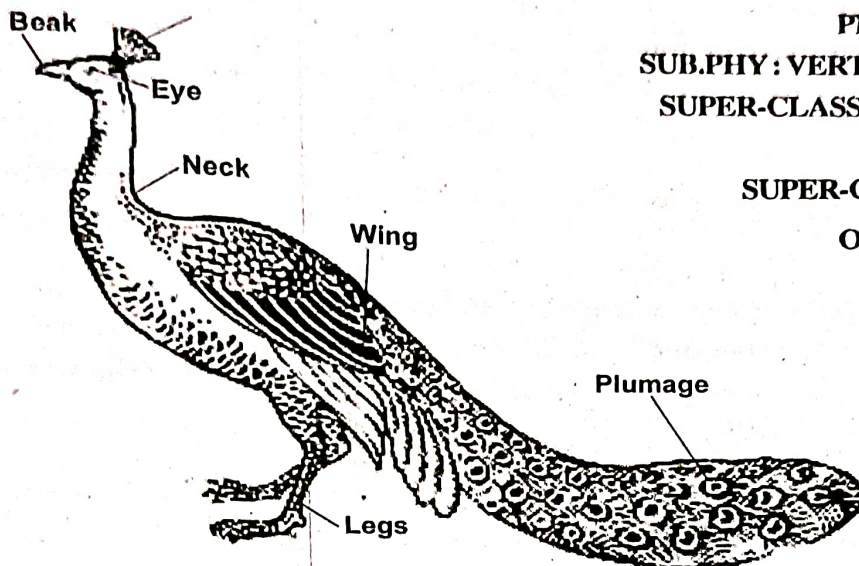


Fig : Peacock

PHYLUM : CHORDATA
 SUB.PHY : VERTEBRATA/CRANIATA
 SUPER-CLASS : GNATHOSTOMATA
 CLASS : AVES
 SUPER-CLASS : NEORNITHES
 ORDER : GALIFORMES

- Common name is the Peacock or Peafowl. It is very common in warmer climate prevalent in India and is named as the National bird.
- Peacocks are most commonly found in deserts, dry savanna areas and dense forests.
- It is a medium sized bird most closely related to the pheasant.
- Peacock is found in warmer climate and most commonly found in India.
- Male peacocks are elaborate while the females are dull and brown.
- The male peacock is most well known for its enormous and elaborate tail feathers which fan out behind as a beautiful plumage fan of nearly two meters in length.
- The male peacock attracts a female to mate with by showing off his array of elaborate feathers.
- Male peacock will fan his tail out in order to make himself look bigger and thus tries to intimidate approaching predators.
- The peacock is an omnivorous bird and feeds on insects, plants, seeds, and flower heads.
- Peacocks have also been known to munch on small mammals and reptiles as supplement their diet.
- Males are known as peacocks while females are known as peahens.
- The male peacock is about twice the size of the female peahen.
- At rest, the male drags its brightly colored elaborate tail feathers as a tail or a train.
- The green peacock, is listed as being vulnerable to extinction mainly due to hunting and habitat loss.

(53) Feathers

In birds, the body is covered by ectodermal exoskeleton formed of feathers. They arise from papillae on the skin. Each feather has a central rachis, a blade like vane formed of barbs and barbicels. The typical feather is the flight feather called quill feather. Feathers on the body are of four types.

(a) **Contour feathers:** These are the general pennaceous feathers covering the body and are called quills.

A quill feather has a stalk or quill. Its basal part is the hollow *calamus* with pith formed of dry pulp. It is embedded in the skin. opens below by an *inferior umbilicus* and above by a *superior umbilicus*. Loose and soft tuft of barbs at the superior umbilicus constitute after shaft.

The stalk above the calamus is a solid *rachis* having an umbilical groove on its underside. The blade on either side of the rachis is the *vane* or *vaxillum*. It is composed of a large number of flattened *barbs* connected to one another with *barbules*. The barbules are tiny strands that criss-cross on the flattened sides of the barbs. This forms a kind of miniature mesh holding all the barbs together to stabilize the vanes.

(b) **Flight feathers (*Pennae volatus*):**

- ❑ These are the long, stiff, asymmetrically shaped, but symmetrically paired pennaceous feathers on the wings or tail of a bird.
- ❑ Quills on the wings are called **remiges** (singular **remex**) and those on the tail are called **rectrices** (singular **rectrix**).
- ❑ The primary function of the flight feathers is to aid in the generation of both thrust and lift, thereby enabling flight.

(c) **Filoplumes:** A third rarer type of feather is the hair like **filoplumes** also called as pin feathers. They grow along the fluffy down feathers. In some passerines, filoplumes arise exposed beyond the contour feathers on the neck. Each filoplume has a central long and slender calamus. At the tip of the calamus, a tuft of weak barbs with barbules are present. These are visible only in the dressed birds only.

(d) Down feathers lie beneath the vaned feathers. Newly hatched birds of some species have a special kind of down feathers (neossophtiles) which are pushed out when the normal feathers (teleoptiles) emerge. The body downs of birds form into a layer of fine feathers under the tougher exterior feathers. Very young birds are clad only in down.

The down feather is considered to be the simplest of all feather types. These are fluffy as they lack barbicels. Hence the barbules float free of each other, allowing the down to trap air and provide excellent thermal insulation and contributes to the buoyancy of aquatic birds. At the base of the feather, the rachis expands to form the hollow tubular calamus (or quill) which inserts into a follicle in the skin. The basal part of the calamus is without vanes. This part is embedded within the skin follicle and has an opening at the base (proximal umbilicus) and a small opening on the side (distal umbilicus).

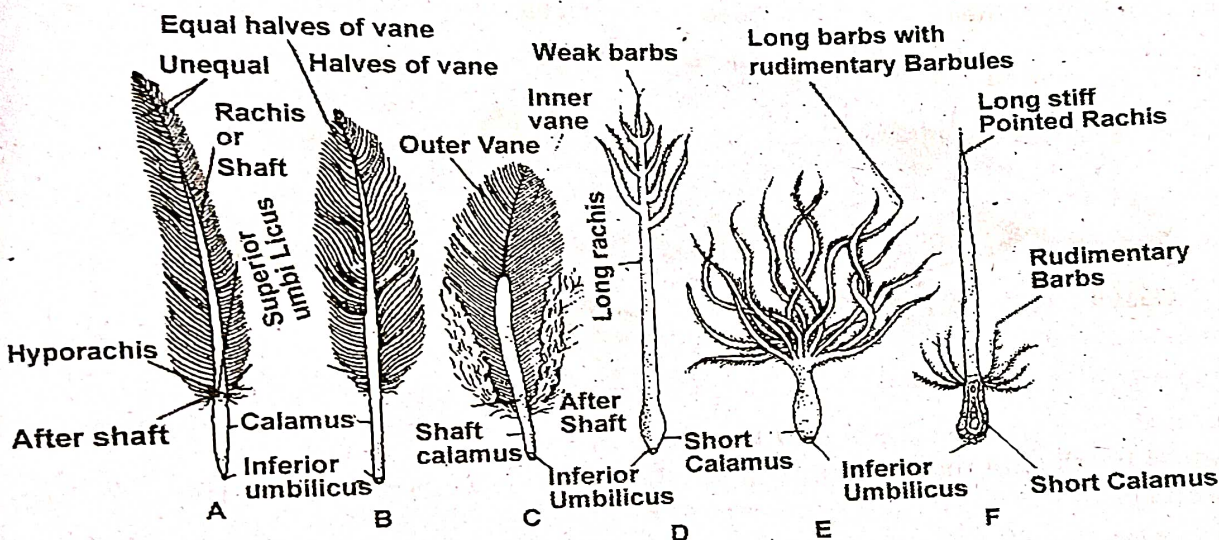


Fig : A : Contour feather,
 B or C : Flight feather, D or E : Filoplume,
 F: Down feather

VIII **MAMMALIA**

(54) *Ornithorhynchus*

GENERAL NAME: DUCKBILL

PHYLUM : CHORDATA, SUB-PHY : VERTEBRATA OR CRANIATA

SUPER CLASS : GNATHOSTOMATA, CLASS : MAMMALIA, ORDER : PROTOTHERIA

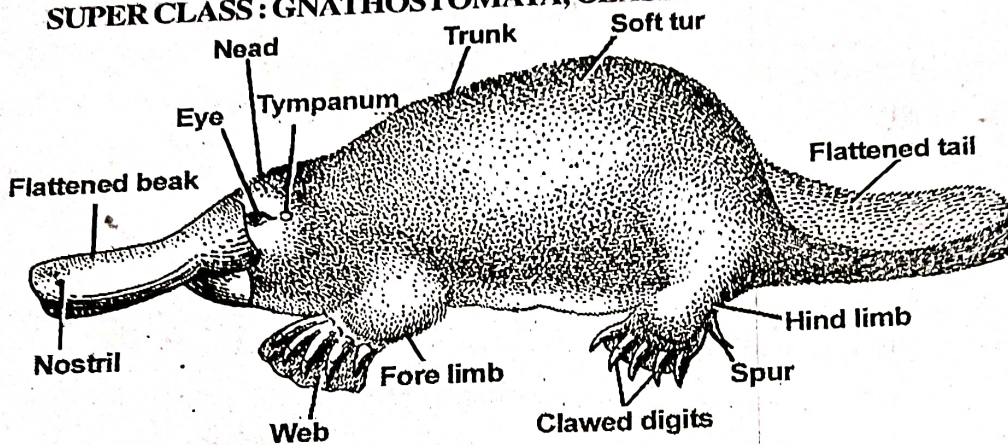


Fig : Duck Bill

- It is a small burrowing mammal seen along the banks of water ponds and rivers in Australia and Tasmania.
- Body is covered by fine hair.
- Head is well differentiated with a long, and smooth forming fur covering over the body, flattened beak covered by thin skin fold.
- Nostrils are located at the tip of the beak.
- Eyes are small and protected by eye lids, eye balls are covered by nictitating membrane.
- Adults are edentate and have no external ear pinnae.
- Corpus callosum is absent in the brain.
- Pentadactyl limbs with curved fingers.
- Web is present in between the fingers of the limbs.
- Tail is flat and oar like helping in swimming.
- Pectoral girdle has 'T' shaped inter clavicle.

- ❑ Sweat glands are modified to form the mammary glands.
- ❑ Teats are absent and hence milk oozes out through small pores.
- ❑ Females have neither uterus nor oviduct as they are oviparous. Eggs are laid in the nests built at their own.
- ❑ Males have testes in association with kidneys in the abdominal cavity.

(55) *Tachyglossus* (or) *Echidna*

GENERAL NAME: SPINY ANTEATER

PHYLUM : CHORDATA
 SUB-PHY : VERTEBRATA OR CRANIATA
 SUPER CLASS : GNATHOSTOMATA
 CLASS : MAMMALIA
 ORDER : PROTOTHERIA

- ❑ A terrestrial small burrowing, nocturnal mammal inhabiting Australia, Tasmania and Newguinea.
- ❑ It feeds mainly on ants.
- ❑ Head bears a long snout with nostrils at its tip.
- ❑ Head and neck are almost continuous without showing any demarcation.
- ❑ Eyes are small without nititating membrane.
- ❑ External ear pinnae are absent. Jaws are edentate.
- ❑ Tongue is sticky and helps in feeding on ants.
- ❑ Pectoral and pelvic girdles resemble those of reptiles.
- ❑ Web is absent in between the toes and fingers of limbs.
- ❑ Claws are curved and help in digging the ground to make burrows.
- ❑ Second finger of the hind limb is curved to clean the spines over the body.
- ❑ Ankle bones possess a poisonous claw.
- ❑ Male exhibit gynecomastism where they possess well developed mammary glands producing milk.
- ❑ Mammary glands open into the brood pouch in females. Hence eggs are held in the brood pouch for incubation.

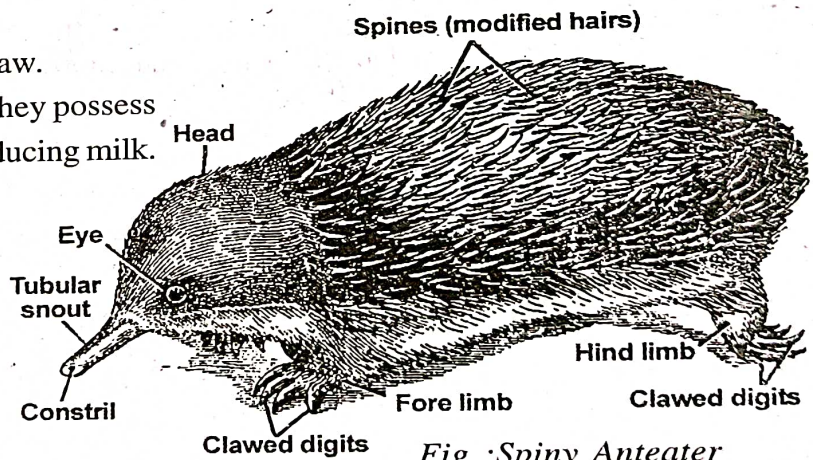


Fig : Spiny Anteater

(56) *Pteropus*

GENERAL NAME: FLYING FOX

PHYLUM: CHORDATA
 SUB-PHY: VERTEBRATA OR CRANIATA
 SUPER CLASS: GNATHOSTOMATA
 CLASS: MAMMALIA
 ORDER: CHIROPTERA

- ❑ It is generally seen in India and Asian continent.
- ❑ It is a flying mammal and hence the forelimbs are modified into wings.
- ❑ Body is divided into a head, neck and trunk. Tail is absent.
- ❑ Body is covered by black or dark coloured hair. Ventral hair is soft.
- ❑ Head is elongated with a pair of conspicuous eyes having sharp sight.
- ❑ External ear pinnae are large and very sensitive to sound waves.
- ❑ They are seen hanging from the tree branches during resting times.
- ❑ Limbs are pentadactyl and toes are clawed.
- ❑ Body is light in weight.
- ❑ Lateral skin is extended into patagium.
- ❑ Patagium is supported by fore limb bones and the first two fingers are clawed.
- ❑ Premolars are grooved and digestive system has an enlarged pyloric stomach.
- ❑ Bats can receive ultrasonic waves released from their body to identify the obstacles in their way. This echo mechanism make them to escape from hitting the surfaces even during high speed movement..

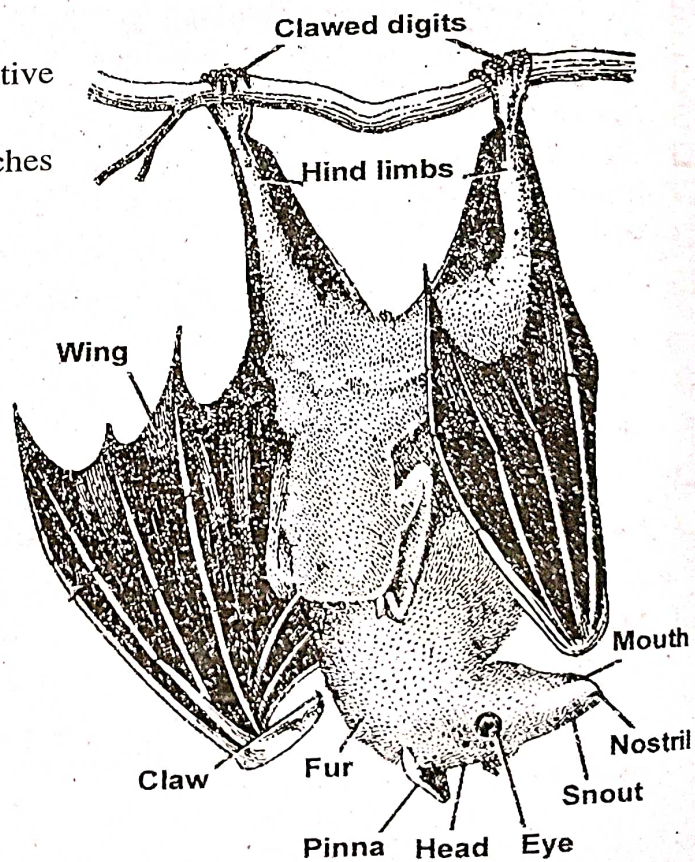


Fig : Flying Fox

(57) *Funambulus palmarum*

GENERAL NAME: SQUIRREL

PHYLUM: CHORDATA

SUB-PHY: VERTEBRATA OR CRANIATA

SUPER CLASS: GNATHOSTOMATA

CLASS: MAMMALIA

ORDER: RODENTIA

- ❑ Actively a tail.
- ❑ Head is small with an elongated snout having a pair of nostrils, a pair of conspicuous black eyes, a pair of large ear pinnae and long vibrissae near the tip of the snout.
- ❑ The organism can sit on its hind limbs while the fore limbs are used for holding the food.
- ❑ Body is dorsally having four to five coloured longitudinal stripes.
- ❑ Tail is covered with dense tuft of hair.
- ❑ Fore limbs are shorter than the hind limbs. Digits are clawed.
- ❑ Incisors work as chisels for cutting the vegetable food material.
- ❑ Teeth show continuous growth. Hence they are put in constant use in food collection.

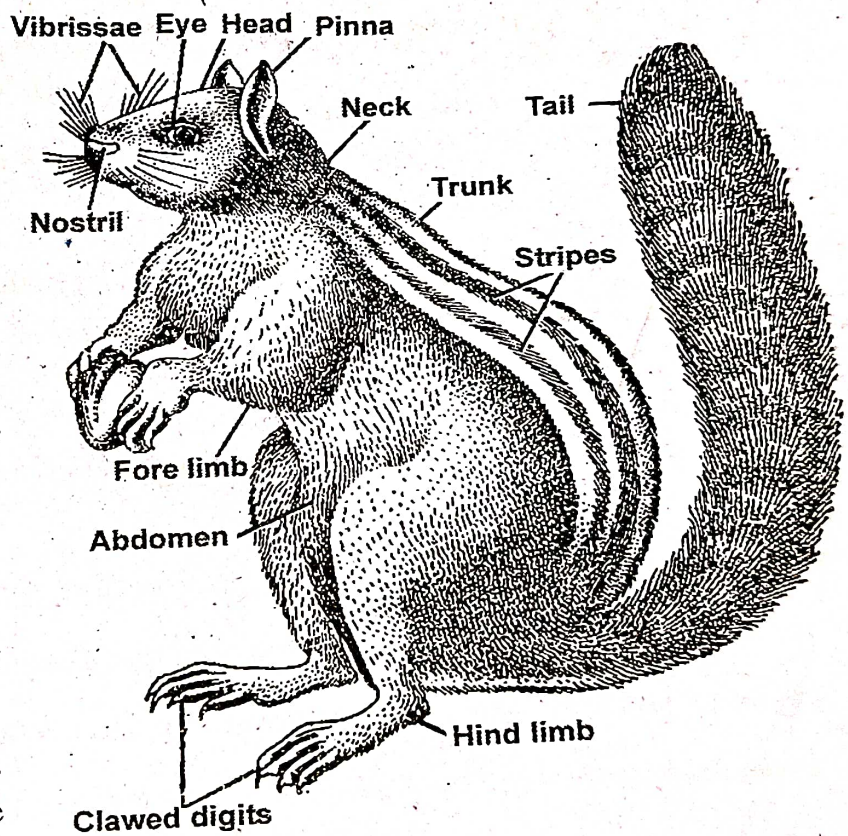


Fig : Squirrel

(58) *Manis*

GENERAL NAME: PANGOLIN

PHYLUM: CHORDATA
 SUB.PHY: VERTEBRATA OR CRANIATA
 SUPER CLASS: GNATHOSTOMATA
 CLASS: MAMMALIA
 ORDER: PHOLIDATA

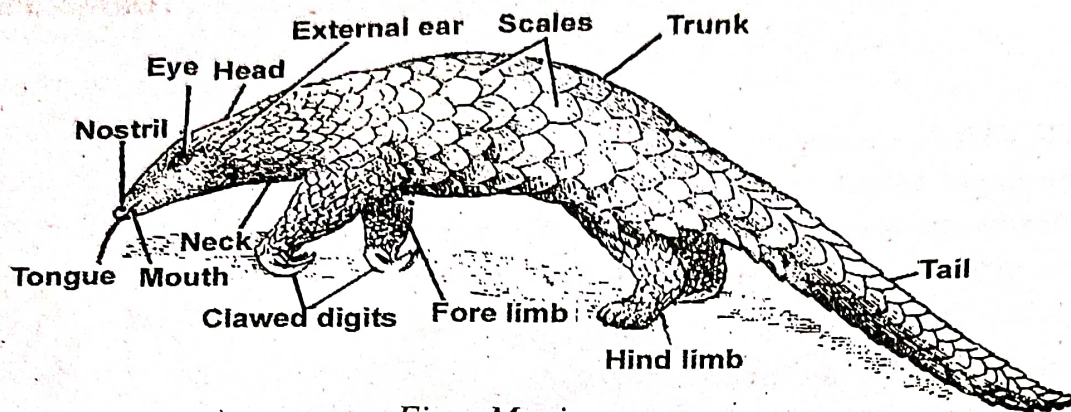


Fig : *Manis*

- It is rarely seen in human habitations but is of common occurrence in forest areas, dense vegetations, grass lands and hilly areas of Africa, Australia, Sikkim, Nepal and India.
- It mainly feeds on ants and white ants.
- Body is divisible into an elongated head with snout, a short neck, a columnar trunk and a long tail.
- Head bears a pair of black eyes, a pair of nostrils at the tip of the snout and vibrissae.
- Elongated snout is used to collect the food material with the help of the sticky tongue.
- External ears are small and limbs are strong and pentadactyl with curved claw bearing digits.
- Entire body is covered by thick, flat and rhomboidal plates formed by the fusion of hair.
- Scales are arranged in a systematic fashion interspersed with hardened hair. Ventral surface is also covered by smooth and soft hair.
- They move very slowly on the substratum as if they are creeping.
- Internally, gizzard is seen in association with alimentary canal.

(59) *Loris tardigradus*

GENERAL NAME: KAOLA

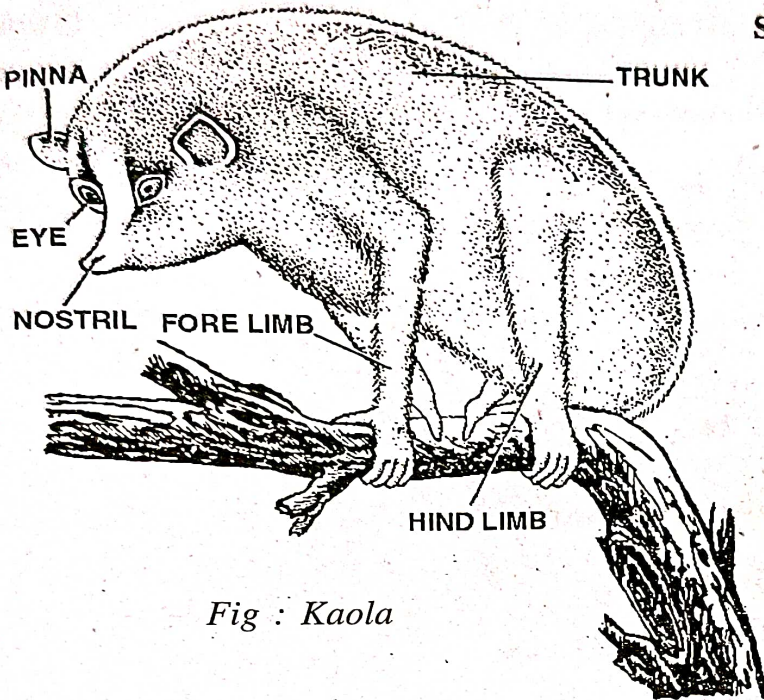


Fig : Kaola

PHYLUM: CHORDATA
 SUB.PHY: VERTEBRATA OR CRANIATA
 SUPER CLASS: GNATHOSTOMATA
 CLASS: MAMMALIA
 ORDER: PRIMATA

- A small nocturnal and solitary arboreal mammal inhabiting India, Ceylon and Madagascar.
- Body is covered by shiny, brown coloured dense covering of hair.
- Head is small having nostrils on the elongated and pointed snout at its free end.
- Eyes are large and ball like showing slow movements. Vision is binocular.
- External ear pinnae are small and triangular.
- Thecodont and Heterodont dentition.
- Tail is long and prehensile.
- Fore and hind limbs are long., thin and weak.
- Slow moving organisms seen hanging upside down on the tree branches.

(60) *Erinaceus*

GENERAL NAME: HEDGEHOG

PHYLUM : CHORDATA
 SUB-PHY : VERTEBRATA OR CRANIATA
 SUPER CLASS : GNATHOSTOMATA
 CLASS : MAMMALIA
 ORDER : INSECTIVORA

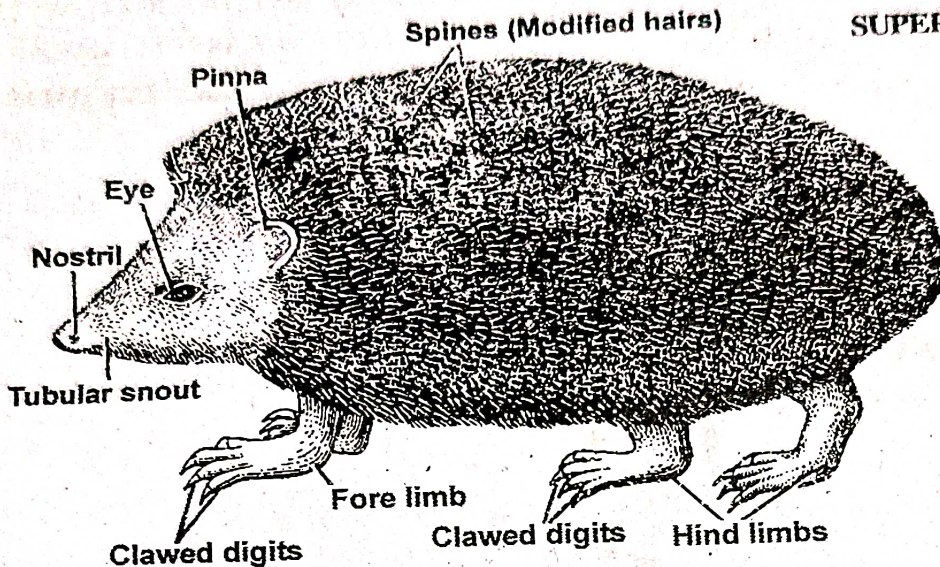


Fig : Head Hog

- It inhabits the bushes and burrows of the northern hemisphere of the globe.
- Dorsal surface of the body is covered by hard, pointed and backwardly directed hard spines. They help in protecting the organism and are formed by the modification of hair.
- In between the spines, hair is smooth and soft.
- Head is prolonged into a long, pointed snout at its free end.
- Nostrils are located at the tip of the snout.
- Jaws are provided with thecodont and heterodont teeth.
- Dental formula is $3,1,4,3 / 3,1,4,3$.
- Eyes, ear pinnae and limbs are short.
- Anterior part of the trunk is supported by 14-15 ribs.
- Limbs are pentadactyl and fingers end in claws.
- Special muscles are present for the movement of the spines.
- Fertilization is internal followed by internal development. Hence viviparous organism.
- Spines become erect and the organism coils into a spiny ball whenever it is disturbed.
- It feeds on fruits, insects and small mammals.

IX

HISTOLOGY

(61) T.S. Liver

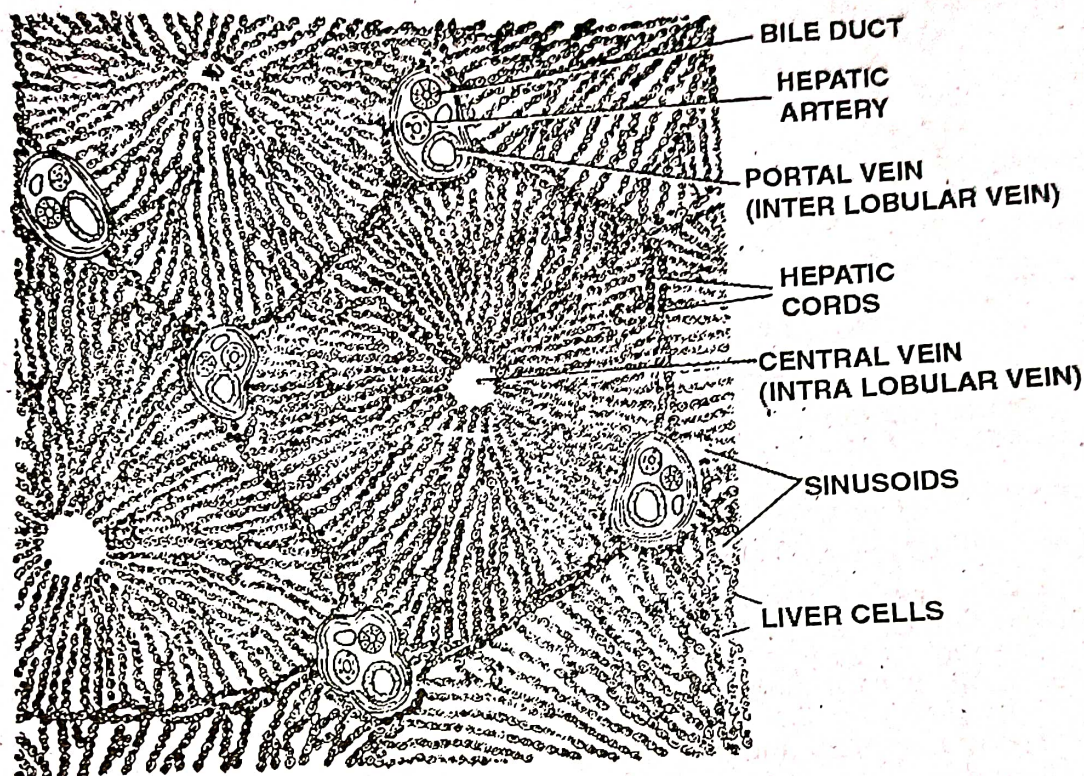


Fig : T.S.Liver

- Liver is the largest gland of the body, associated with alimentary canal.
- It is a brownish lobular gland composed of a number of hexagonal glisson capsules.
- Centrally arranged vacuoles enclosing interlobular veins are present in between the capsules.
- Each capsule encloses a number of radially arranged fine filaments called hepatic cords. Each filament is composed of a number of serially arranged polygonal hepatic cells.
- Hepatic cords are concerned with the production of bilejuice.
- Bile is alkaline in nature and helps in the emulsification of the fats.
- Liver is concerned with the production of excretory products, detoxification of toxic substances and in distribution of digested food materials.
- It also helps in storing reserve food materials in the form of glycogen.

(62) *T.S. Pancreas*

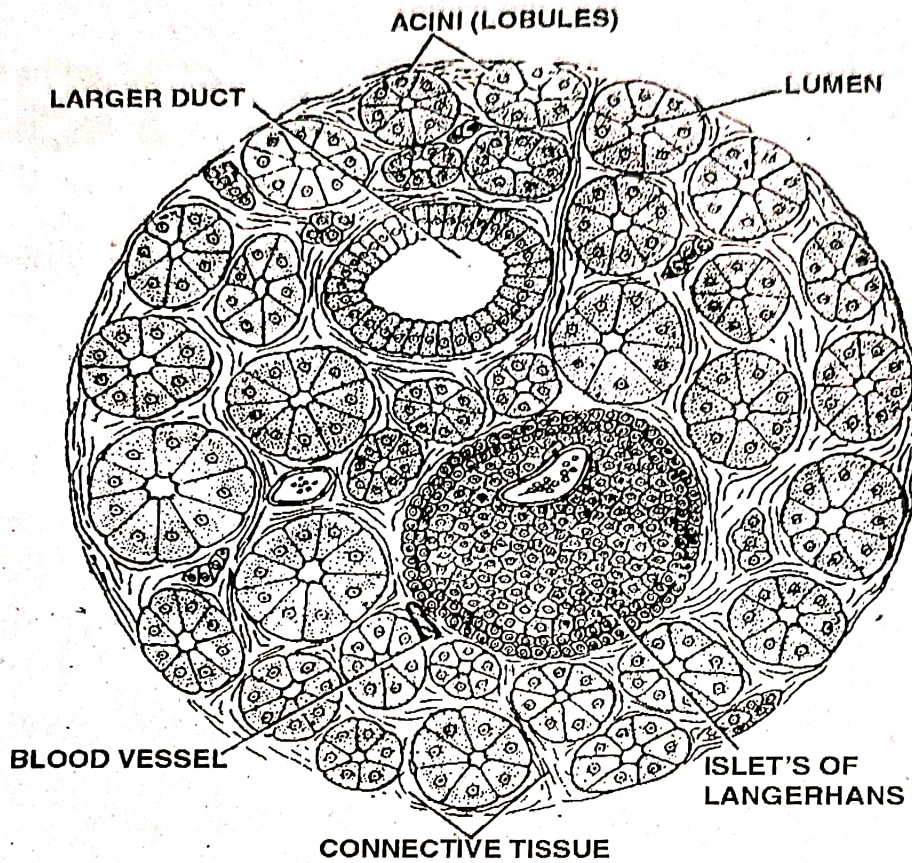


Fig : *T.S. Pancreas*

- ❑ One of the important digestive gland associated with intestine is the pancreas.
- ❑ It is of both exocrine (enzymatic) and endocrine (hormonal) in nature.
- ❑ The gland is alveolar, spongy and is composed of a number of lobules called acini. Hence it is called acinar gland or alveolar gland.
- ❑ Each acini is composed of acinar cells responsible for secreting digestive enzymes such as steapsin, amylopsin and trypsin.
- ❑ Group of cells present inbetween the acinar lobes are the islets of langer hans.
- ❑ Each island is composed of two types of cells viz. The α -cells secretiry glucogon and β -cells secretiy insulin.
- ❑ The hormones are released directly into blood.
- ❑ They help in regulating blood-glucose level in the body. Hence the gland is called a sweet bread.

(63) T. S. Kidney

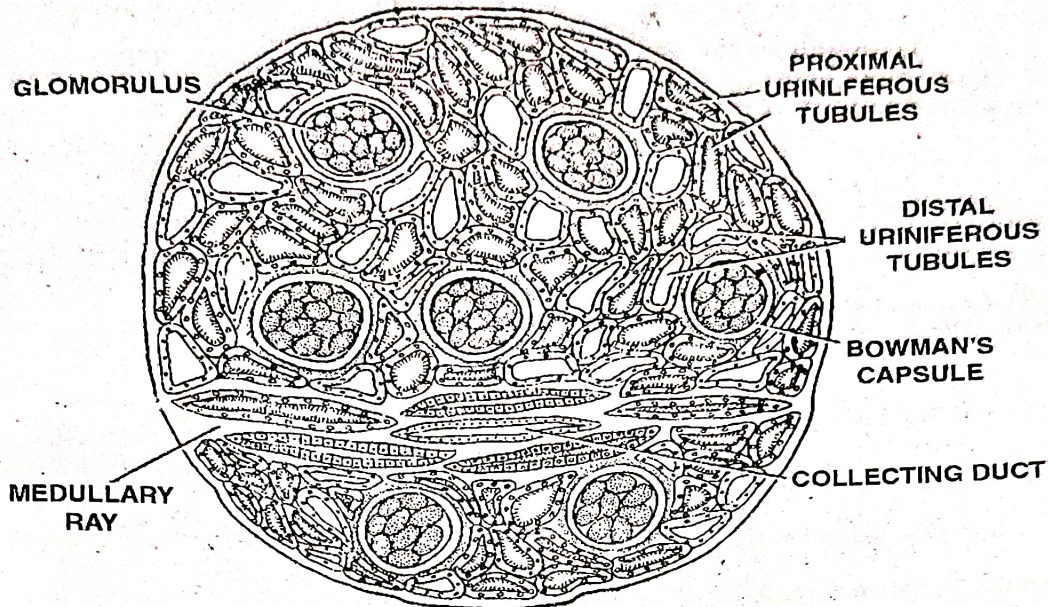


Fig : T.S.Kidney

- The section through the kidney is almost bean shaped showing all the details.
- Outer most capsular covering of the kidney is made of connective tissue.
- Cavity of the kidney is occupied by cortex at the periphery and medulla at the centre.
- In the cortical portion, lie the uriniferous tubules, glomeruli, Bowman's cups and other related structures while in medulla lie the renal pyramids, medullary rays, Henle's tubules etc.,
- Hilus is the central deep notch on the surface of the kidney at which the blood vessels and ureters are arranged.
- Sections of the uriniferous tubules are seen in different shapes in the cortical region of the section. Those with ciliated cells are considered as proximal tubules, and with glandular cells are considered as distal tubules. Malpighian capsules are seen in between the cavities of these tubules. The glomeruli of these capsules are formed by the arterioles.
- Medullary region has the segments of the loops of Henle.
- In between these loops, sections of the collecting tubules, blood capillaries are seen.
- The main function of the medulla is to filter the excretory products from the blood reaching the kidney.

(64) T.S. Stomach

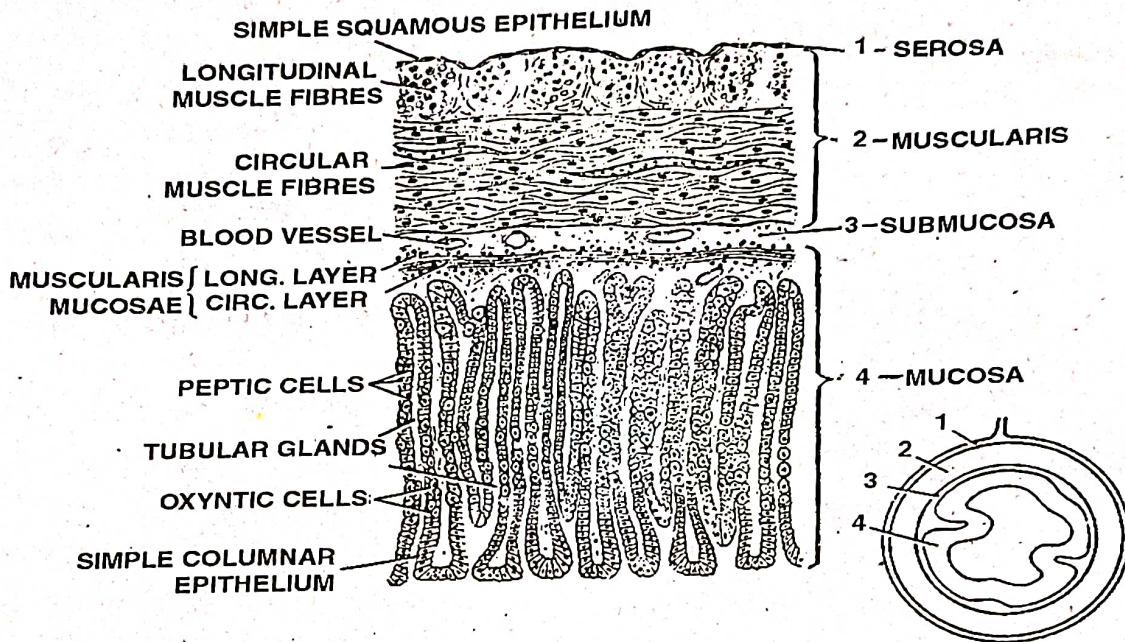


Fig : T.S. Stomach

- It is the component of the alimentary canal helping to store and digest the food materials.
- Wall of the stomach is composed of an outer serosa and inner mucosa. In between the two, muscular layer, submucosa and mucosa muscularis are present.
- Serosa is composed of squamous epithelium while the inner most mucosa is composed of columnar epithelium.
- Muscle layer is composed of an outer longitudinal and inner circular muscles. Their contractions are responsible for the peristalytic movements to increase or decrease the lumen.
- These muscles are held by connective tissue layers.
- Submucosa has connective tissue, blood capillaries and nerve endings.
- Mucosa muscularis also possess muscle cells arranged in two layers.
- Mucosa is thick and cells are columnar possessing tubular and gastric glands.
- Oxyntic cells of the gastric glands secrete dil. Hydrochloric acid. Peptic cells secrete digestive enzymes.
- Tubular glands secrete mucous material necessary for the supply of water for digestion.
- Inner wall of the stomach is highly folded and the folds are called rugae. They increase the area of the stomach.

(65) T. S. Intestine

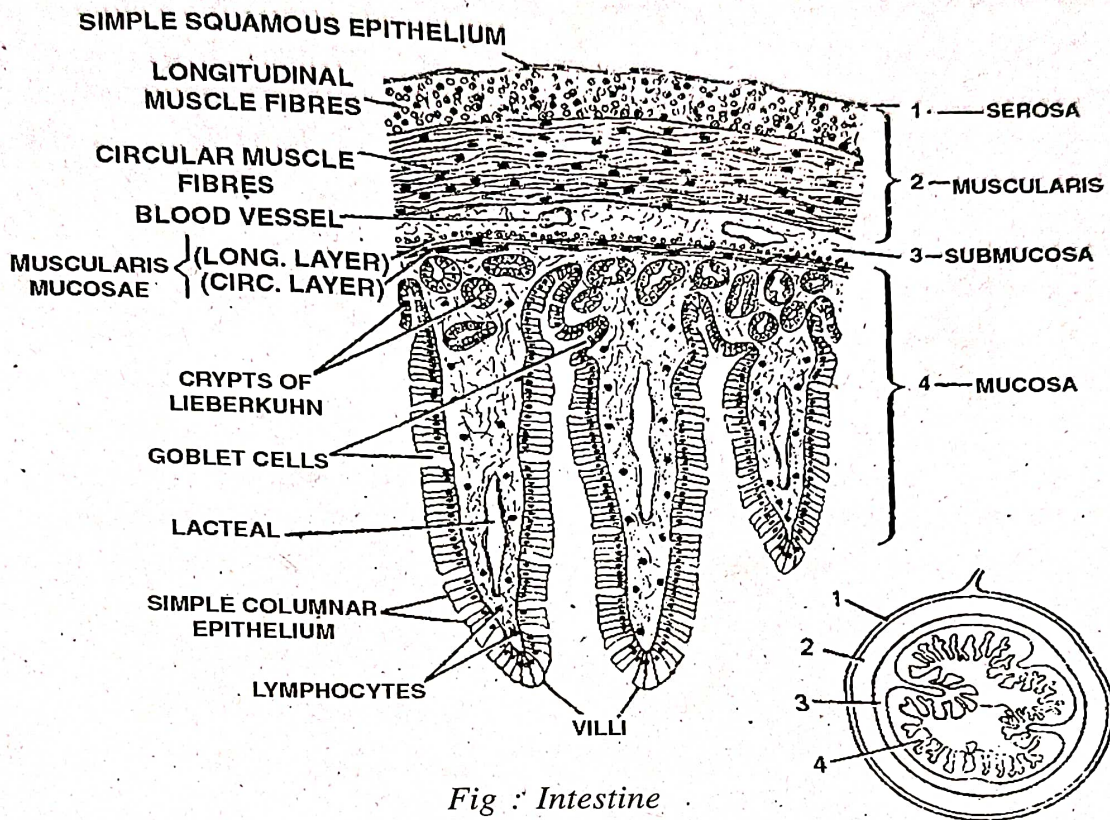


Fig : Intestine

- Intestine is the longest component of the alimentary canal.
 - It is a tubular one with narrow lumen and plenty of digestive glands releasing enzymes for digestion.
- Intestinal wall is composed of an outer serosa, followed by muscular layer, submucosa, muscularis and inner most mucosa.
- Serosa is formed of squamous epithelium while the mucosa is composed of columnar epithelium.
 - Muscle layer is composed of an outer longitudinal and inner circular muscle components. Their contractions help in moving the food in intestinal cavity.
 - Submucosa has connective tissue, blood capillaries and nerve endings.
 - Mucosa muscularis is composed of thin muscle units arranged in two layers.
 - Mucosa is composed of Columnar cells. This layer form a number of folds called villi containing blood capillaries, lymph vessels and lymphocytes.
 - Leiberkuhn crypts are the glandular follicles present at the base of the villi. They form into Brunner's glands and secrete intestinal juices collectively forming into, succus entericus.

(66) T.S. Lung

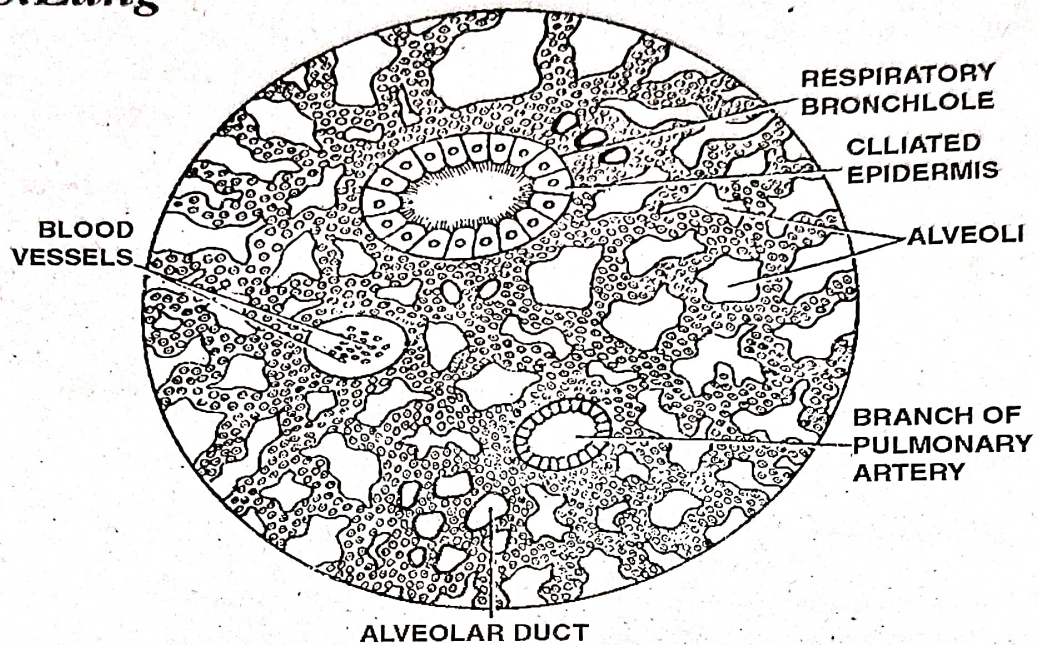


Fig : T.S. Lung

- Lungs are the spongy and soft lobes present in the ventral thoracic cavity.
- Lungs are meant for respiration and originated from endoderm.
- The right lung is of three lobes while the left has only two.
- The thin membrane surrounding the lung is the pleural peritoneum.
- Section shows the well knit alveoli surrounded by simple epithelium.
- Sections of tracheoles, pulmonary arterioles, pulmonary venules are also seen.
- The wall of the alveoli is bathed in a thin layer of blood oozing from the blood capillaries.
- Sections of trachea surrounded by ciliated epithelium are also seen.

(67) T.S. Artery

- ❑ Circulatory system is responsible for the transport of materials in the body.
- ❑ Arteries are meant for distribution of blood to different parts of the body.
- ❑ They are the Thick walled, muscular tubes innervating all the body systems through their capillary net work.
- ❑ Lumen of the artery is less considered to that of vein.
- ❑ Arteries are non-valvular having theca externa (tunica adventitia), theca intermedia (tunica media) and theca interna as (tunica intima) the components of the wall.
- ❑ Theca externa is composed of connective tissue layer with elastic nature.
- ❑ Theca media has muscle cells and elastic tissue as its components.
- ❑ Theca interna is a unilaminar endothelium.
- ❑ Blood pressure in the arteries is regulated by sympathetic nerves.

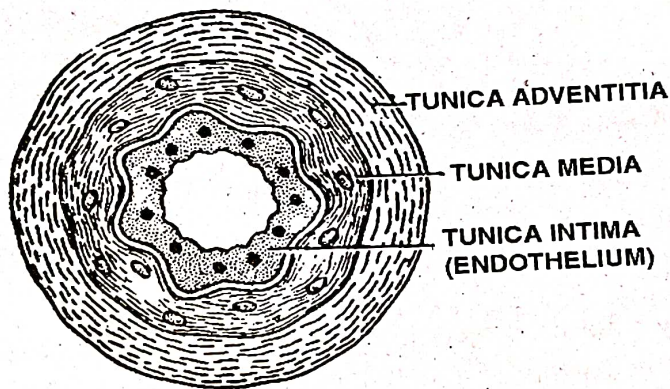


Fig : T.S. Artery

(68) T.S. Vein

- ❑ Veins are the thin walled blood vessels collecting blood from various organs
- ❑ They are non muscular, non pulsatile. Blood flows at low pressure in veins.
- ❑ The outer wall is the theca externa composed of connective tissue with white fibres.
- ❑ Theca media has elastic fibres but the muscle components are poor.
- ❑ Theca interna is formed of endothelium.
- ❑ Lumen of the vein is wide compared to that of the artery.
- ❑ Sympathetic nerve fibres are distributed in the middle layer.

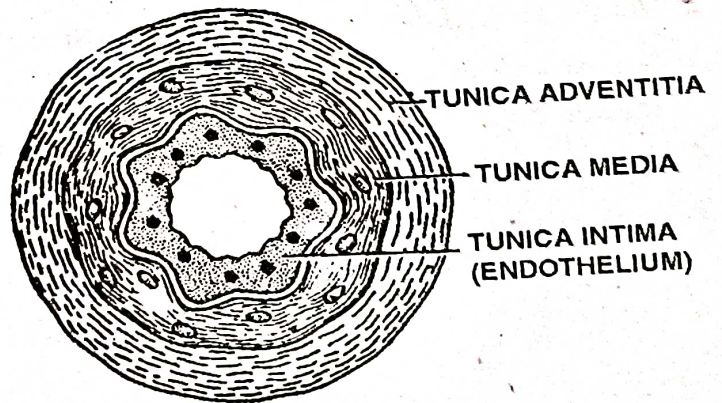


Fig : T.S. Veni

(69) T.S. Bone

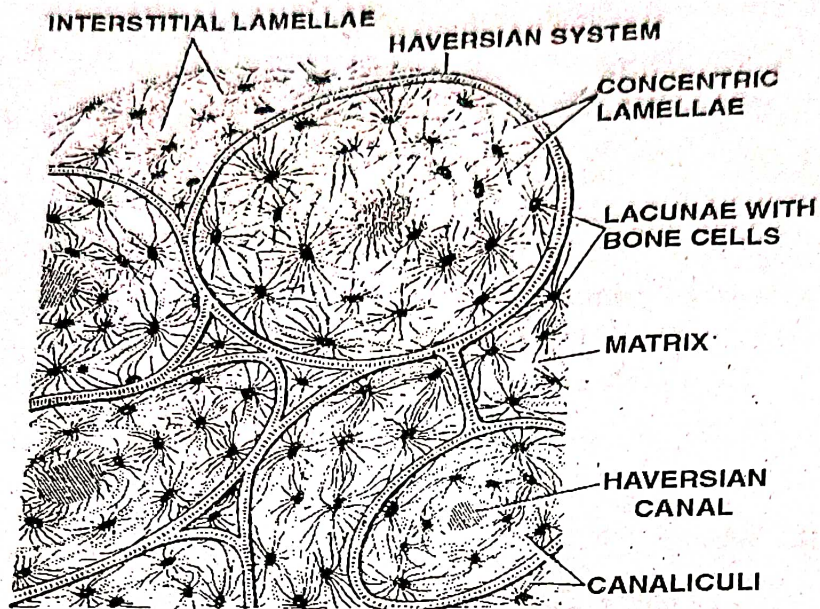


Fig : T.S. Bone

- Bones are the solid strong supporting structures of the body giving protection to the internal organs.
- Bone is surrounded by a hard connective tissue membrane called periosteum. Internally the bone cavity is lined by endosteum. The bone cavity is filled with bone marrow
- Bone proper in its section contains hard matrix composed of osseon, a hard protein.
- Matrix is interspersed by a number of structural units called osteons.
- Each osteon has a central haversian canal surrounded by osteocytes arranged in concentric whorls.
- The branched canaliculi around the osteocytes connect the cells with each other.
- The whorl around the canaliculi are formed of the lamellae of the matrix. These are called intermediate lamellae.
- The vertical haversian canals are interconnected by transverse volkman canals.
- Bones are of two types viz. the rod like compact bones and plate like dermal bones.

(70) T.S. Spinal Cord

PRACTICALS

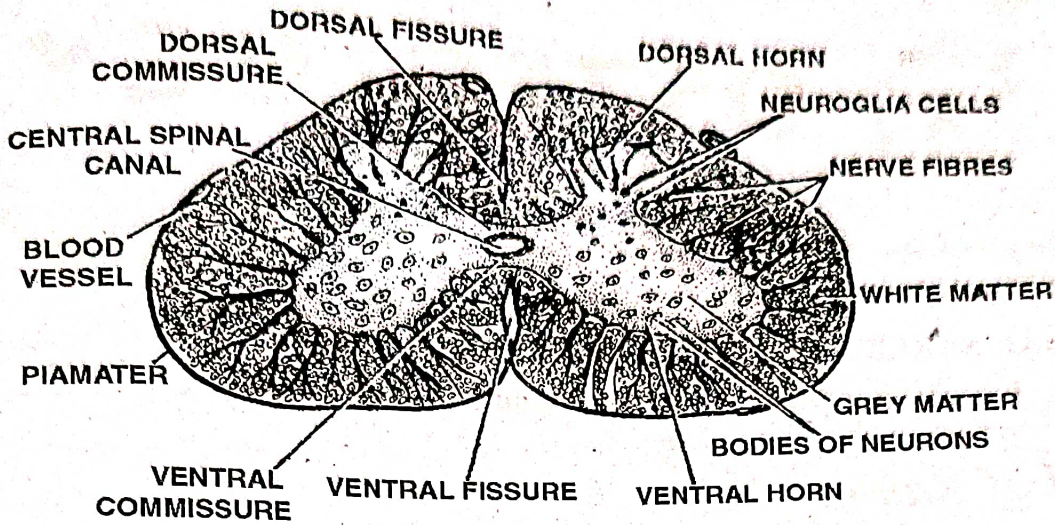


Fig : T.S.Spinal Cord

- ❑ Spinal cord is a tubular one present on the mid dorsal side of the body extending from anterior to the posterior end.
- ❑ It is a component of the central neurons system.
- ❑ It is the posterior extension of the medulla oblongata.
- ❑ Spinal cord is formed from ectoderm.
- ❑ It has a central spinal canal surrounded by gray matter and white matter.
- ❑ White matter is composed of medullated nerve fibres while the gray matter is composed of neurons.
- ❑ The nerve cells of the Gray matter are drawn out as dorsal and ventral horns. They contribute for the formation of spinal nerves.
- ❑ Spinal cord is surrounded by three connective tissue membranes viz., inner most piamater, outer dura mater and inbetween an arachroid membrane.
- ❑ Spinal cord regulates all the unvoluntary activites of the body.


OSTEOLOGY

Note : Practice the diagrams with parts.

A. AXIAL SKELETON IN RABBIT: Axial skeleton is the one which lies on the axis of the body. It is represented by the skull, sternum and vertebral column. There are 46 bones that make up the spinal column alone.

(71) Skull of Rabbit

The dorsal, ventral or lateral view of the skull may be asked to draw and label in the examination. Hence you are advised to practice the figures given here several times so as to draw them at your own when asked in the practical examination.

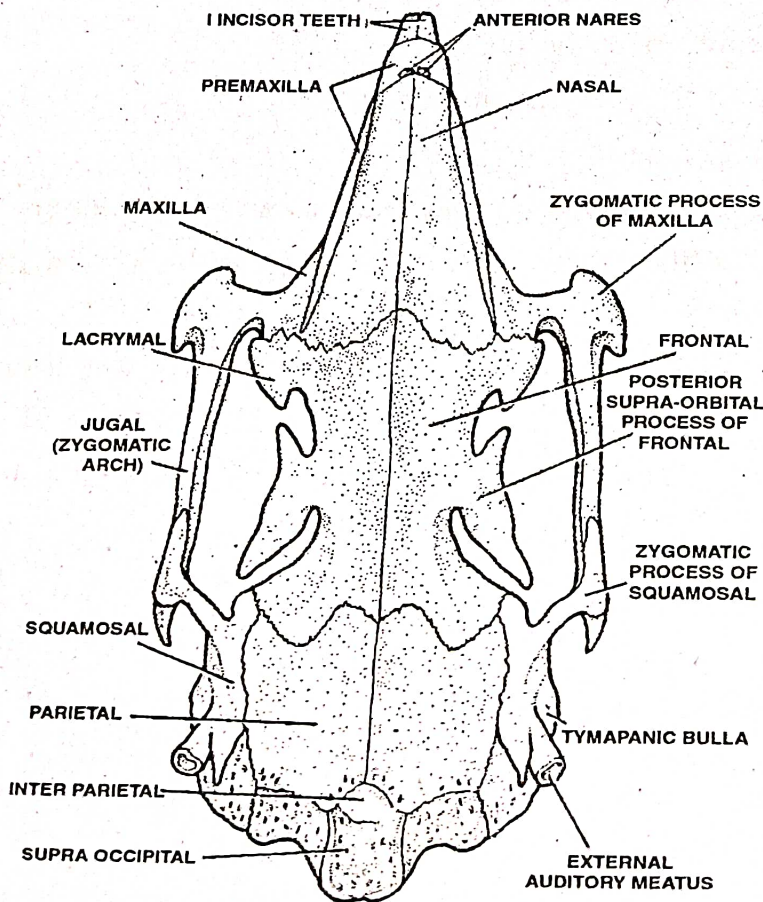


Fig : Dorsal View

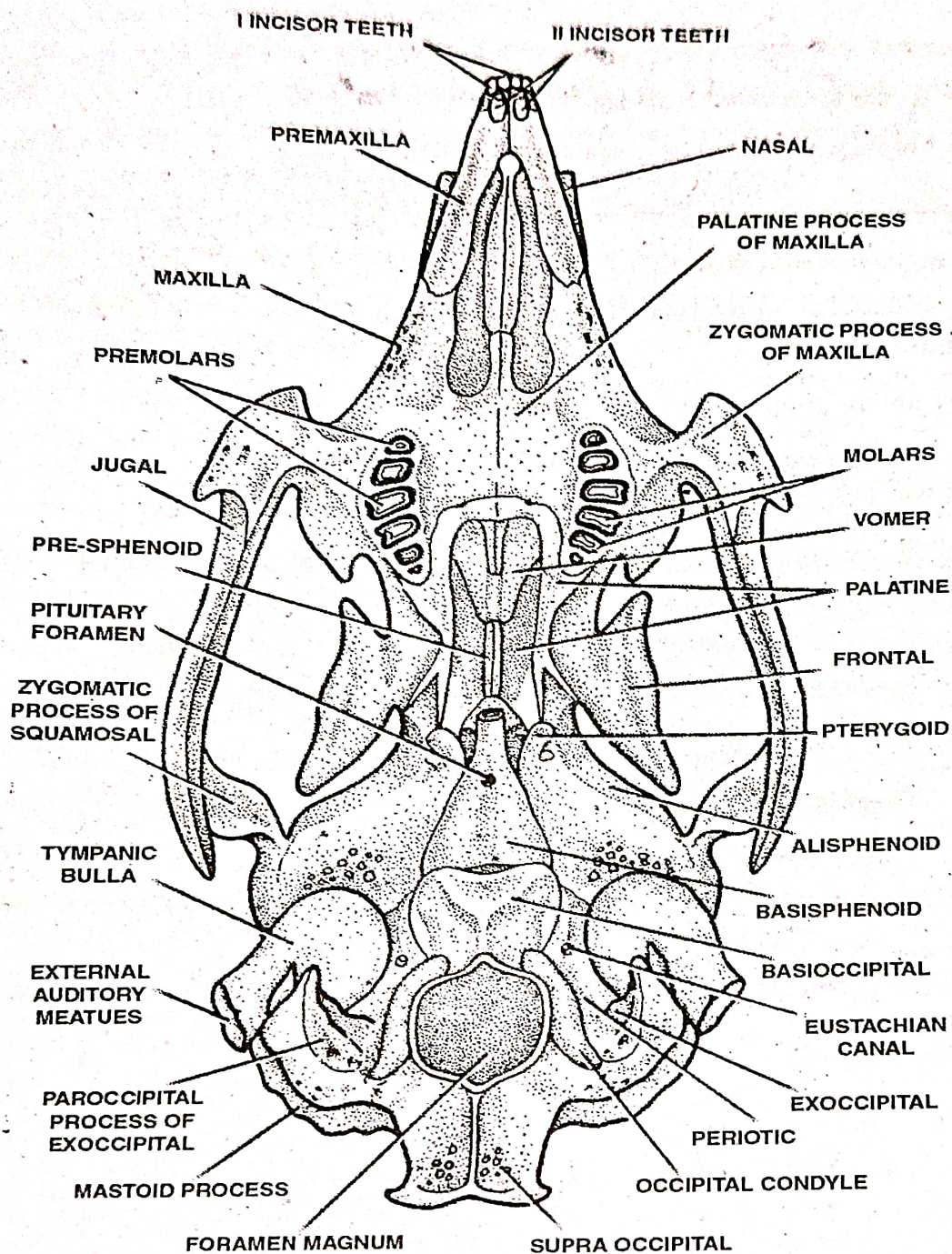


Fig : Ventral View

(72) Lower Jaw of Rabbit

- ❑ It is formed of two equal halves.
- ❑ Each half of the lower jaw is called dentary.
- ❑ They are anteriorly connected by mandibular symphysis.
- ❑ Each dentary consists of 1 incisor, 2 molars and 3 premolars.
- ❑ There is no canine and the space between the incisor and canine is called diastema.
- ❑ Teeth are heterodont (different), diphyodont (arise twice in life time) and thecodont (arranged in sockets).
- ❑ Upwardly drawn process lying at the distal part is the caronoid process.
- ❑ The ball like extension located behind this caronoid process is the condyle. It is with this region, lower jaw is suspended to the upper jaw.
- ❑ The postero-inferior border of the lower jaw is drawn into a pointed angular process.

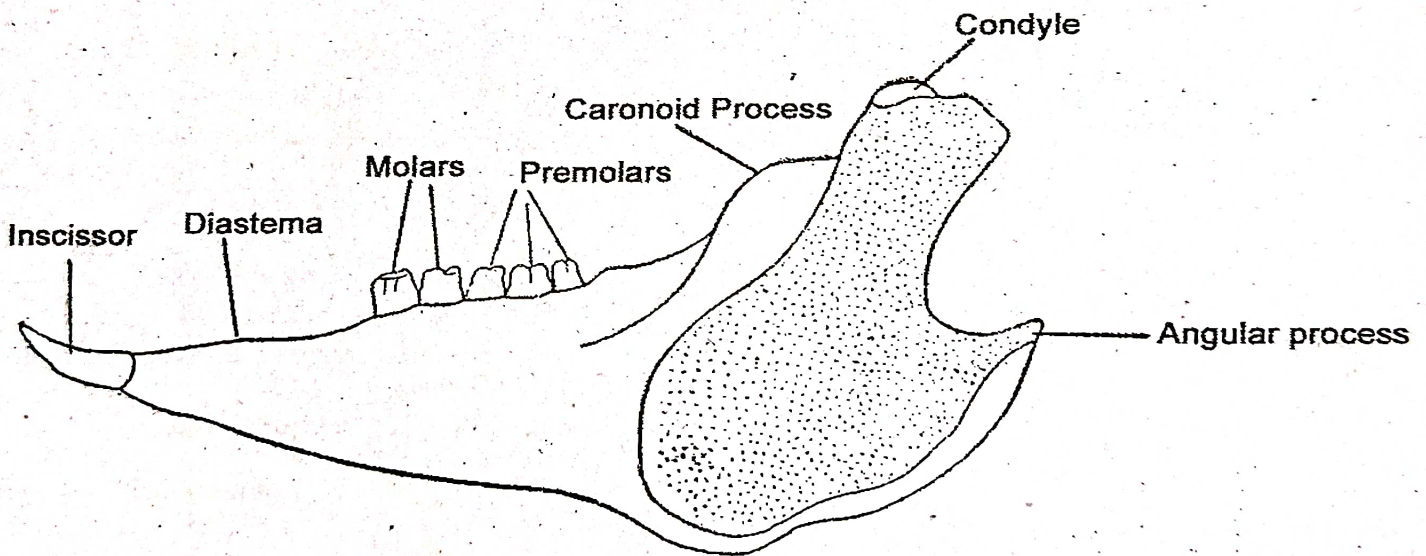


Fig : Lower Jaw

(73) Vertebral Column in Rabbit

It consists of 46 vertebrae differentiated into cervical (neck), thoracic (chest), lumbar (lower back), sacral (pelvis) and caudal parts.

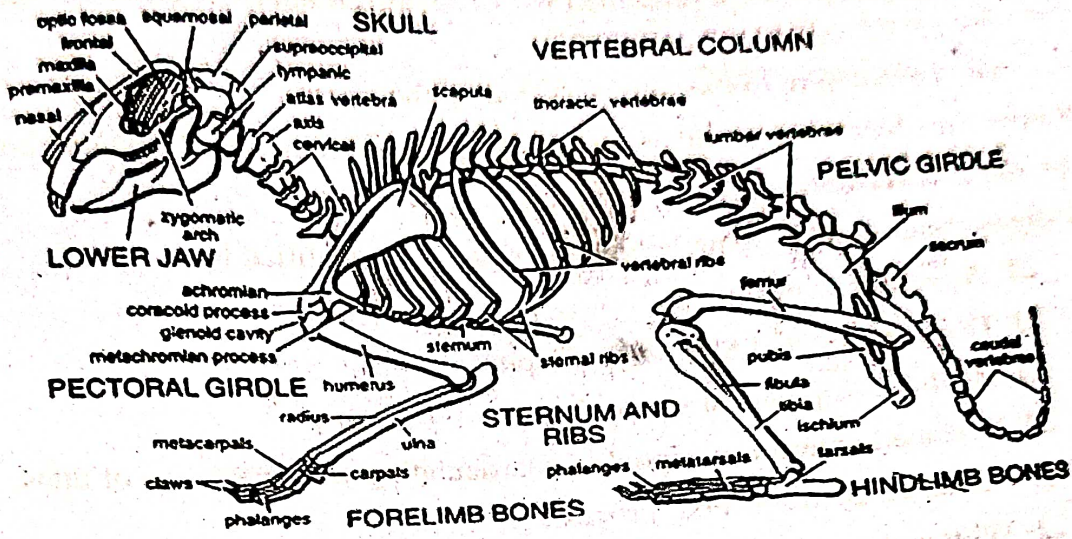


Fig.: Rabbit skeleton

(a) **Cervical Vertebra** : Neck in rabbit is short and has seven vertebrae of which the first one is the atlas and the second one is called the axis.

- (i) **Atlas or the 1st Vertebra**: It is identified by
 - Its location just behind the skull as a first piece.

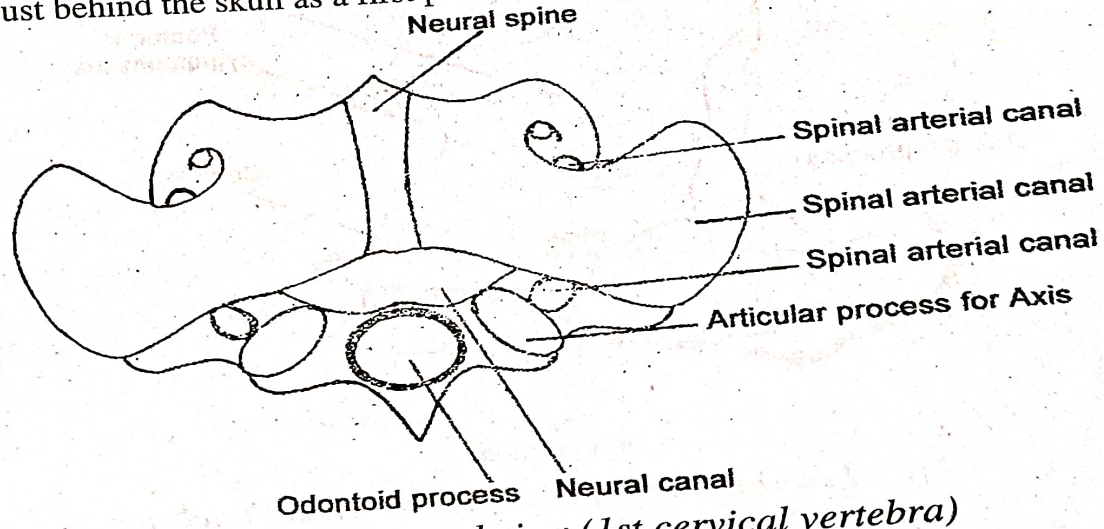


Fig.: Rabbit-Atlas-Dorsal view (1st cervical vertebra)

- Its ring like shape having articulation with the skull.
- Reduced neural spine and broad wing like transverse processes.
- Absence of Centrum and anterior zygapophyses.
- Presence of a pair of facets anteriorly to accommodate the occipital condyles of the skull.
- Posterior zygapophyses are represented by a pair of flat plates to articulate with the second vertebra, the axis.
- Spinal canal at the centre of the ring is lodged by the spinal cord.
- Small openings located dorsally and ventrally are the foramen for the spinal arteries.

(ii) Axis or the 2nd Vertebra:

This is the second vertebra lying behind the atlas. It is identified by

- Acoelous centrum.
- Dorsally located Sharp neural spine.
- Well developed post ygapophyses.
- Reduced anterior zygapophyses articulating with the facets of atlas.
- Absence of transverse processes.
- Widened spinal canal, pointed neural spine with a crest.

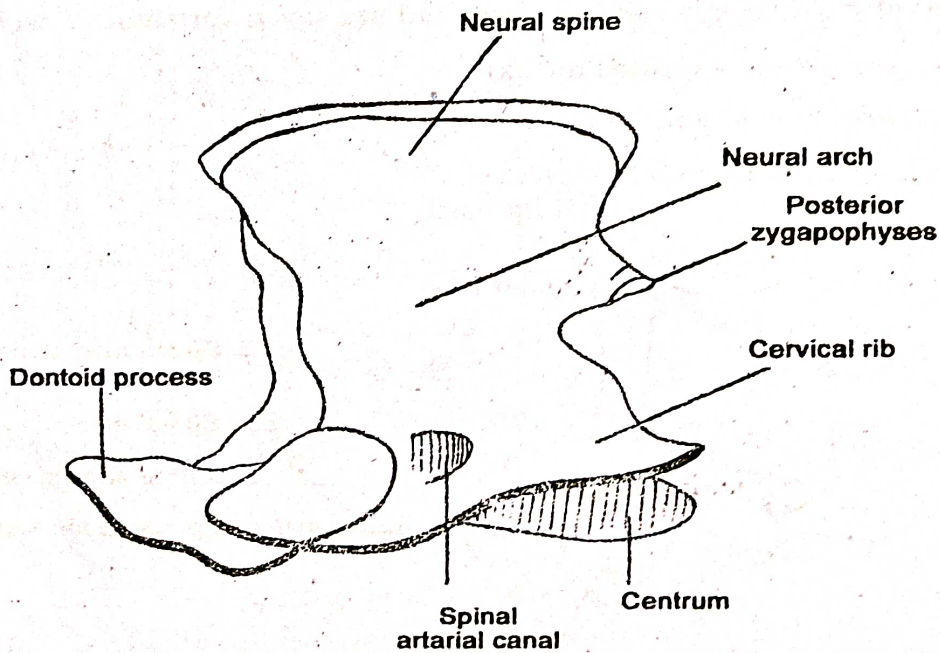


Fig : Lateral View of axis (2nd cervical vertebrae)

(iii) *Typical cervical vertebrae:*

These are five in number and support the neck. Each one is identified by

- The presence of all the important components.
- A short and pointed neural spine.
- Well developed anterior and posterior zygapophyses for articulation.
- Flattened centrum (amphiplatyan type)
- Bifurcated transverse processes.
- A pair of arterial foramen for spinal arteries on either side of the centrum and at the base of the reduced cervical ribs.
- A pair of reduced cervical ribs.

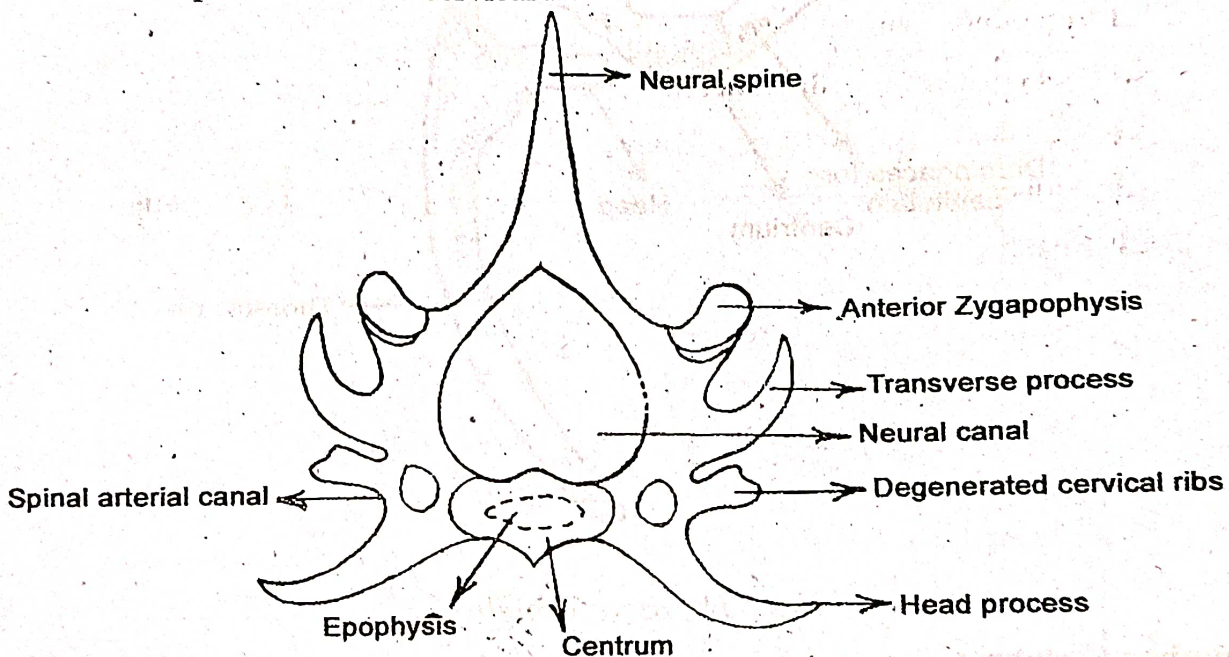


Fig : Atlas-Dorsal view (1st cervical vertebrae)

(b) **Thoracic Vertebra** : The chest or the anterior part of the body behind the neck is composed of 12 thoracic vertebrae. Each one is identified by

- A long dorsal neural spine.
- Short transverse processes.
- Partially formed demi facets for articulation with the tubercular process of the ribs.
- Centrum has a pair of capitular facets for articulation with the capitulum of the rib.

- Well formed anterior and posterior zygapophyses.
- A pair of metapophyses just above the anterior zygapophyses.

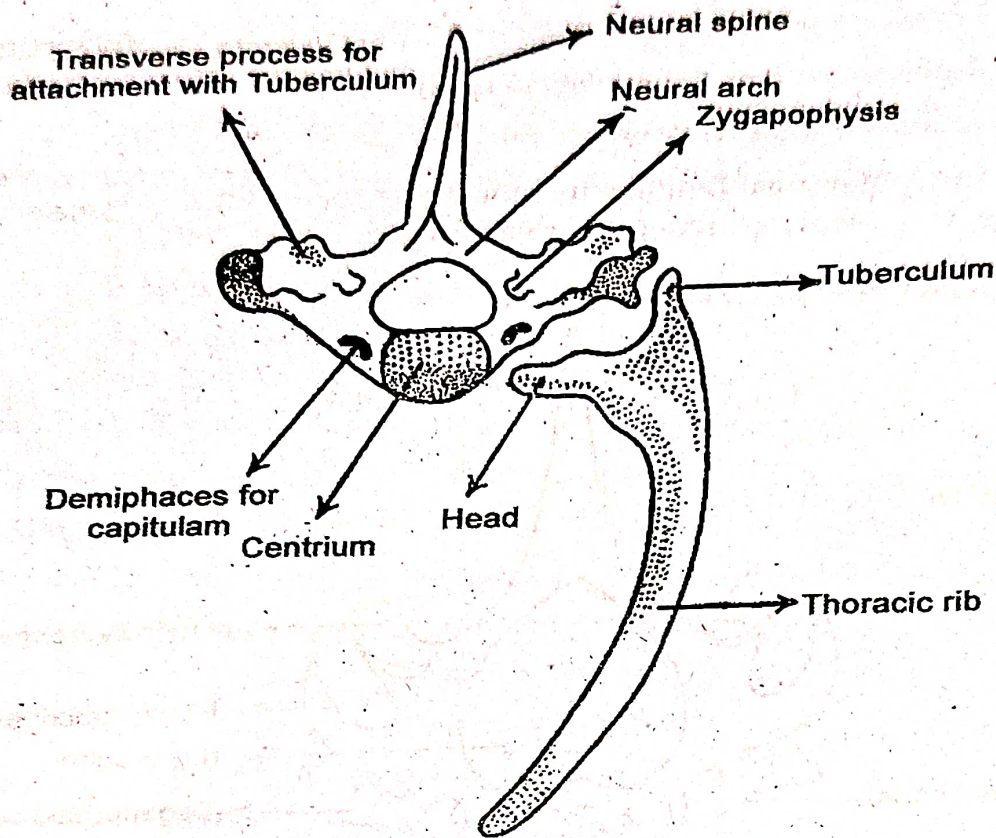


Fig : Thoracic Vertebra

(c) **Lumbar Vertebra:** There are 7 lumbar (the lower back) vertebrae in rabbit. The lumbar vertebrae are elongated to allow for considerable flexion and extension during hopping, but this makes them susceptible to fracture. Each one is identified by

- Long and crest like anteriorly projected neural spine
- Stout transverse processes.
- Presence of both metapophyses and anapophyses
- Presence of hypapophyses in the first two lumbar vertebrae
- Hypapophyses are absent in the rest of the five lumbar vertebrae. These possess posteriorly directed transverse process.

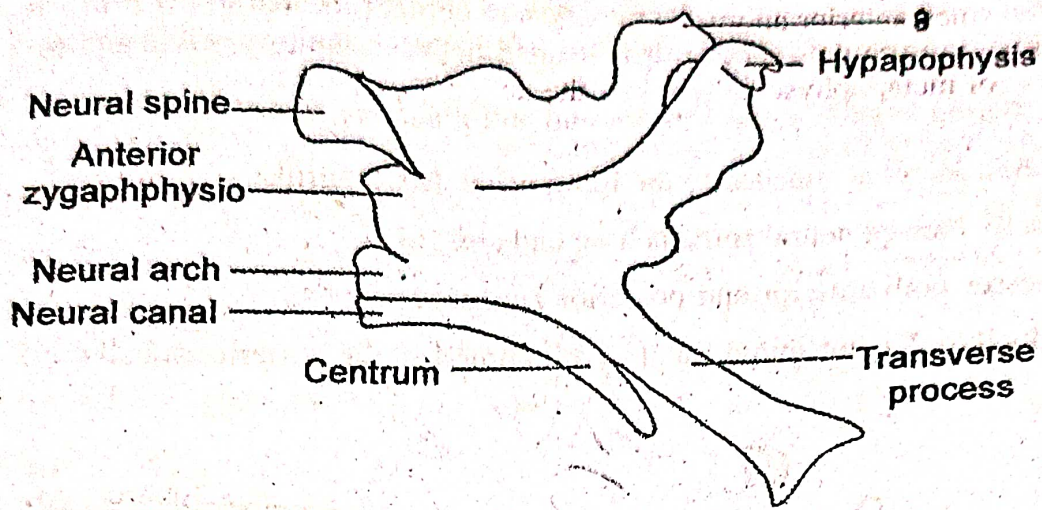


Fig : Rabbit-2nd vertebra (Axis)

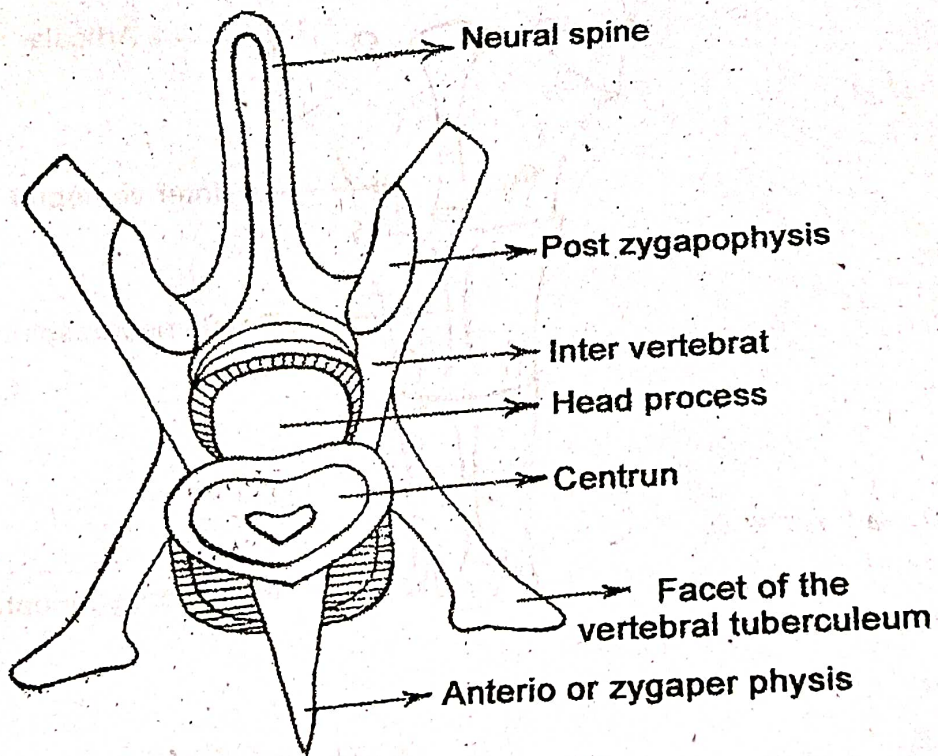


Fig : Anterior lumbar vertebrae

(d) **Sacral Vertebra:** Sacral vertebrae are 4 in number located in the pelvis region of the body. They fuse to form the sacrum. It is located between the two pelvic arches.

- ❑ The sacrum is wide at the anterior end and gradually tapers posteriorly.
- ❑ The first sacral is attached to the ilium of the pelvic girdle.
- ❑ Dorsally located neural spine is long and crest like.
- ❑ Possesses both anterior and posterior zygapophyses.
- ❑ Gradually reducing spinal canal to accommodate the posterior spinal cord.

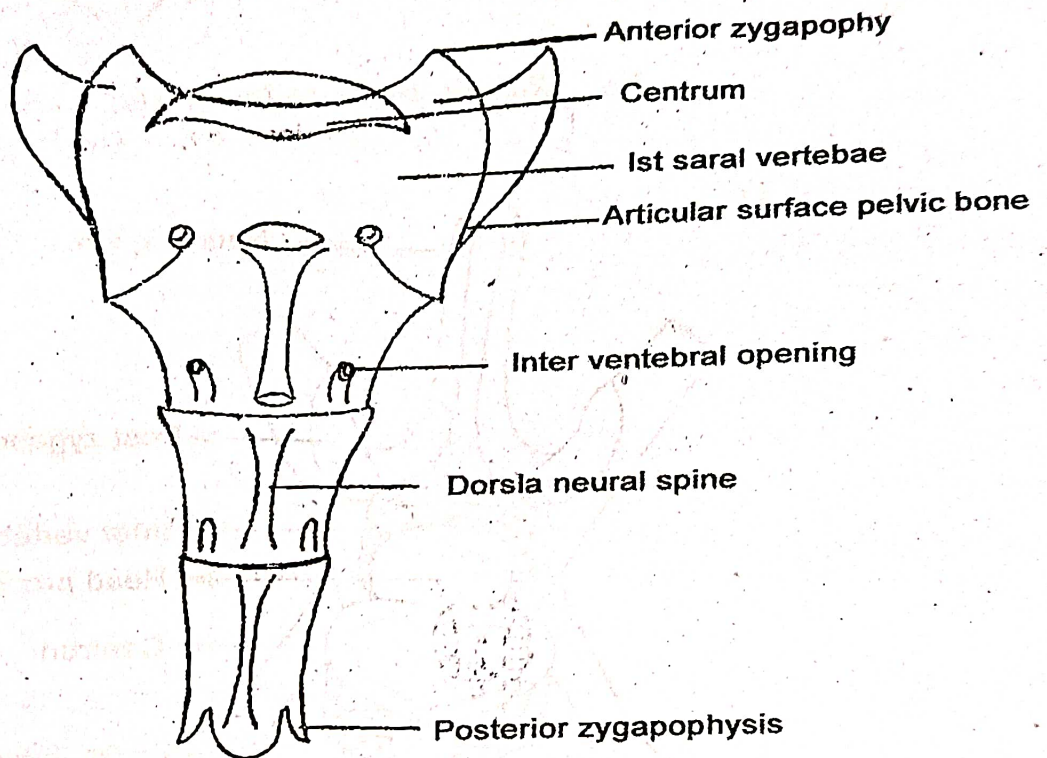


Fig : Sacral vertebrae

(e) **Caudal Vertebrae :** 16 Coccygeal free vertebrae constitute the tail or the caudal part. The anterior caudals have conspicuous centrum, well developed neural arches and transverse processes.

- The posterior caudals have reduced neural arches and transverse processes.
- Centrum is well seen.
- Short neural spine is pointed and posteriorly directed.
- Anterior and posterior zygapophyses are well formed.
- Spinal arterial foramina are present.
- Bifurcated transverse processes

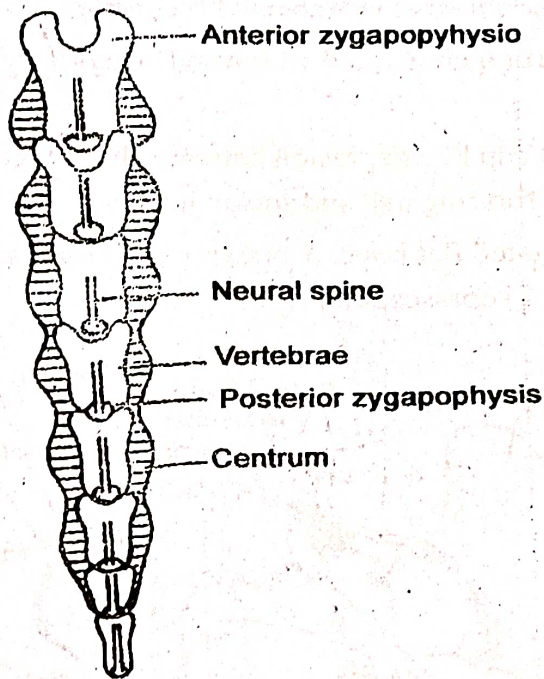


Fig : Caudal vertebrae

APPENDICULAR SKELETON

(74) Pectoral Girdle of Varanus

- ❑ It belongs to the appendicular skeleton giving support to the fore limbs and protection to the heart, lungs and other important organs.
- ❑ It shows bilateral symmetry and can be divided into two equal halves.
- ❑ Each half has a coracoid, scapula, clavicle, epi coracoid and supra scapula.
- ❑ Sternum and interclavicles are present in between the two halves of the girdle.
- ❑ Clavicles and inter clavicles unite to form a 'T' shaped episternum.
- ❑ Of all the bones, coracoid is larger, flat possessing coracoid fenestrae. Presence of two fenestrae divides the coracoid into an outer precoracoid, mesocoracoid and an inner epicoracoid.
- ❑ Epicoracoid is cartilagenous and is formed irregularly towards the anterior margin of the coracoid.
- ❑ Glenoid cavity is a cup like depression between the coracoid and scapula. Head of the humerus fits into this cavity forming ball and socket joint.
- ❑ Scapula is an elongated flat bone. Coracoid is present attached to the outer margin of scapula and inner margin of suprascapula.

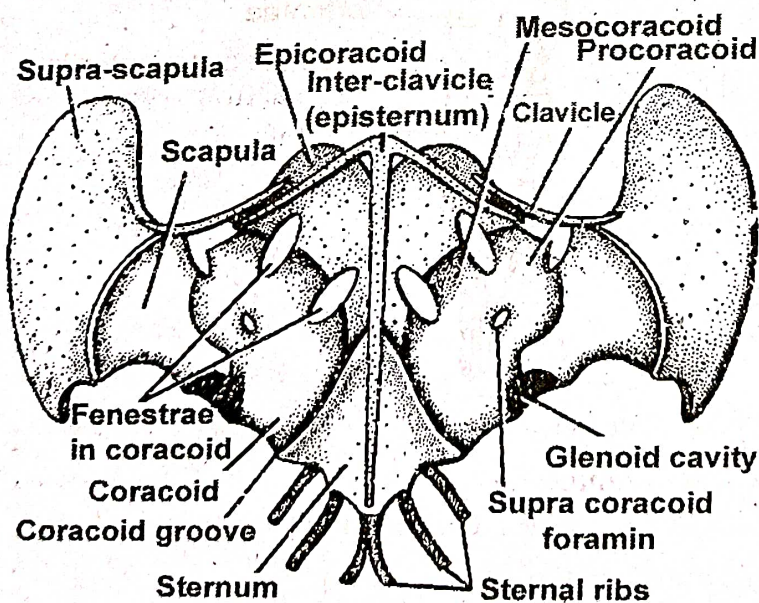


Fig : Apendicular skeleton

(75) Pectoral Girdle of Bird

- It is the anterior girdle of the appendicular skeleton giving support to the fore limbs and protection to us the heart, lungs etc.
- It occurs in two similar units on either side of the body.
- Each unit has a clavicle, coracoid and scapula as its components. Of these coracoid and scapula are strong.

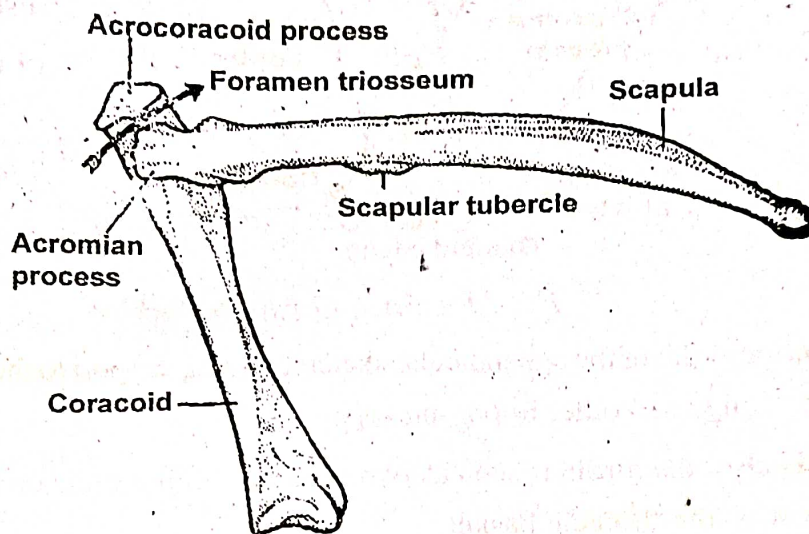


Fig : Pectoral Girdle of Bird

- Pectoral girdle is attached to the sternum and gives the action of fulcrum during the movement of the wings.
- Coracoid is a rod like bone directed towards the ventral side.
- Towards inner ventral side, it is articulated to scapula. At the outer junctional point, a cup like glenoid cavity, is present into which the head of the humerus fits in.
- Anterior to the glenoid cavity, coracoid grows as acrocoracoid process.
- Scapula is a flat shovel like one with a number of tubercles over its surface.
- Clavicle is present towards the antero ventral side of the fusion point of coracoid and scapula. It meets with its counter part to form a 'U' shaped furcula. This acts as a spring during flight. It is also called as a merry - thought bone.
- The opening located at the junction of these three bones is the foramen triosseum. It acts as pulleys for the contraction of pectoratis minor.

(76) Pectoral Girdle of Rabbit

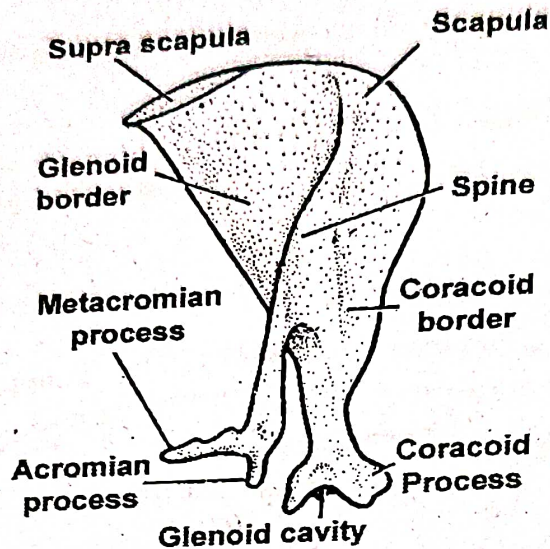


Fig : Pectoral Girdle of Rabbit

- It is the anterior girdle of the appendicular skeleton giving support to the fore limbs and protection to the heart, lungs and other important organs.
- In mammals also, the girdle is seen as two separate similar units on either side of the body in association with the thoracic basket.
- Each unit has three bones viz, the coracoid, scapula and clavicle.
- Scapula is almost a triangular expanded flat plate.
- Coracoid is degenerated and in association with the narrow end of the scapula forms into a coracoid process.
- Glenoid cavity is present at this junction of the compound bone.
- Humerus fits into the glenoid cavity forming the ball & socket joint.
- Outer margin of the Scapula is drawn into a long spiny acromion process, parallel to the coracoid process.
- The posterior margin of thin acromian process is backwardly directed as metacromian process or the apex of the scapula.
- Supra scapula is a thin cartilagenous component in association with the dorsal margin of the scapula.

(77) Pelvic Girdle of Varanus

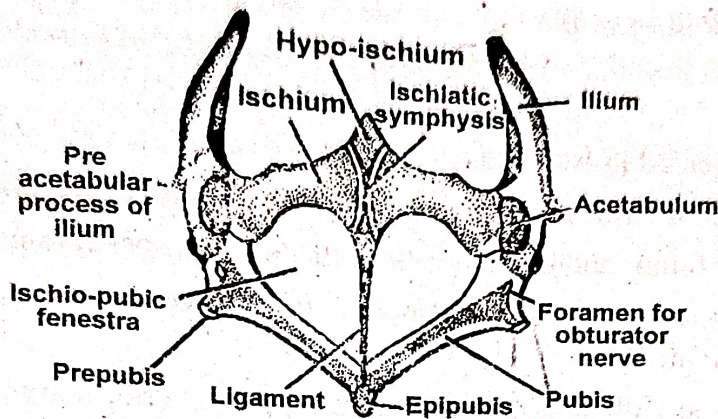


Fig : Pelvic Girdle of Varanus

- Among two girdles present in the body of the vertebrate organism, pelvic girdle is the posterior one giving support to the hind limbs and protection to the reproductive organs, gonads, kidneys etc.
- Pelvic girdle has two equal halves viz, the os innominata.
- Each half is composed of three bones viz., the ilium, the ischium and pubis.
- Ilium is a rod shaped bone directed dorsoposteriorly in articulation with sacral vertebrae.
- Anteriorly, it is grown as an anterior process and contributes for the formation of acetabulum.
- Pubis is a slightly curved bone. It forms into a circular bone in association with its counter part through a symphysis.
- Pubis has a cartilagenous epipubic tuberculum at its anterior end.
- Obturator for a men is located at the junction of the ilium ischium and pubis. Outer to this is a small rod like prepubis bone. Pubis also contributes for the formation of acetabulum.
- Ischium is again a flat, curved posterior bone of the girdle. It unites with its counterpart through an ischiatic symphysis.
- It is associated with the ilium and pubis at its outer edge and at the junction of these three bones, a cup like acetabulum is present. Head of the femur fits into this cavity.
- Hypo - Ischium is seen as a calcified cartilage located at the anterior margin of the ischiatic symphysis
- The cavity present in between the ischium and pubis is the ischiopubic foramen.

(78) Pelvic Girdle of Pigeon

- ❑ Among two girdles present in the body of the vertebrate organism, the pelvic girdle is the posterior one giving support to the hind limbs and protection to the reproductive organs, gonads, kidneys etc.
- ❑ Pelvic girdle is represented in two units.
- ❑ Each unit is composed of three bones viz., the ilium, the ischium and pubis.
- ❑ The joint between the femur and pelvic girdle is the ball and socket joint.
- ❑ Ilium is an elongated and wide flattened bone. It is grown in both anterior and posterior directions to the acetabulum.
- ❑ Its inner margin is fused with synsacrum while the outer anterior margin is concave.
- ❑ Ischium is attached to the postero - outer edge of the ilium.
- ❑ Anterior ridge like projection in front of the acetabulum is the antitrochanter. This articulates with the trochanter of the femur.
- ❑ Ischium is also a flat and wide bone extending as a rod behind the acetabulum and parallel to the ilium. It finally fuses with ilium.
- ❑ The ilio ischiatic foramen separates the above bone from the ilium.
- ❑ Pubis is a thin, long rod shaped bone. Posteriorly, it runs parallel to the ischium.
- ❑ At acetabular cup, pubis is associated with ischium to form into a pubic process.
- ❑ Foramen in between the ischium and pubis is considered as obturator foramen for the passage of obturator nerve.

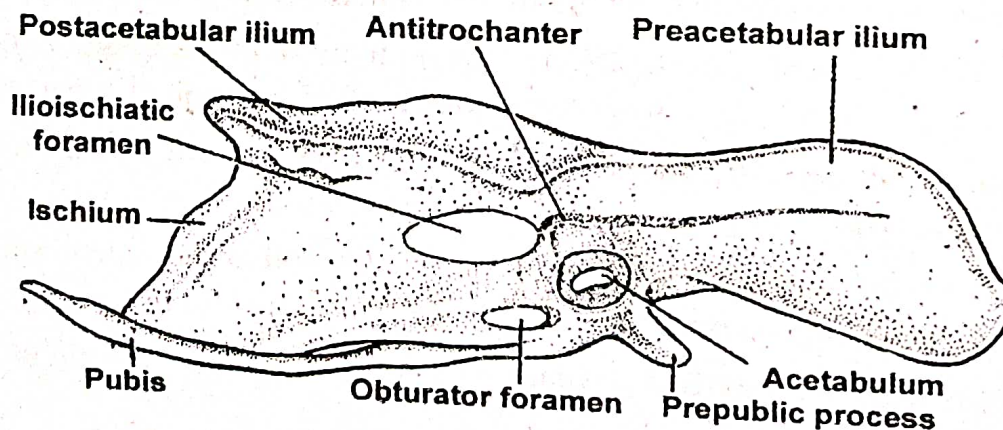


Fig : Pelvic Girdle of Pigeon

(79) Pelvic girdle of Rabbit

- Among two girdles present in the body of the vertebrate organism, the pelvic girdle is the posterior one giving support to the hind limbs and protection to the reproductive organs, gonads, kidneys etc.
- Pelvic girdle has two equal halves viz, the os- innominata.
- Each half is composed of three bones viz., the ilium, the ischium and pubis.
- Both the halves are united posteriorly by a symphysis.
- Ilium is a long bone with a wide anterior rod like posterior end.
- This articulates with sacral vertebrae of the vertebral column. Towards its inner margin, acetabulum is present.
- Ischium is a strong and flat bone forming the posterior part of the os-innominatum. It also contributes to the formation of acetabulum. Posteriorly, it has a conspicuous ischiatic tubercle.
- Pubis is a small bone connected anteriorly with ilium and posteriorly with pubis. In between these three bones, a wide obturator foramen is present. It is not a part of the acetabulum.
- Femur fits into the acetabulum and forms a ball and socket joint with the pelvic girdle.

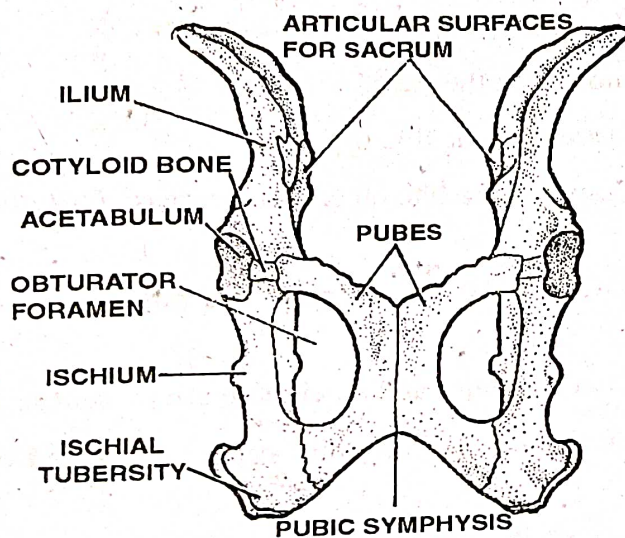


Fig : Pelvic girdle of Rabbit

(80) *Varanus* : Forelimb Skeleton

- Fore limbs ball and socket joint with pectoral girdle.
- They are pentadactyl and digits end in claws.
- Humerus, radio ulna, carpals, metacarpals and phalanges are the chief components of the forelimbs.

Humerus: It is the bone supporting the brachium of the fore limb. It is short and strong. Its shaft is a thin rod at the centre and ends are broad.

- Proximally, the bone is round and forms into a head fitting into the glenoid cavity of the pectoral girdle.
- Distally, the bone has a pulley like trochlea. On either side of this, a radial and ulnar condyles are present in continuation of Radio ulna.
- Deltoid ridge is grown as a bone over the head of the humerus.
- It bears a basipetal pit at its tip.

Radio Ulna: It is the bone of the antebrachium. Radio and ulna are separate at the centre and fused at their ends.

- Radio is a soft rod like bone. Shaft is having epiphysis in either side.
- Distally, it has a concave pit into which the radial fits in.
- Ulna is a stout and long bone arranged outside the radio.
- Proximally it has an inwardly grown spine like olecranon process. Distally it is in articulation with ulnare.

Hand/Manis: It is composed of carpals, meta carpals and phalanges supporting the wrist, hand and digits and fingers.

- Towards radio ulna, radial, an intermedium and an eulnare are present forming the first row.
- Second row is composed of one carpal and the third row is composed of five small carpal bones .
- Hand is supported by five meta carpals. Fingers are supported by phalanges. Digital formula of the fore limb is 2,3,4,4,3.

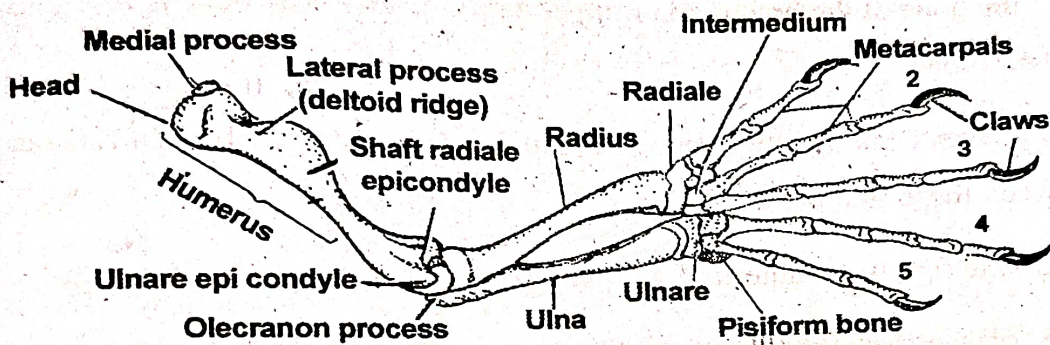


Fig : Fore limb skeleton

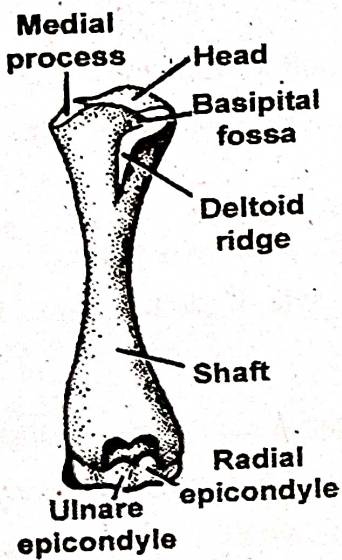


Fig : Humerus

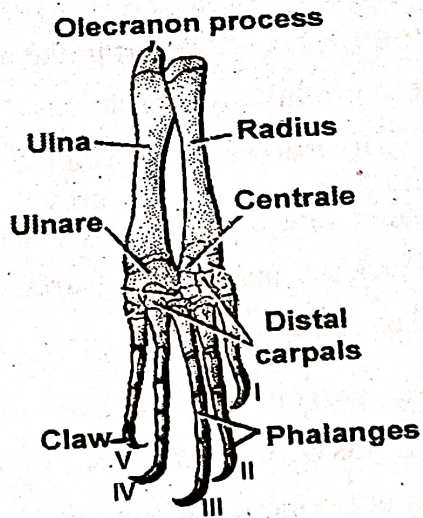


fig : Radio ulna & Carpals

(81) Pigeon : Forelimb Skeleton

- Fore limbs are modified into wings in birds. Each wing is supported by humerus, radio ulna and a carpometacarpal.

Humerus: It is the bone of the brachium or upper hand. Shaft of the bone is elongated while both the ends are broad.

- Proximally it is convex forming into a head fitting in the glenoid cavity. Ball and socket joint is formed in between these two bones.
- At the head of the humerus, an anterior and a posterior axial tubercles are visible.
- Deltoid ridge is formed from the anterior axial tubercle.
- Post axial tubercle is large. The shaft bears a pneumatic pore through which air tubules enter the bone.
- Distally, humerus has a trochlear surface having inter condylar groove, coronoid pit and olecranon pit articulating with radio ulna.

Radio ulna : It gives support to the antebrachium. It is a compound bone having a long and slender radio proximally. Radio has a pit into which the trochlear surface of the humerus fits in. Distally it articulates with carpals.

Ulna is again a long curved, strong bone having a nutritional pore. Proximally it is drawn as olecranon process and articular surface articulating with the condyle of the humerus. Distally it is bound to carpal and radio.

Carpometacarpus: It is the bone of the wrist. Three distal carpals and three metacarpals fuse to form this compound bone. First metacarpal is stout and short. Second metacarpal is strong, straight bone while the third is a thin curved rod. It fuses with the second metacarpal at its posterior axial end.

- Hand is formed of three fingers. Digital formula of fore limbs is 1, 2, 1, 0, 0- Hence fourth and fifth fingers are absent.

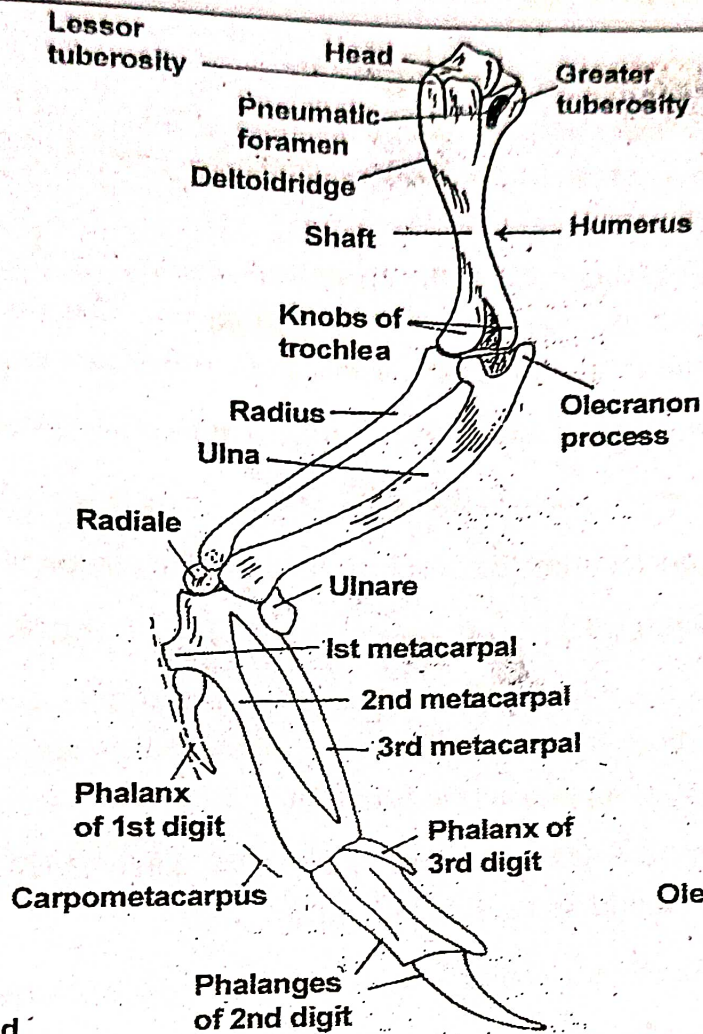


fig : Forelimb skeleton Pigeon

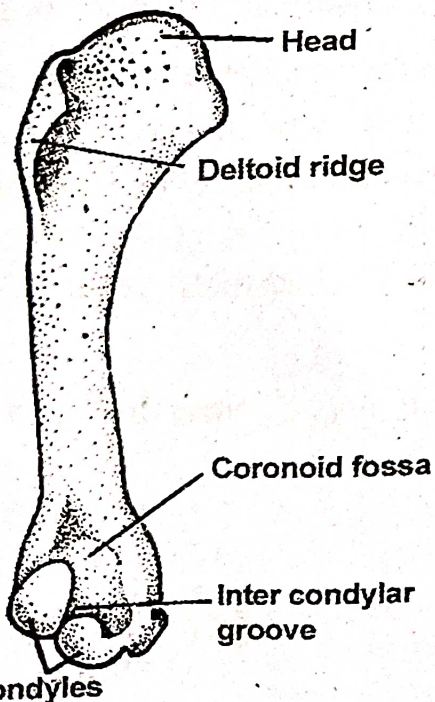


Fig : Humerus

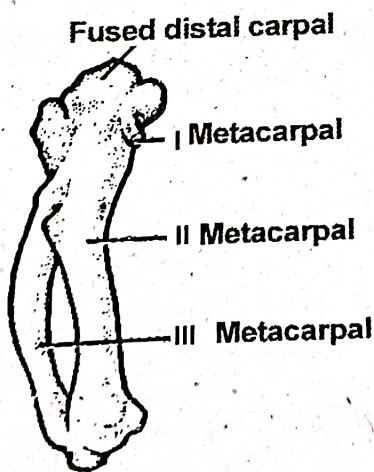


Fig : Carpometacarpus

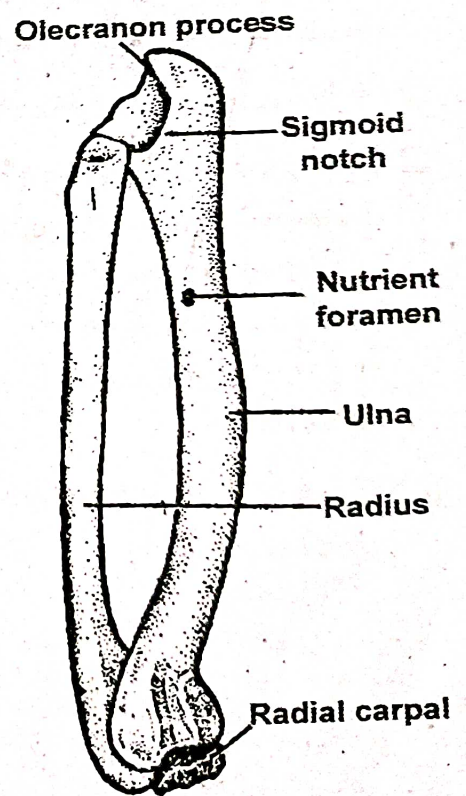


Fig : Radio ulna

(82) Rabbit : Forelimb Skeleton

- ❑ Fore limb consists of upper arm, fore arm, wrist, hand or manus and fingers supported internally by humerus, radioulna, carpals, meta carpals and phalanges respectively. Limbs are pentadactyl, and end in claws/nails.

Humerus: Long supporting bone of the upper arm. Its shaft is strong and rod like. Proximal end is broad and convex forming into the head of humerus. This fits into the glenoid cavity of the pectoral girdle and form a ball and socket joint for free and easy movement.

- ❑ The two projections on either side of the head help in providing steadyness to the limbs.
- ❑ Head is followed by shaft antero axial side . On its, lies a ridge called deltoid ridge.
- ❑ Distally the bone bears a pulley like trochlea for free articulation with radioulna.
- ❑ Olecranon pit and supra trochlear foramina are visible near the olecranon ridge.

Radio ulna: This is a compound bone giving support to the fore arm and is formed by the close association of both radio and ulna. Both these bones are almost equal in length and closely arranged to give support to the fore arm.

- ❑ Radio is a long outer bone with a curved end towards dorsal side helping in articulating with trochlea at its proximal end and carpal at its distal end.
- ❑ Ulna is the inner bone slightly longer than the radio having proximally the olecranon process.
- ❑ It bears a deep sigmoid notch just beneath the olecranon process into which the trochlea of the humerus fits in. Distally it becomes thin and articulates with a carpal. About eight carpals arranged in three rows support the wrist. First row has three carpals viz, the radiale, intermedium and ulnare. Second row comprises of only one carpal while the third row has four pieces viz the trapizium, osmagnum and two uncinat bones. Elongated metacarpals are attached to these bones.
- ❑ Phalanges are the small bead like bones ending in claws. Their number varies from species to species.

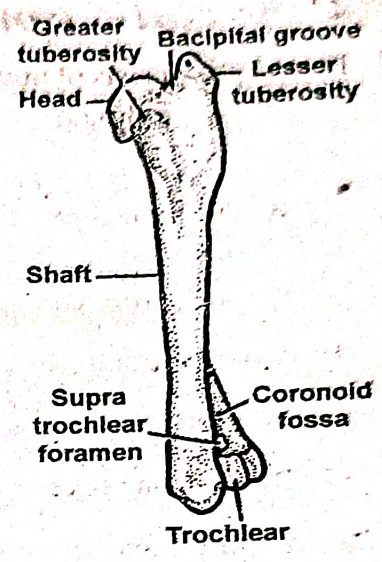
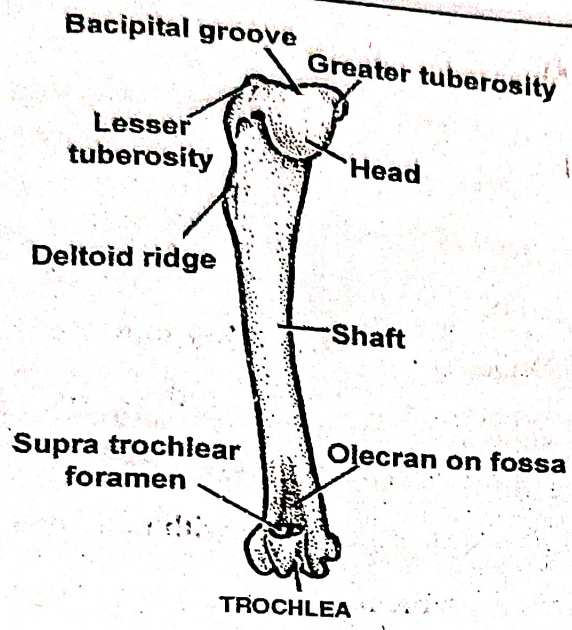


Fig : Humerus Lateral view

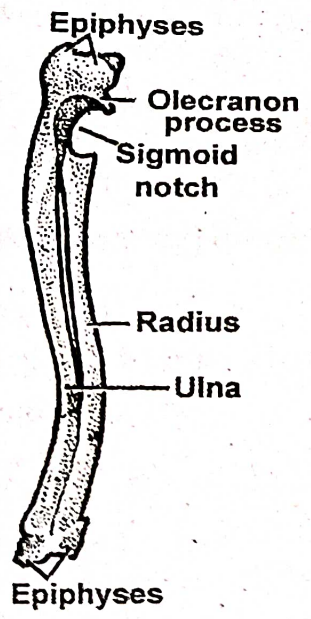
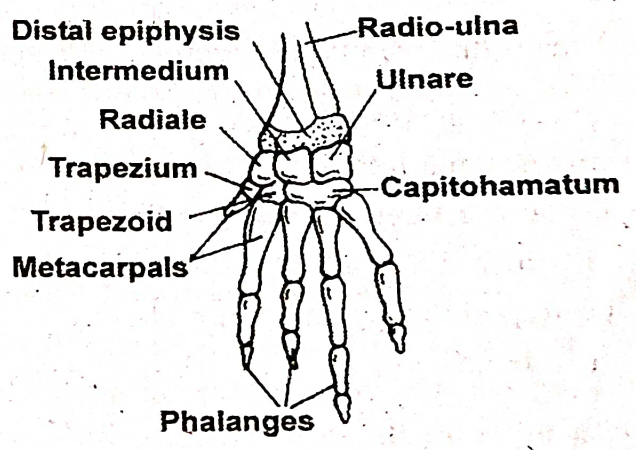


Fig : Radioulna



Phalanges

(83) *Varanus* : Hindlimb Skeleton

- Hind limbs are the posterior pair of limbs supported by pelvic girdle. They form ball and socket joint with the acetabulum of the pelvic girdle.
- Thigh, foreleg, ankle, pes and toes are the components of the hind limb supported internally by femur, tibiofibula.

Ankle bones or tarsals, metatarsals and phalanges.

Femur: It is a long and strong rod like bone supporting the thigh. It possesses two epiphyses. Proximal epiphysis is formed into a round head fitting into the acetabulum.

- Lesser trochanter is the second tuberculum located just beneath the first one towards the anterior axis.
- Greater trochanter to be seen towards the post axis is reduced and like a pulley. Distal trochanter is formed into two condyles and articulates with tibiofibula.

Tibiofibula: A compound bone formed by the union of outer tibia and inner fibula. It gives support to the foreleg.

- Tibia is slightly curved strong bone having nodule process at its proximal end and concavities into which the condyles of the femur fits in.
- Fibula is a long, thin bone articulating with femur at its proximal end. Distally it is associated with tarsal bones.
- Ankle is supported by five tarsals. Proximal row has two pieces and distal row has three pieces. Proximal row articulates with tibiofibula while the distal row with metatarsals. Phalanges are arranged in the formula of 2, 3, 4, 5, 3. All the digits end in claws.

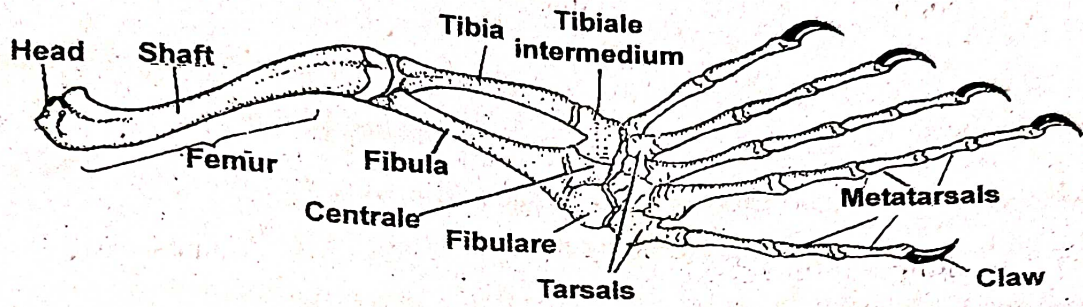


Fig : Varanus-Hind Limb skeleton

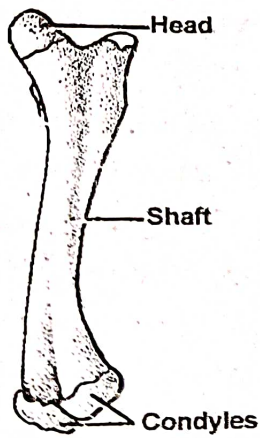


Fig : Femur

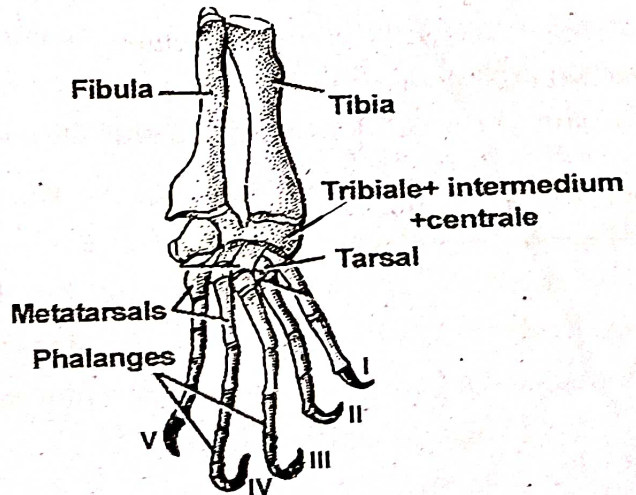


Fig : Tibiofibula

(84) Pigeon : Hindlimb Skeleton

- ❑ Hind limbs are the posterior pair of limbs supported by pelvic girdle. They form ball and socket joint with the acetabulum of the pelvic girdle.
- ❑ Thigh, foreleg, ankle, pes and toes are the components of the limb / leg supported internally by femur, Tibio fibula, Ankle bones or tarsals, metatarsals and phalanges.
- ❑ Hind limbs are stronger and shorter to borne the entire weight of the body. The muscles are powerful and are used in perching/holding the substratum with firm grip.
- ❑ **Femur:** It is a short strong bone supporting the thigh. Both proximal and distal ends are broad and flat.
- ❑ Proximally, the bone becomes round and fits into the acetabulum of the pelvic girdle. Irregular outer surface is produced into greater trochanter. Into the concavity between the head and greater trochanter, the antitrochanter of the ilium fits in. Distally, it has a patellar groove towards anterior side into which patella, the sesmoid bone fits in and forms the knee joint. On either side of the patellar groove, a pair of condyles are present forming articulation with the proximal portion of the tibio fibula.

Tibio Fibula: It is gain a compound bone formed by the association of tibio and fibula. It supports the fore leg. Tibio fuses with tarsus to form tibiotarsus which is long, strong and a straight bone. Proximally it is drawn into a sharp knemial ridge. The pits on either side of the ridges receive the condyles of the femur. Distally, it is associated with the pulley like tarsometatarsal. Fibula is thin, slender bone associated with Tibio on its outer surface. Proximally, it articulates with femur. Distal tarsals, second, third and fourth metatarsals fuse to form the compound tarsometatarsus. It is a strong rod like bone articulating proximally with tibiotarsus and distally with three free metatarsals. Phalanges are the small pieces attached to the metatarsals of the foot. First metatarsal is represented as a projection over the tibiotarsus. Proximally it has two cup like depressions with which tibio fibula articulates. In males, the tibiotarsuls bears a conspicuous projection called spur. Phalanges of the hind limb are arranged in 2,3,4,4 formula and are clawed.

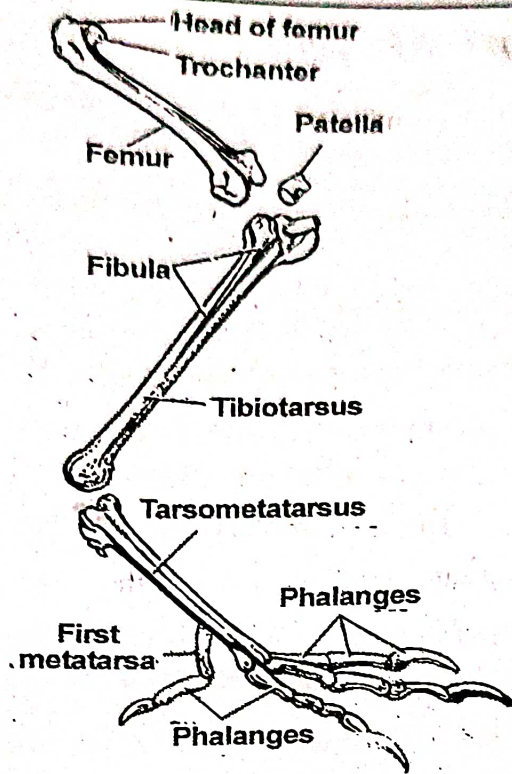


Fig : Pigeon Hindlimb Skeleton

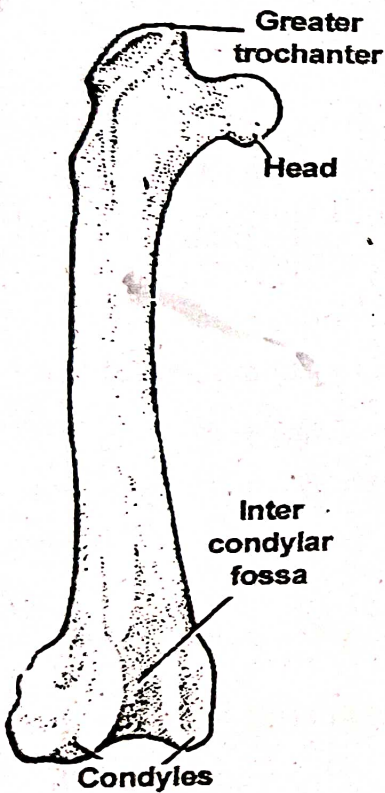


Fig : Femur

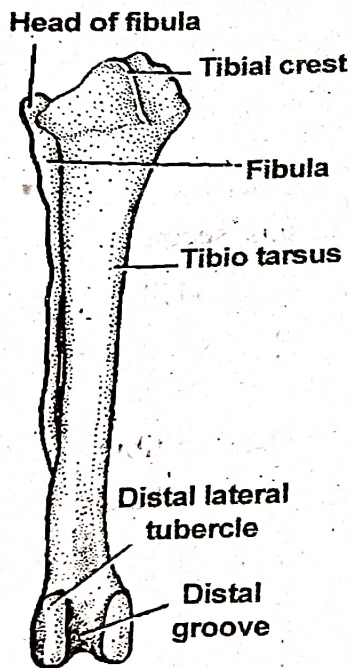


Fig : Tibio Tarsus

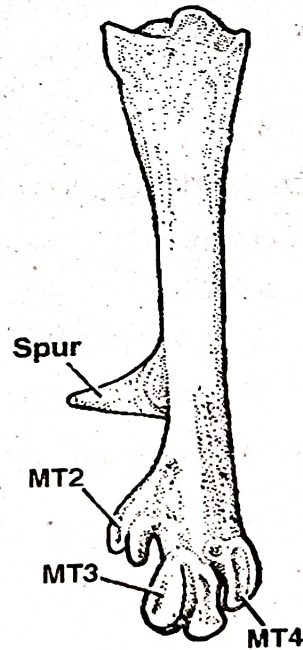


Fig : Tarso Meta Tarsus

(85) Rabbit : Hindlimb skeleton

- Hind limbs are the posterior pair of limbs supported by pelvic girdle. They form ball and socket joint with the acetabulum of the pelvic girdle.
- Thigh, foreleg, ankle, pes and toes are the components of the hind limb leg supported internally by femur and, tibiofibula.
- Ankle bones or tarsals, metatarsals and phalanges.
- Femur** : It is a long and strong bone supporting the thigh region. Its proximal and distal ends are broad.
- Proximally two tubercles are visible on either side of the head of femur. These are the greater and lesser trochanter. Distally two large condyles coaree present in association with tibiofibula. The groove between these condyles is the patekar groove. Outer to the distal condyle, a small projecting knob called balbella visible. proximally, the head of the femur fits into the acetabulum of the pelvic girdle and form ball and socket joint for free movement.

Tibio fibula: It is again a compound bone formed by the association of two bones. If these two, tibia is strong, straight and rod like one with broadened proximal and distal ends. Proximally, the tibia is drawn into a long cnemial process.

- Fibula is a thin a slender bone having a disc like patella at its proximity tibia articulates proximally with the condyles of the femur and distally with astragalus bone of the ankle.
- Fibula articulates proximally with fibin and distally with calcaneum of ankle bones or tarsals.

Foot: Ankle, pes and fingers are the components of the foot.

- Ankle is supported by three rows of tarsals.
- First row has astragalus and calcaneum..
- Second row has a navicular bone.
- Third row has cuboidal, external and internal tarsals.
- Calcaneum is projected out at its distal end. Phalanges support the digits of the toes.
- Phalangial formula of the hind limb is 2,2,2,2. All the phalanges are provided with nails.

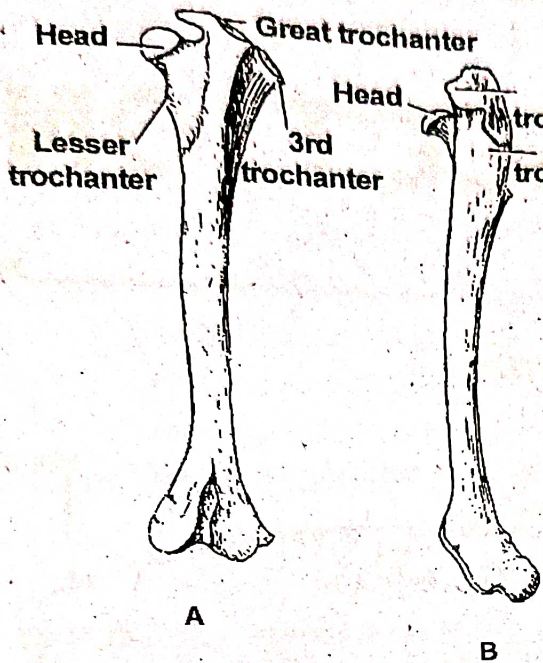


Fig : Femur

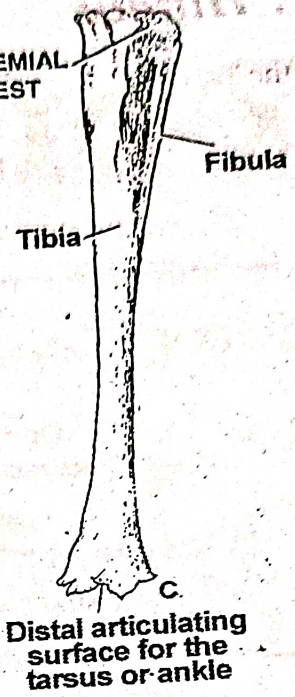


Fig : Tibio Fibula

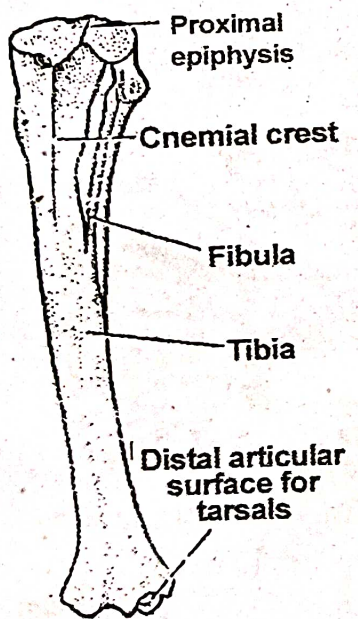


Fig : Tibio Fibula

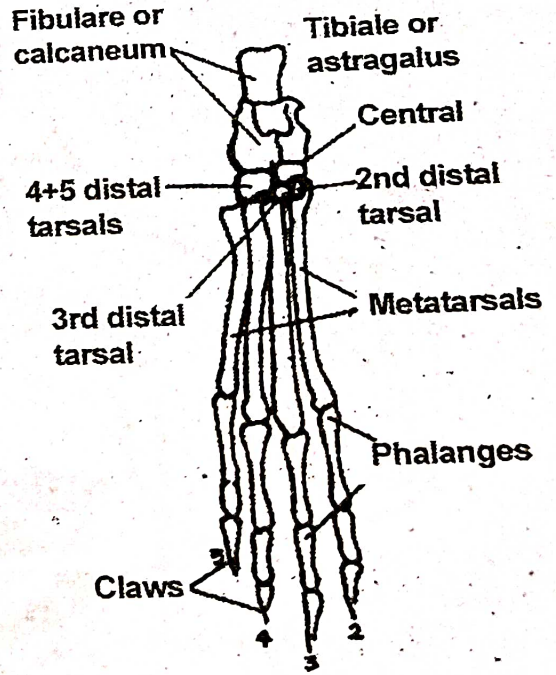


Fig : Bones of the Foot

X

DISSECTION

(86) Dissections of *Labeo/Tilapia*

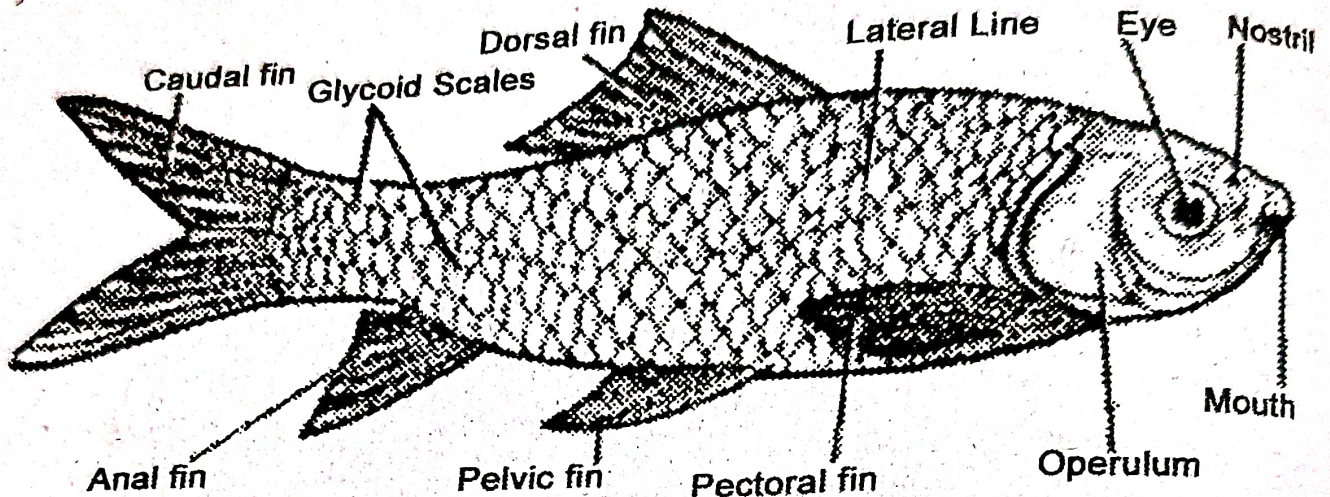


Fig : *Aabeo rohita*

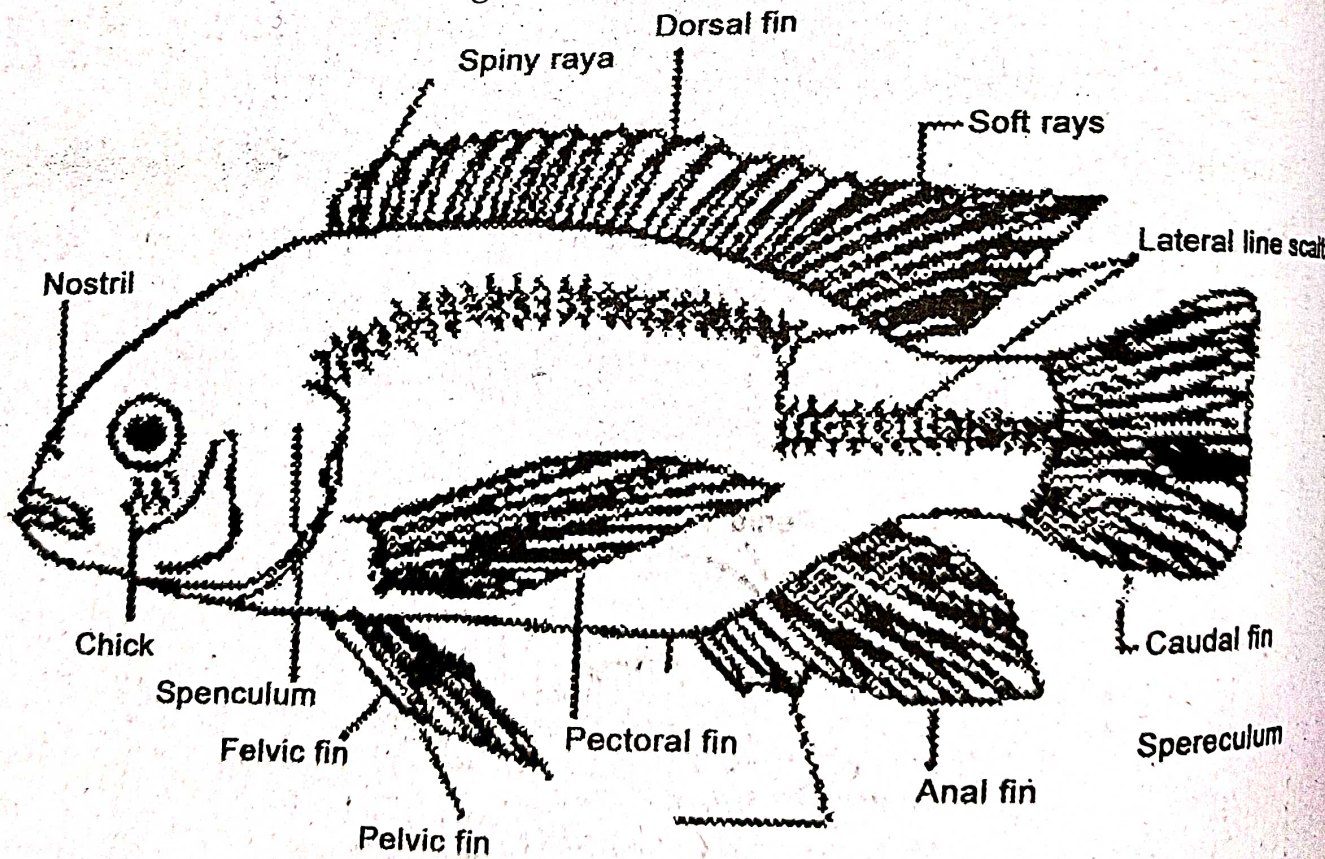


Fig : *Thilapia* Fish.

(87) Fish Digestive system

This is a long tubular one extending between anterior mouth and posterior anus. The dissection is done by fixing the fish on its ventral side over the wax plate.

Body is opened by cutting ventromedially behind the mouth and cleaning the unwanted material in between the coils of the canal. The entire system with the Liver lobes is displayed over the black paper. Draw the diagram and label the parts.

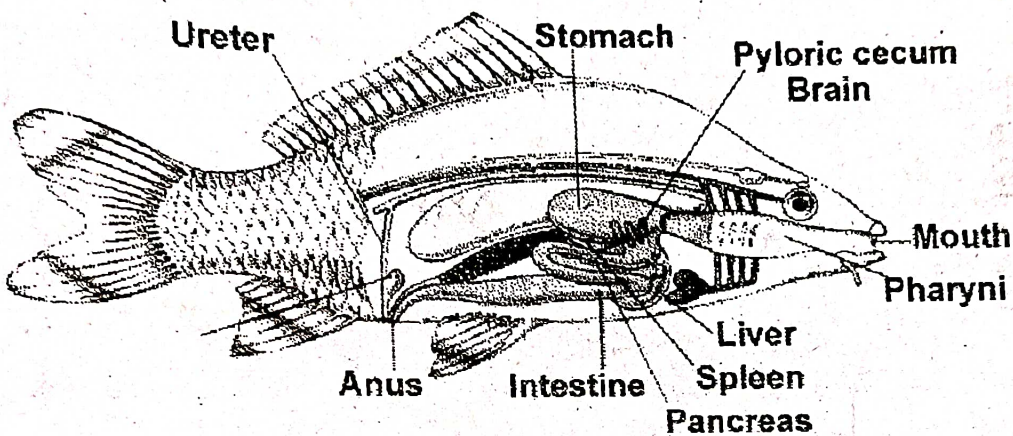


Fig : Digestive system

(88) Fish Brain

- It is located in the cranium of the skull supporting the head region.
- The fish is fixed on its dorsal side over the wax tray.
- The skull is broken carefully with a bone cutter mid dorsally and slowly the broken pieces of the bones are removed. Brain is separated slowly and kept either insitu or mounted over the black paper in a prettidsh.
- Draw the diagram and label the parts.

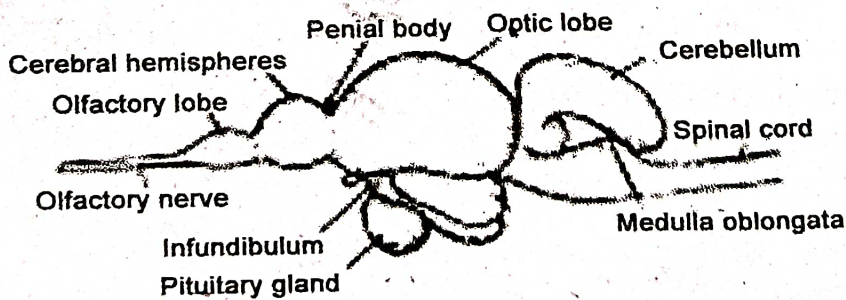


Fig : Fish Brain

(89) *Tilapia Webarian apparatus*

- ❑ It is located on either side of the head region between the operculum and the eye.
- ❑ The structure itself consists of a set of minute bones originating from the first few vertebrae.
- ❑ These bones grow to physically connect the auditory system, specifically the inner ear to the swim bladder. The structure acts as an amplifier of sound waves to be received by the inner ear.
- ❑ On each side webarian apparatus consists of bony elements namely the scaphus, the intercalarium, the lateral processes, the tripus and the claustrum as shown in the diagram.

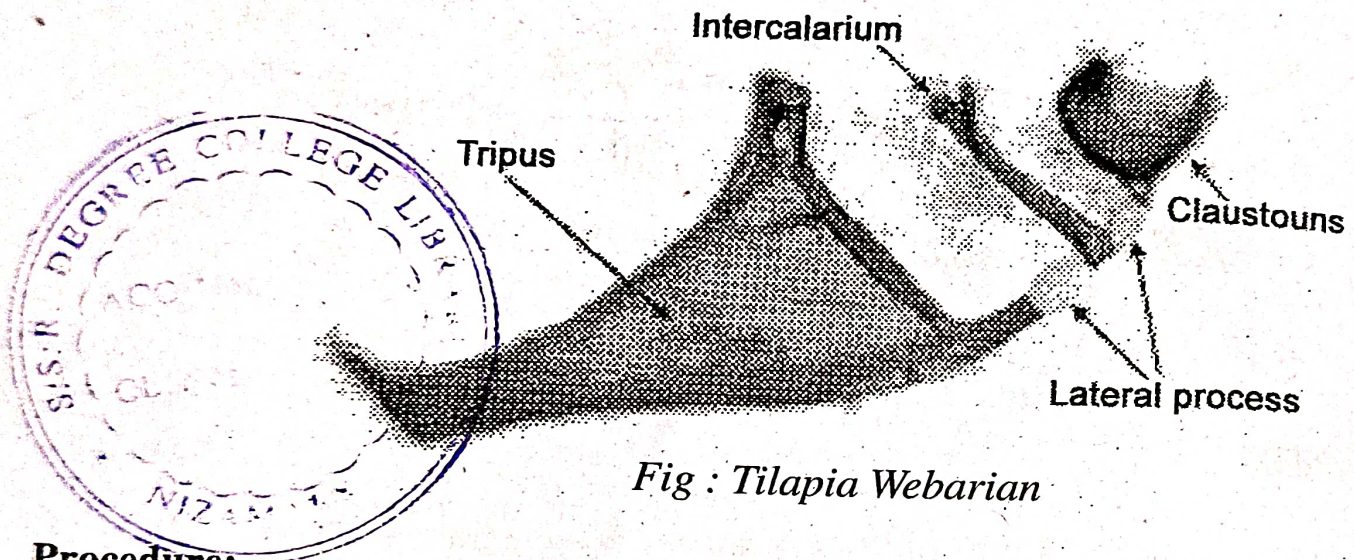


Fig : *Tilapia Webarian*

Procedure:

- ❑ Fix the fish on its lateral side over the wax tray.
- ❑ Remove the skin in between the operculum and the eye.
- ❑ Gently break the bony skull and see for the minute elements of the apparatus in front of the swim bladder.
- ❑ Gently separate the apparatus and keep it in the prettidish.
- ❑ The elements of the apparatus can either be separated or intact.
- ❑ Draw the diagram and label the parts.

90) **V, VII, IX and X Cranial nerves**

- ❑ These are located on either side of the cervical region of the fish.
- ❑ **Fix the fish on its lateral side over the wax plate.**
- ❑ Gently cut open the skin behind the skull and operculum.
- ❑ Stretch the animal when one can see the nerves.
- ❑ Clean the unnecessary membranous matter in between and display the nerves insitu by inserting small pieces of black paper.

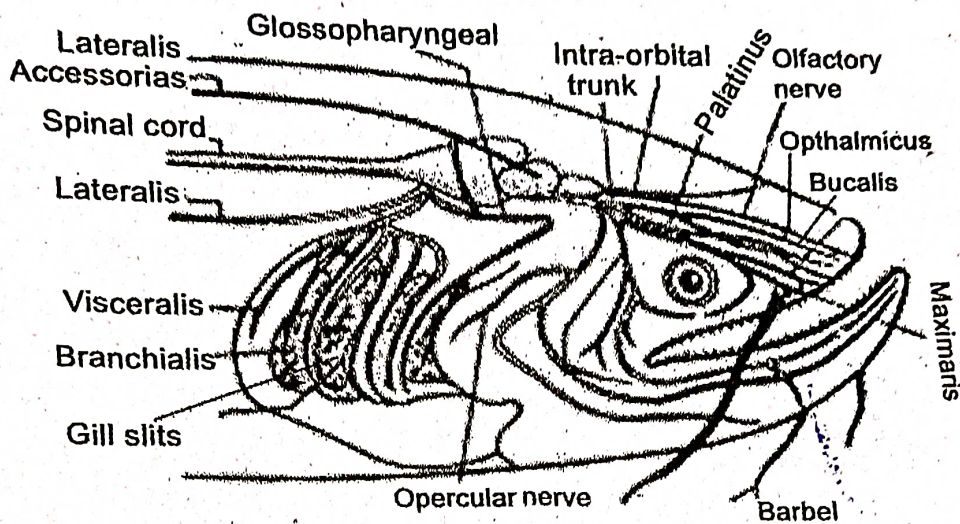


Fig : Cranial Nerves in Labeo