B.Sc ZOOLOGY II SEMESTER MANUAL

Phylum: HEMICHORDATA

1. Balanoglossus

Phylum : **Hemichordata**
Class : **Enteropneusta**

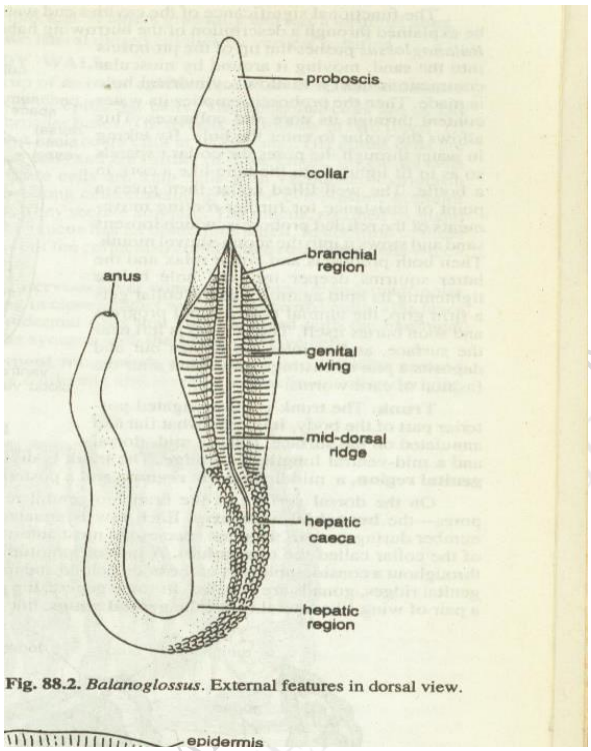


Fig. 88.2. *Balanoglossus*. External features in dorsal view.

.1) Inhabits the marine waters at crusade islands of Tamilnadu in India.
2) A worm like tubicolous, burrowing organism with enterocoelous coelome and pharyngeal gill slits.
3) Body is divided into an anterior proboscis, a middle collar and a long trunk.
4) Body is brittle with a high power of regeneration.
5) Externally, body is covered by mucous layer.
6) Proboscis is a short, conical muscular part helping in making burrow.
7) It bears a proboscis pore and narrows into a fine proboscis stalk posteriorly to connect with collar.
8) Collar is another muscular ring with elevations and pits on the surface.
9) 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.

2. *Tornaria larva*

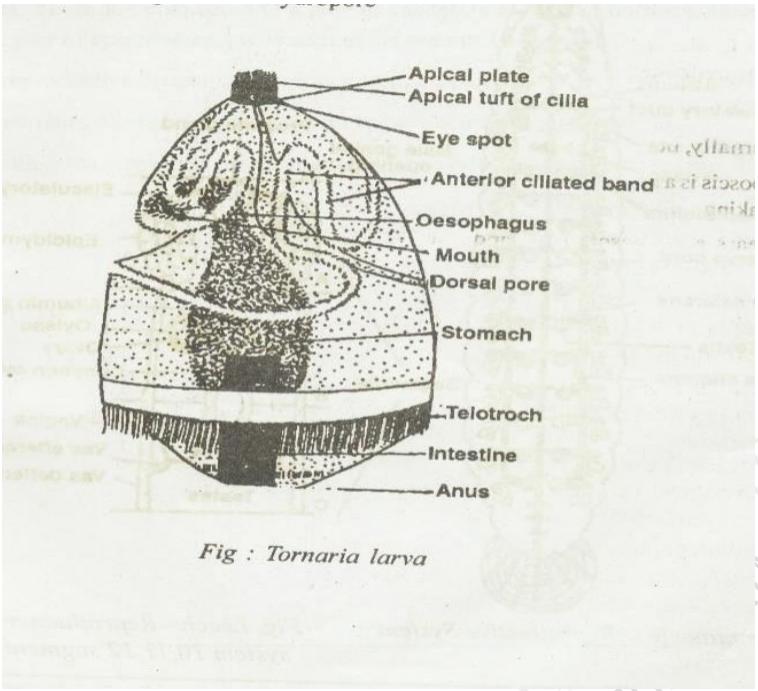


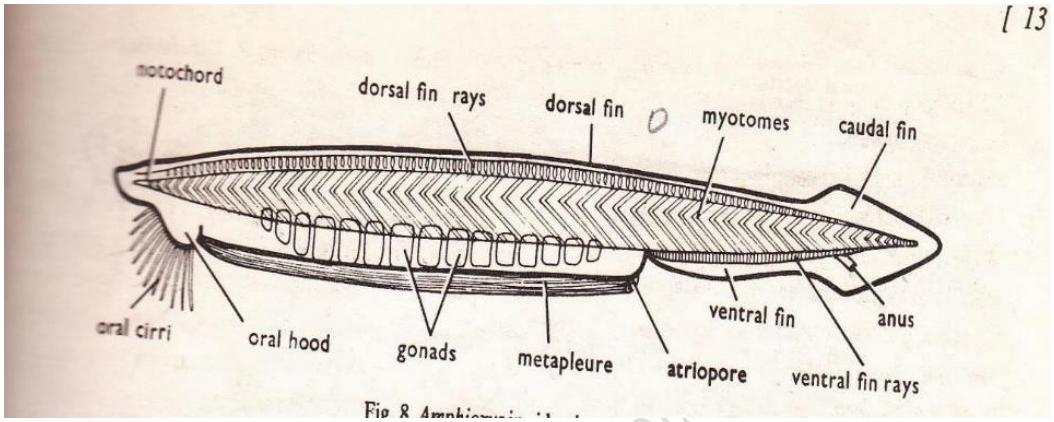
Fig : Tornaria larva

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

PROTOCHORDATA

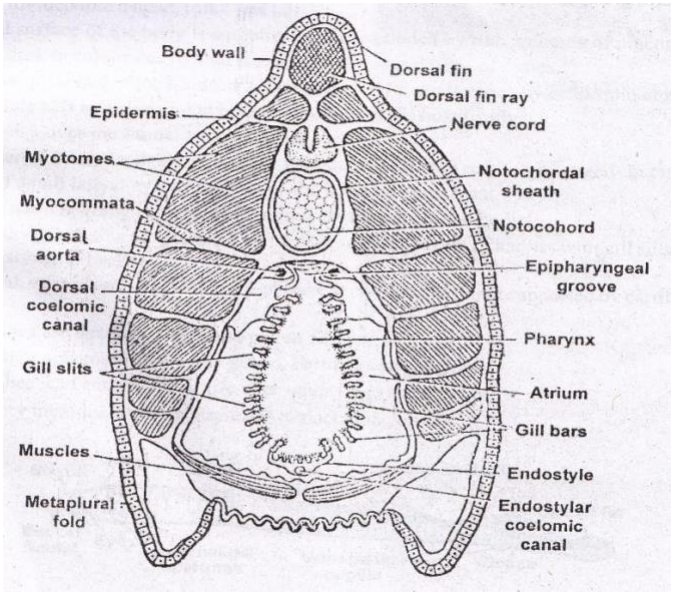
3. Brachiostoma *lanceolatum*(Amphioxus)

Phylum : **Chordata**
Sub Phylum : **Cephalochordata**
Class : **Leptocardii**



1) It is commonly called as Amphioxus.
2) It is burrowing fish like marine organism and adult is less than 5cm long.
3) Body is elongated and pointed at both the ends.
4) Body is bilaterally symmetrical and laterally compressed.
5) Anterior end is called rostrum ventrally it contain tentacular oral cirri.
6) Epidermis become folded on either side of the body known as meta pleural folds.
7) Persistant notochord is present.
8) Body has a dorsal, ventral and caudal fins in continuation. They helps in locomotion.
9) A number of < - shaped myotomes are present.
10) Unisexuals, exhibit sexual dimorphism.
11) External fertilization and development is indirect.
Life cycle includes free swimming larvae exhibit progressive metamorphosis.

4. Amphioxus – T.S. Through Pharynx :

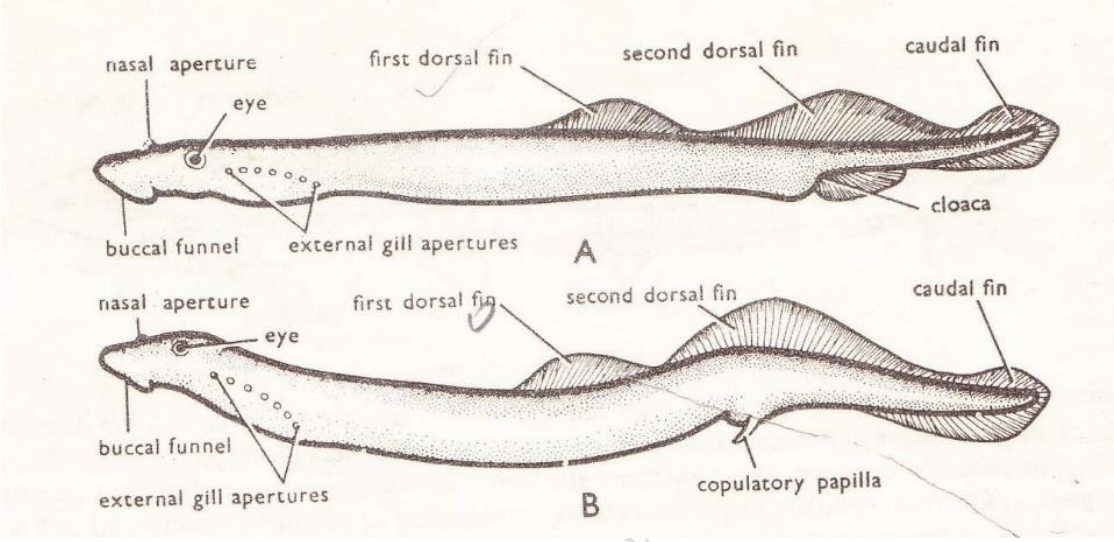


1) Amphioxus appears triangular in outline in transverse section with a pointed dorsal and wide ventral side.
2) Epidermis forms metapleural folds ventrolaterally. Epidermis is composed of simple columnar epithelium.
3) Muscles are arranged in the form of myotomes extending between dorso– lateral to ventral side of the body.
4) Notochord is surrounded by notochordal sheath and is composed of vacuolar tissue.
5) A dorsal fin with fin ray is seen on the mid dorsal side.
6) The sections of the tubular nerve cord, notochord and dorsal blood vessels are present below the dorsal fin.
7) Atrial cavity encircles the pharynx and gonads on all sides.
8) Atrial cavity present around the intestinal tube.
9) Coelom extends as dorsal columbic canals on either side of supra-pharyngeal grooves.
10) Gonads are present on the ventrolateral region of the pharynx.
11) Hepatic diverticulum extends below the pharynx on its right side.

CYCLOSTOMATA

5. Petromyzon *marinus*:

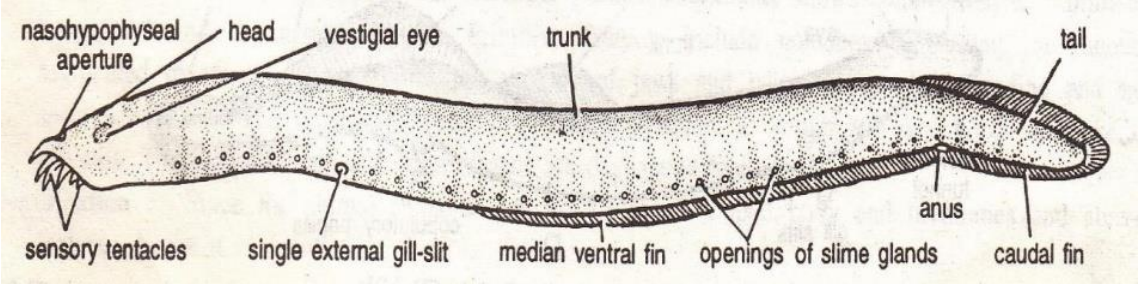
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Class	:	**Agnatha**
Sub Class	:	**Cyclostomata**
Order	:	**Petromyzontia**



1. It is commonly called as lamprey. It is cctoparasite on the fishes
2. Body is eel – like, measuring about 90cm long.
3. Body is divided into head, trunk and tail.
4. Body is mucilaginous, highly pigmented and is devoid of scale.
5. Head contain buccal funnel anterio-ventrally.
6. A pair of functional small lateral eyes is present.
7. A single nasal opening is present at the mid dorsal region of the body.
8. 7-14 pairs of gill slits are present.
9. The dorsal, ventral and candal fins are unpaired, supported by cartilagenous fin rays.
10. Unisexuals, fertilization is external.
11. Life cycle takeplace through Ammocoetus larva.

6. Myxine *glutinosa* :

Phylum : **Chordata**
Subphylum :**Vertebrata**
Class : **Agnatha**
Sub Class : **Cyclostomata**
Order : **Myxinoidea**

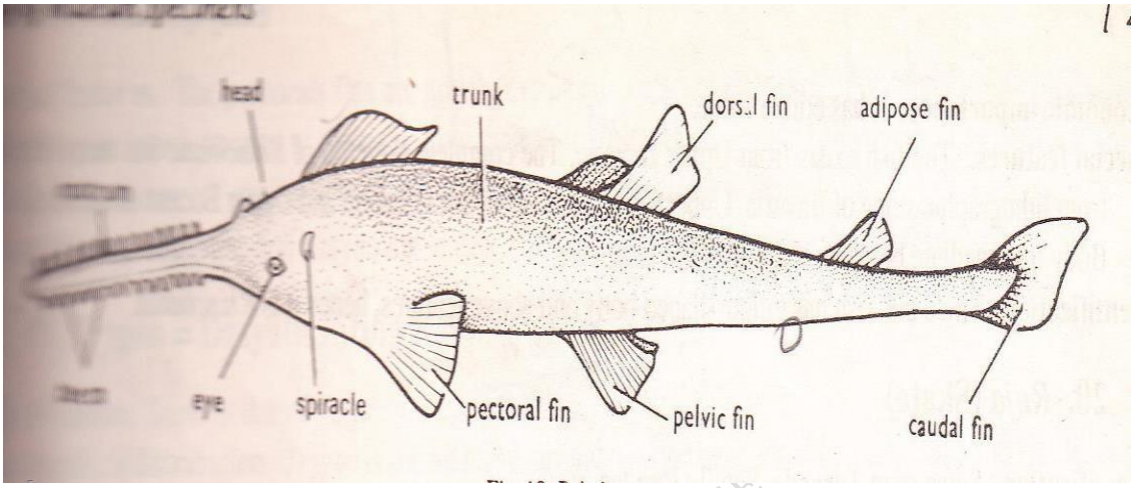


1. It is commonly called as Hag – fish.
2. Body is ribbon-like and laterally compressed.
3. Body is smooth and scaleless, highly mucilaginous
4. Mouth bears a pair of soft lips anterio-posteriorly
5. Buccel funnel and horny teeth are absent
6. Mouth is surrounded by 4 pairs of tentacles supported by gill bars.
7. A single dorsal nasal opening is present near the mouth
8. A pair of vestigeal lateral eyes are present
9. Dorsal, ventral and candal fins are unpaired
10. 6 pairs of gill slits are present on eitherside of the pharynx
11. Bisexual or Hermaphrodite development is direct.

PISCES

Pristis :

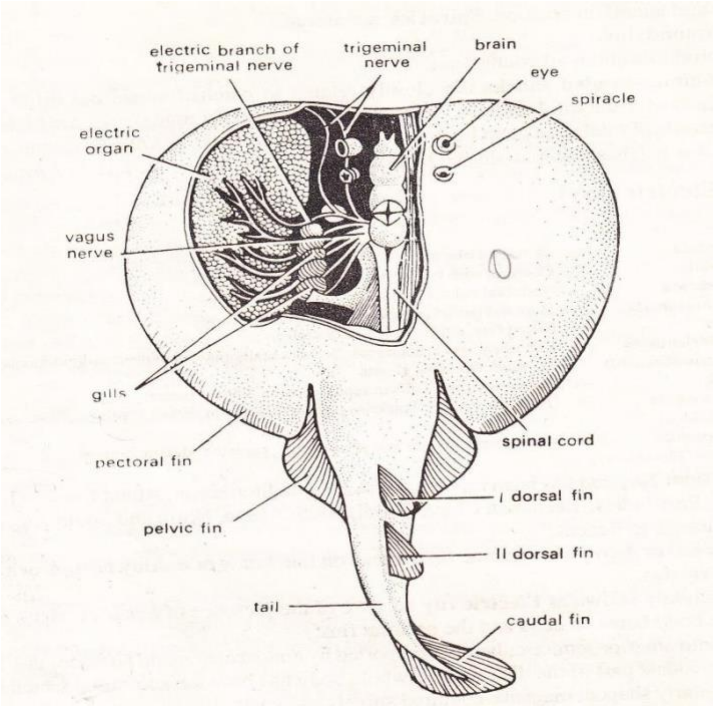
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Series	:	**Pisces**
Class	:	**Elasmobranchi**
Order	:	**Euselachii**



1) It is commonly called as saw fish, weighing 350-1200 lbs and measuring about 3-6 metres in length.
2) Marine and free-lining fish
3) Head is flattened dorsoventrally with elongated rostrum with pointed sharp teeth, used for protection against predators.
4) Head contain a pair of lateral eyes at the base of rostrum
5) A pair of branchial openings are present on either side of the pharyngeal region.
6) Tail is provided with heterocercal tail
7) Body contain paired pectoral, pelvic fins and unpaired dorsal, ventral and adipose fins.
8) Unisexual and viviparous.

Torpedo :

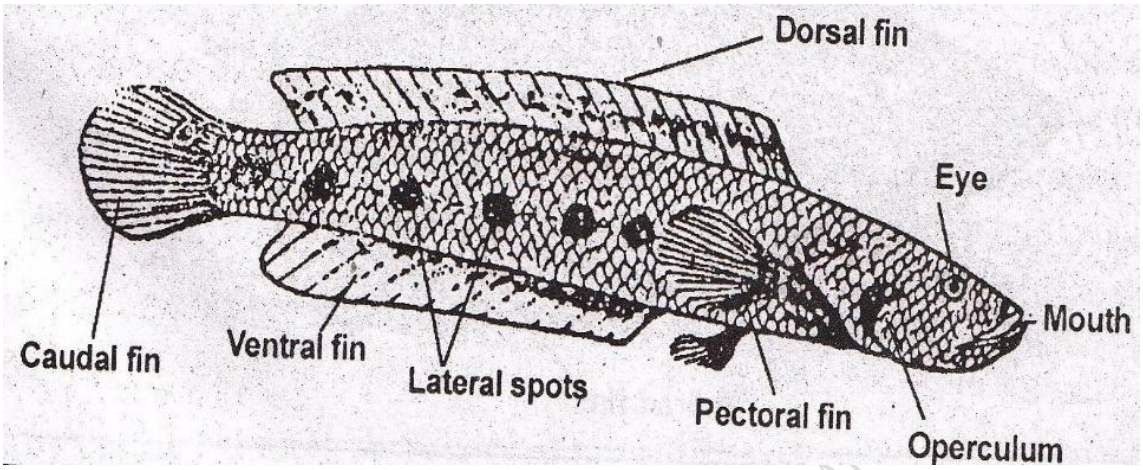
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Group	:	**Pisces**
Class	:	**Elasmobronchii**
Order	:	**Hypotremata**



1) It is commonly called as Electric ray fish
2) Body is dorso-ventrally compressed.
3) Anteriorly disc-like head is present. It is supported internally by a cartilaginous endoskeleton.
4) Body is smooth and scaleless.
5) Dorsally head contain paired eyes and respiratory openings
6) Head contain vide mouth anterioventrally
7) A pair of electric organs are present at the base of the eyes. They are modified muscles. They are innervated by cranial nerves.
8) A pair of pectoral, a pair of pelnic fins are present at the lower side of the disc. A pair of dorsal fins are present.
9) Tail is short with caudal fin

Channa *punctatus* :

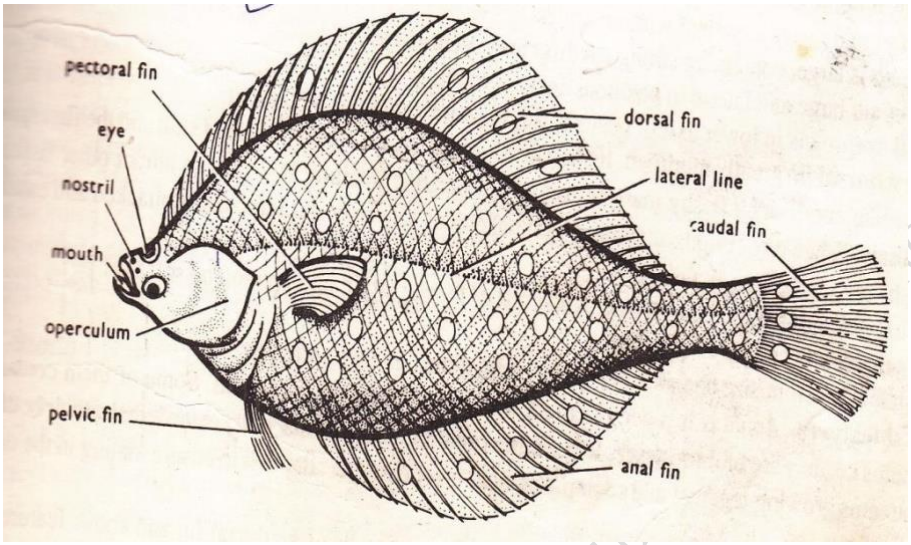
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Group	:	**Pisces**
Class	:	**Osteichthyes**
Sub Class	:	**Actinopterygii**
Order	:	**Mugili formes**



1) It is commonly called as snake head fish
2) Fresh water and edible fish
3) Body is long, serpentine, slimy and mucilaginous
4) Head is dorsoventrally flat tend with wide mouth
5) It contain accessory respiratory organs
6) Skin is embedded with cyclorid scales
7) Dorsal and ventral fins extend from anterior to posterior region
8) Unisexuals and oviparous.

Pleuronectis

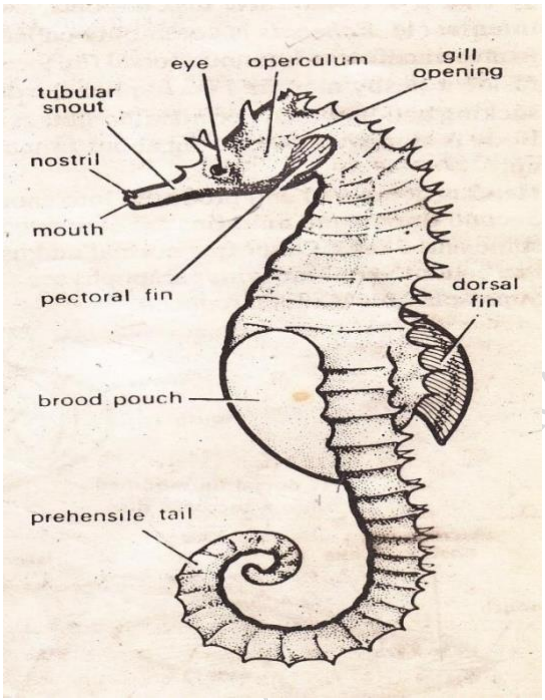
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Group	:	**Pisces**
Class	:	**Osteichthyes**
Sub Class	:	**Actinopterygii**
Super Order	:	**Teleostei**
Order	:	**Pleuronectiformes**



1) It is commonly called as flat fish and edible fish.
2) Body is assymmetrically compressed and is covered by either cycloid or ctenoid scales
3) Anterior end of the head is projected of snout. Mouth is small slit-like with toothed jaws.
4) Dorsal, ventral and candal fins are unpaired and continuous with each other.
5) Pectoral and pelnic fins are present at the anterior end.
6) Anterior end of the cranium is a symmetrical. Thus the lateral eyes come to lie on the left side of the head.
7) Air bladder is present which is hydrostatic organ.
8) Operculum is large, leaf like covering the gills.
9) Unisexual, oviparous.

10) Hippocampus :

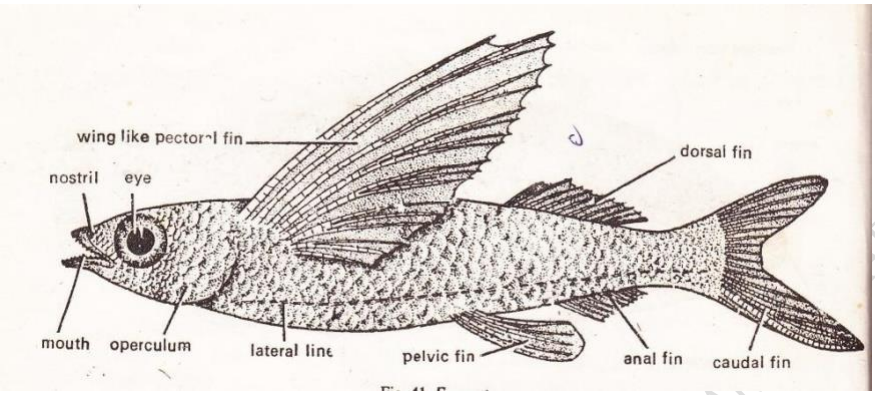
Phylum : **Chordata**
Sub Phylum : **Vertebrata**
Super Class : **Gnathostomata**
Group : **Pisces**
Class : **Osteichthyes** Sub Class : **Actinopterygii**
Order : **Solenechthyes**



1) It is commonly called as sea horse.
2) Body divisible in to head, trunk and tail.
3) Head resembles the head of the horse. It contain elongated rostrum with terminal mouth.
4) A pair of supra orbital spines are present just above the eyes.
5) Pectoral fins are located at the junction between head and the snout. Transparent pelvic fins are present.
6) Body is covered by cutes (bony oscicler) which are modified scales.
7) Dorsal fin is enlarged. Ventral and caudal fins are absent.
8) Gills are covered by an operculum.
9) Tail is prehensile which helps in slow and vertical movement.
10) Unisexuals. Males have a brood pouch opposite to the dorsal fin. It is useful for protecting eggs till they hatch into young ones.

Exocoetus :

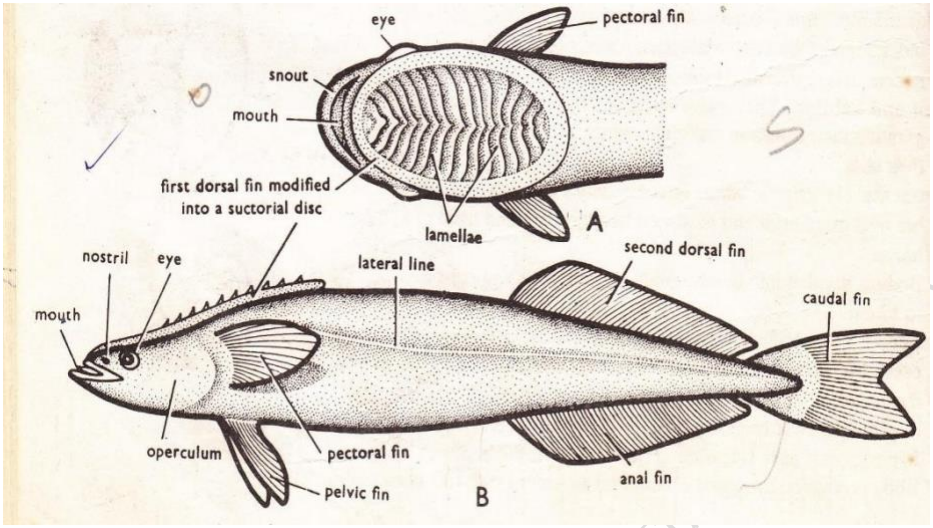
Phylum : **Chordata**
Sub Phylum :**Vertebrata**
Super Class :**Gnathostomata**
Group :**Pisces**
Class :**Osteichthyes** Sub Class :**Actinopterygii**
Order :**Senentognathi**



1) It is commonly called as flying fish.
2) Body divisible into head, trunk and tail.
3) Body is long and laterally compressed.
4) Head contain small mouth bounded by toothed jaws.
5) Body is covered by cycloid scales.
6) Dorsal and ventral fins are unpaired supported by fin rays.
7) Pectoral fins are enlarged and modified into wing like organs for jumping for shorter distances.
8) Tail is homocercal.
9) Unisexuals, and oviparous.

Echenis

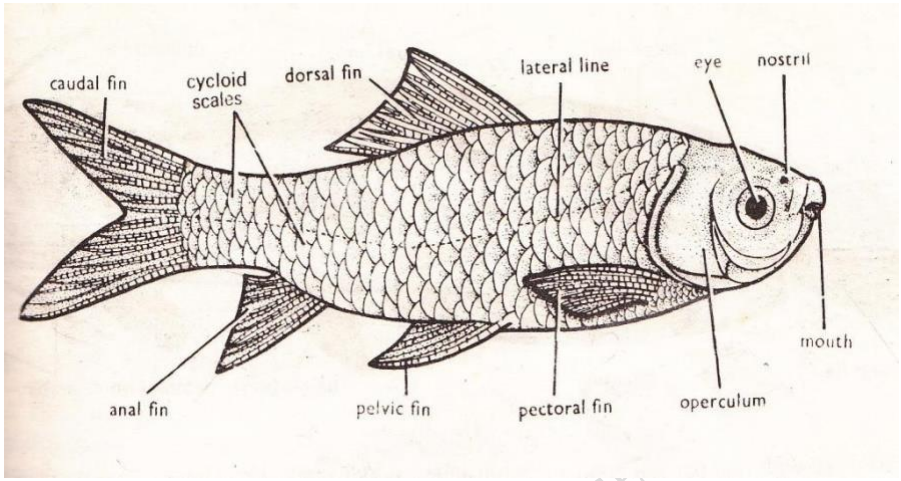
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Group	:	**Pisces**
Class	:	**Osteichthyes**
Sub Class	:	**Actinopterygii**
Order	:	**Discocephalii**



1) It is commonly called as Sucker fish.
2) Body divided into head, trunk and tail.
3) Body is laterally compressed covered by small scales.
4) Head contain wide mouth anterio-dorsally.
5) Paired pectoral and pelvic fins are present. Dorsal and ventral fins are unpaired. The anterior dorsal fin is modified into a dorsal sucker, supported by powerful muscles.
6) Tail fin is homocercal.
7) Laterally head contain a pair of small eyes.
8) Air bladder is absent.
9) Unisexuals and oviparous.

Labeo *rohita*

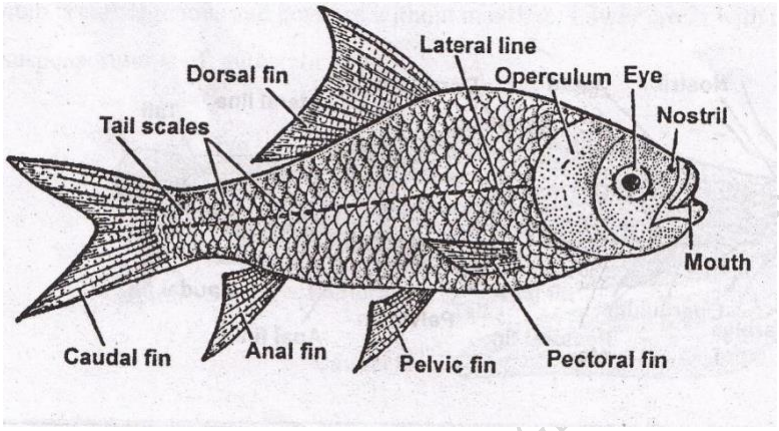
Phylum	:**Chordata**
Sub Phylum	:**Vertebrata** Super
Class	:**Gnathostomata**
Group	:**Pisces**
Class	:**Osteichthyes**
Sub Class	:**Actinopterygii**
Order	:**Ostariophysi**



1) It is commonly called as Rohu.
2) It is fresh water and edible fish.
3) Body is spindle in shape divided into head, trunk and tail.
4) Pectoral and pelvic fins are paired and dorsal, ventral and caudal fins are unpaired, which are supported by cartilaginous fin rays.
5) Head bear dorsoventrally flattened snout with mouth bounded by fleshy lips.
6) A pair of long cirri arise from the upper lip.
7) Body is covered by cycloid scales.
8) Gills and gill chambers are covered by an operculum.
9) Ampullae of lorenzini present in the lateral line as sense organ open out through small openings.
10) Unisexual, oviparous.

Catla *catla*

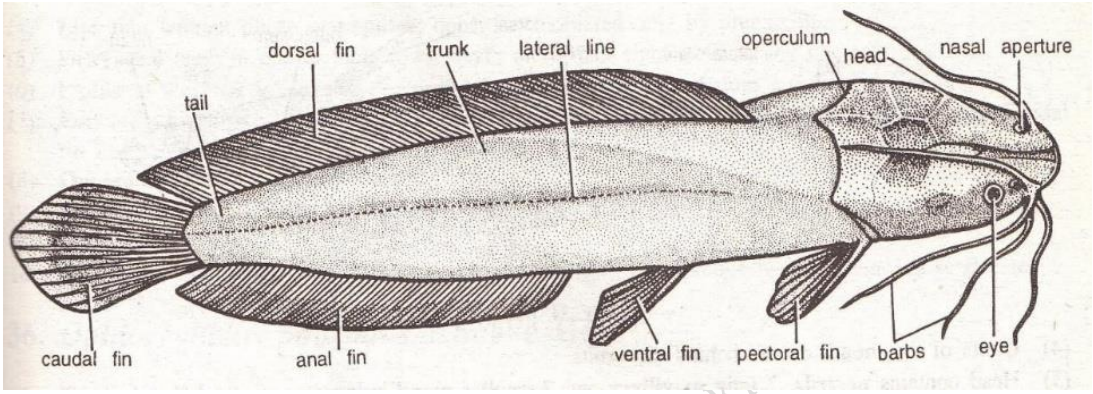
Phylum	:**Chordata**
Sub Phylum	:**Vertebrata** Super
Class	:**Gnathostomata**
Group	:**Pisces**
Class	:**Osteichthyes**
Sub Class	:**Actinopterygii**
Order	:**Ostariophysi**



1) It is major fresh water carp.
2) Body divisible into head, trunk and tail.
3) Head is prominent and large with mouth bounded by lips.
4) Body is covered by cycloid scales and trunk is stout wide.
5) Tail fin is homocercal.
6) The head contains prominent eyes and small nostril.
7) Unisexual and oviparous.

Clarius *batracus*

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Group	:	**Pisces**
Class	:	**Osteichthyes** Sub
Class	:	**Actinopterygii**
Order	:	**Ostariophysi**



1) It is commonly called as Climbing perch.
2) Body is laterally compressed divided into head, trunk and tail.
3) Head is laterally compressed with a pair of lateral eyes, a pair of terminal nostrils, four pairs of long cirri.
4) Spiny pectoral fins, dorsal and caudal fins are present.
5) Circular lobe like diphycercal tail fin is present.
6) Body is smooth and scale less.
7) Air bladder is present having connection with the lung.
8) Acessary respiratory organs are present.
9) Unisexual, oviparous.

Anguilla *anguilla*

Phylum	:**Chordata**
Sub Phylum	:**Vertebrata** Super
Class	:**Gnathostomata**
Group	:**Pisces**
Class	:**Osteichthyes**
Sub Class	:**Actinopterygii**
Order	:**Angvilli forms.**

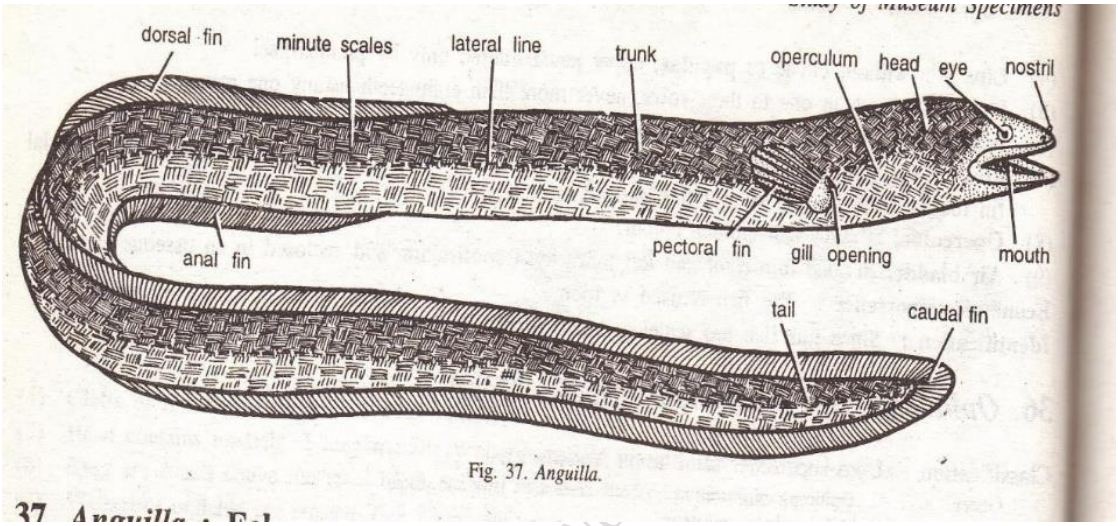


Fig. 37. *Anguilla.*

1) It is commonly called as Eel – fish.
2) Marine and snake like fish.
3) Body is slender and laterally compressed divided into head, trunk and tail.
4) Mouth is dorso-ventral in position.
5) Gills are covered by an operculum.
6) Body covered by very minute microscopic scales.
7) Paired pectoral fins are present and pelvic fins are absent.
8) Dorsal, ventral and caudal fins are continuous along the margins of the body.
9) It show catadromous migration.
10) Unisexual, oviparous, development is indirect through leptocephalus larva.

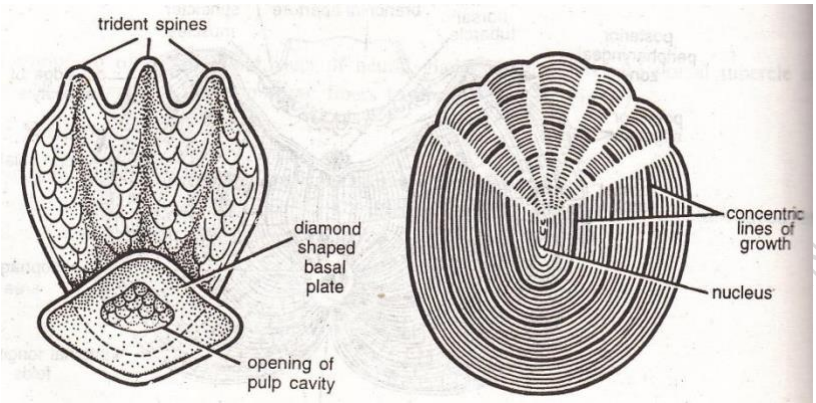
Scales in fishes

In fishes exoskeleton is made by scales developed from the dermis of the skin.

· They are 3 types

1) Placoid Scales 2) Cycloid Scales 3) Ctenoid Scales

1) Placoid Scales



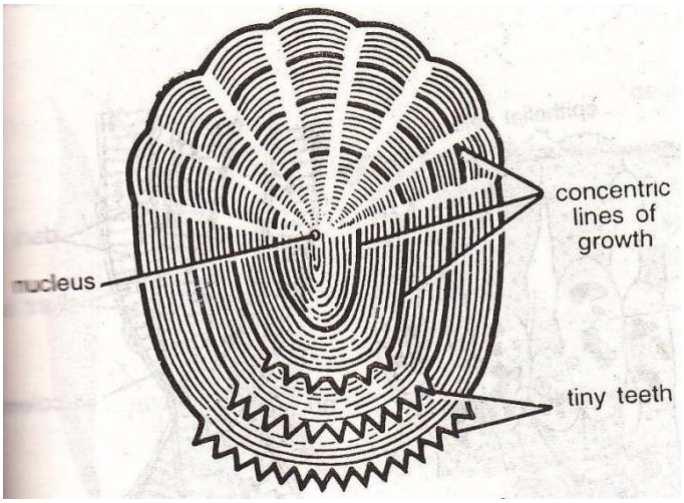
1.Placoid **2.Cycloid**

1) These scales are present in cartilagenous fishes.
2) Each placoid scale has a basal plate and a spine.
3) The spine is a trident. It is formed of dentine.
4) The dentine is covered with a hard layer of introdentine.
5) The dentine encloses a pulp cavity which opens below through the basal plate. Blood vessels and nerves enter the pulp cavity.
6) The pulp cavity filled with pulp. The pulp contains many odontoblasts.

2) Cycloid Scales:

1) They are found in bony fishes namely Dipnoi fishes and Carps.
2) They are thin and circular in outline.
3) Anterior part of the scale is embedded in the skin and the posterior part is exposed.
4) Each scale contain a central focus and a number of concentric lines. There are called the lines of growth. They help in determination of age of fishes.

3) Ctenoid Scales :

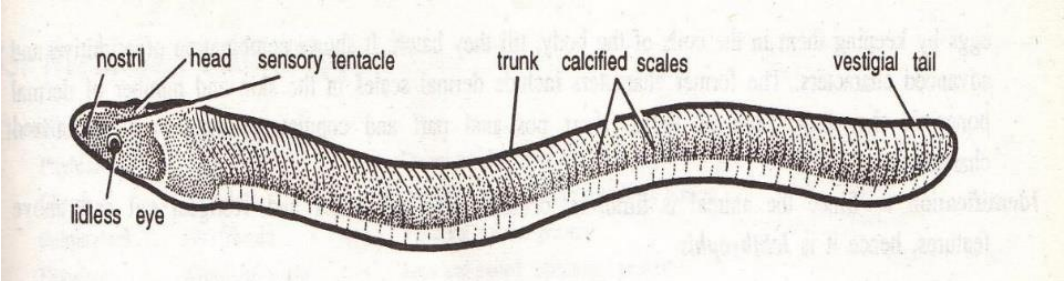


1) These scales are found in Teleost and Dipnoi fishes.
2) The posterior free part of one scale covers the anterior embedded part of the next scale.
3) They resemble the sycloid scales in all respects except for the presence of the horny teeth.
4) Each scale has a central focus and a number of concentric lines.
5) These scales contain chromatophores which give colour to the body.

AMPHIBIA

Icthyophis *glutinosa*:

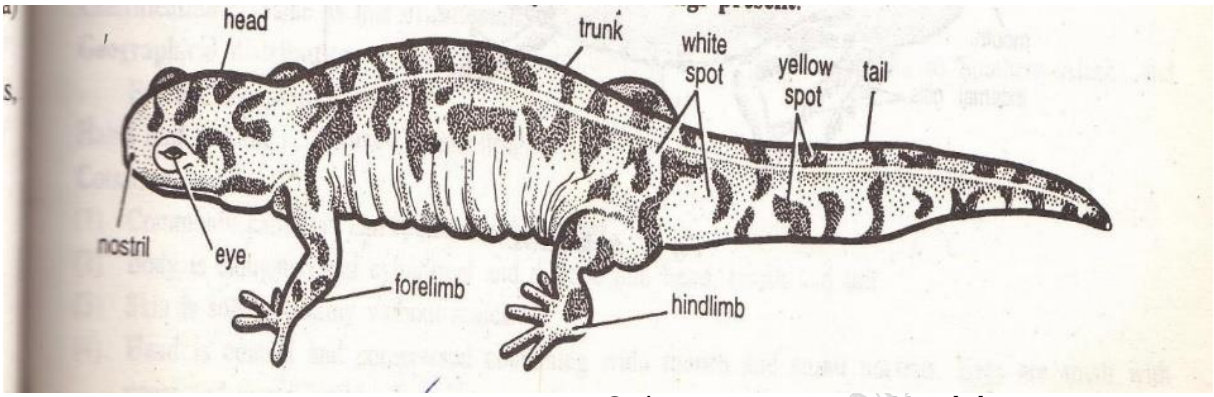
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomat**
Class	:	**Amphibia**
Order	:	**Apoda**



1) It is commonly called as limbless amphibian or caecilian.
2) The body is elongated, worm-like and divided into a head and trunk.
3) Body is covered with a smooth, slimy and transversely ringed skin consting of small calcified scales arranged in transverse rows.
4) Eyes are small and covered by a fold of skin.
5) A short sensory tentacle is present in between the eye and nostril.
6) Limb girdles and limbs are absent.
7) Anus is present ventrally.
8) Unisexuals and oviparous.
9) Fertization is internal.
10) In males, cloaca is everted like copulatory organ.
11) Females curl around the folky eggs and take care till they hatch.

Amblystoma *tigrinum* :

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Amphibia**

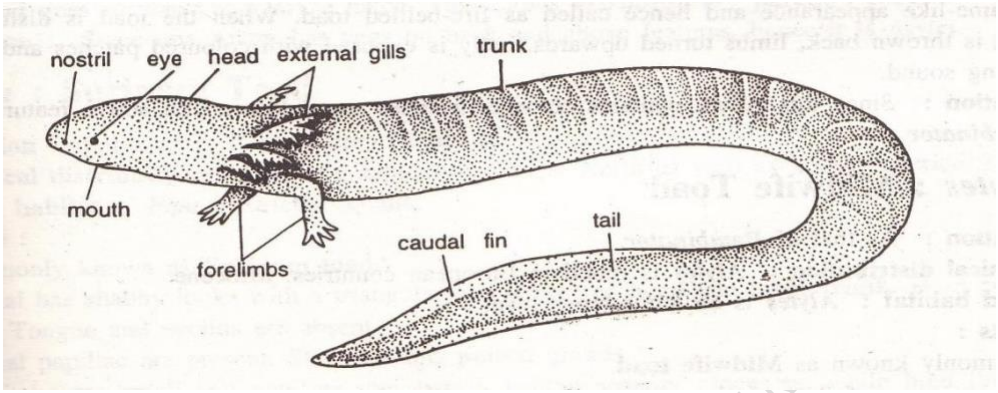


Order	:	**Urodela**

1) It is commonly called as Tiger salamander or spotted salamander.
2) It is tailed amphibian, body divided into head, trunk and tail.
3) Skin is devoid of scales.
4) Forelimbs with 4 fingers and hind limb with 5 toes.
5) The head contains small eyes with eyelids.
6) Tympanic cavity and auditory ossicles are absent.
7) Unisexual and oviparous.
8) Fertilization is internal.
9) Development is indirect takes place through neotenic larval form called Axolotl larva.

Siren:

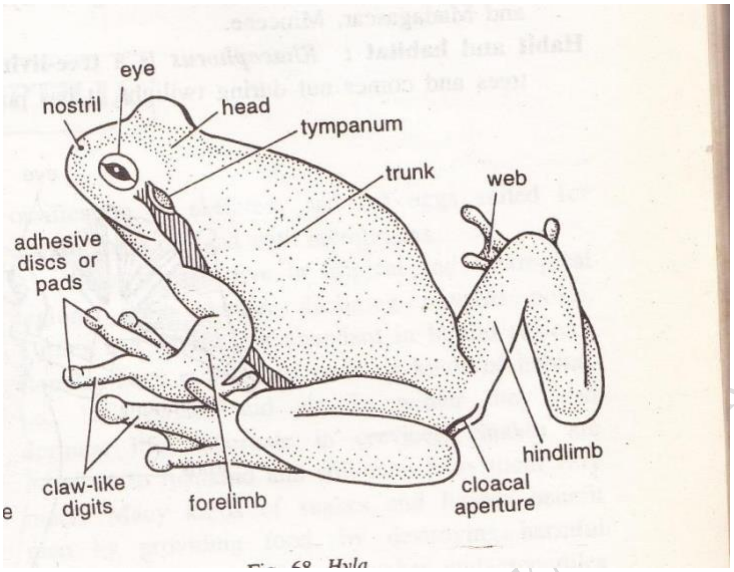
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Amphibia**
Order	:	**Urodela**



1) It is commonly called as mud eel.
2) Body resembles a snake and divided into head, trunk and tail.
3) There are three pairs of external gills which are persistent. Gill-slits one pair.
4) Fore limbs are small containing 4 digits while hind limbs are absent.
5) Head is conical with small eyes and nostrils and the eyes are without eyelids.
6) Tail contains fin and helps in locomotion.
7) Unisexual and oviparous.
8) Fertilization is external.
9) Development is indirect.

Hyla *arborea* :

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Amphibia**
Order	:	**Anura**



1) It is commonly called as Tree toad.
2) Body is divided into head and trunk. Neck and tail are absent.
3) Head is provided with a pair of eyes with transverse pupil.
4) Ventral surface of the body is granular with hygroscopic glands with produce mucus.
5) Fore limbs are shorter than hind limbs.
6) Fingers contain adhesive pads to get firm grip on the substratum
7) Thin web is present between the fingers for leaping in air.
8) Unisexuals and oviparous. Fertilization is external.

RHACOPHORUS

Phylum.....Chordata

Subphylum ....Vertebrata

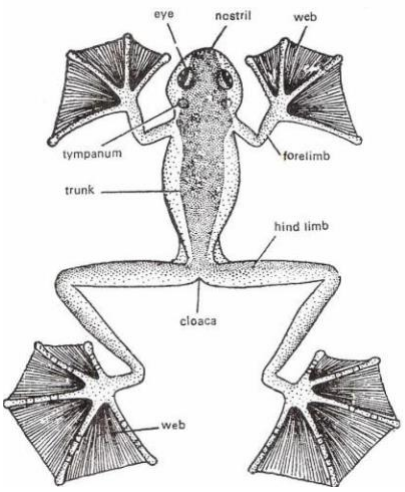
Division .....Gnathostomata.

Subclass……: Tetrapoda

Class .....Amphibia

Order..... Anura

. Genus..... *Rachoporus*



1. *Rhacophoras is* commonly known as **flying frog or tree frog.** Body slender, divided into head andtrunk. Belly narrows posteriorly. Females larger than males.

2. Head broad and somewhat conical.

3. Eyelids well developed. Tympanum behind eyes.

4. Limbs elongated and contain well-developed webs in digits which also bear adhesive cushions at tips. Digits of hin limbs also contain intercalary cartilagm

5. The flying frogs climb on trees and walls and occasionally glide and while alighting on ground, the webs are spread the parachute.

6. Geographical distribution. The tree frogs

BUFO

Phylum.....Chordata

Subphylum ....Vertebrata

Division .....Gnathostomata.

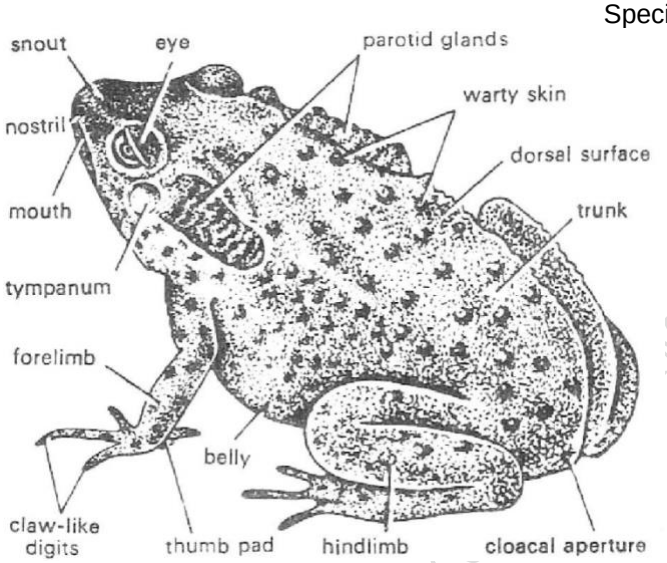
Subclass……: Tetrapoda

Class .....Amphibia

Order..... Anura

. Genus..... *Bufo*.

Species.....m*elonosticus*



1. *Bufo* is commonly called as true **toad**.

2. It differs from frog in having rough, dry and warty skin with more poison glands than mucous glands. The skin is more or less of protective nature than respiratory.

3. Body divided into head and trunk. Head contains large eyes, nostrils and tympanum.

3. Behind eyes there is a pair of large parotid poison glands.
Hind-limbs are short. Toes provided with horny tips and poorly developed webs.

4. Maxilliary teeth, sternum absent and ventral parts of pectoral girdle overlap (arciferous). Sacral vertebra has dilated transverse processes. Vertebrae procoelus. Urostyle with double condyle.

5. Special features: The parotid glands of the toad secrete two toxic substances, bufotalus and bufogus. These toxins cause nausea, respiratory and muscular disturbances and also effect heart functioning, if swallowed by man. *Bufo melanostictus* is found upto 3000 meters in the Himalayas.

Rana *tigrina* :

Phylum : **Chordata**
Sub Phylum : **Vertebrata**
Super Class :**Gnathostomata**
Class : **Amphibia**

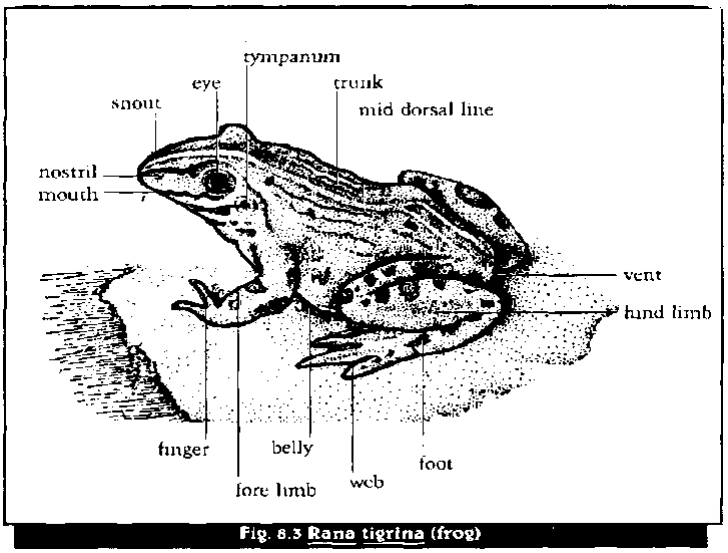
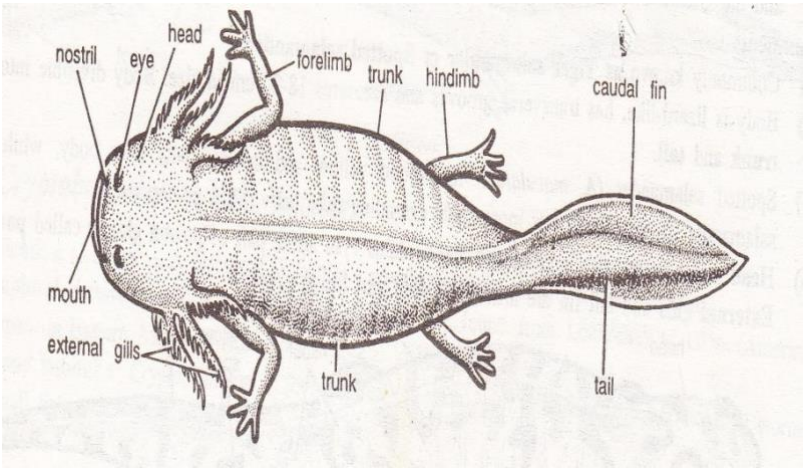


Fig. 8.3 Rana tigrina (frog)

1) It is commonly called as Indian bull frog. Size larger-the largest of the Indian frogs.
2) Body is divided into head and trunk. Neck and tail are absent.
3) Head contain mouth anterio-ventrally. A pair of eyes, a pair of nostrils and a pair of typanum are present in the head.
4) Body is slimy and mucilaginous.
5) Fore limbs are short and hind limbs are long. The limbs are pentadactyle.
6) Unisexuals, exhibit sexual dimorphism. Oviparous.
7) Fertilization is external and development is indirect takes place through tadpole larva.

Axolotl larva:

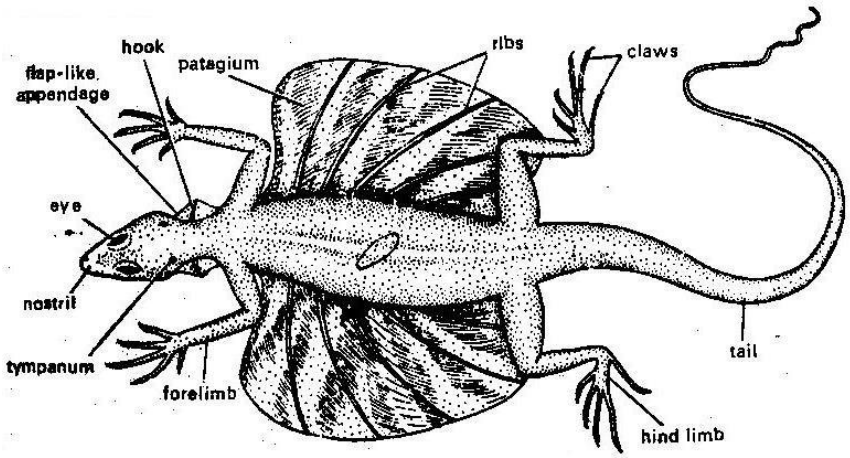


1) It is neotenous larva
2) It is the larval form in the life cycle of Amblystoma.
3) Body is long and dorso-ventrally flattened.
4) The head is broad and is provided with a pair of lateral eyes and a terminal mouth.
5) 3 Pairs of external gills and 4 pairs of gill clefts are present near the neck.
6) Fore limbs and hind limbs are weak not useful for locomotion.
7) Tail fin useful for locomotion.
8) It exhibits the phenomenon of neotony or paedogenesis.

REPTILES

Draco :

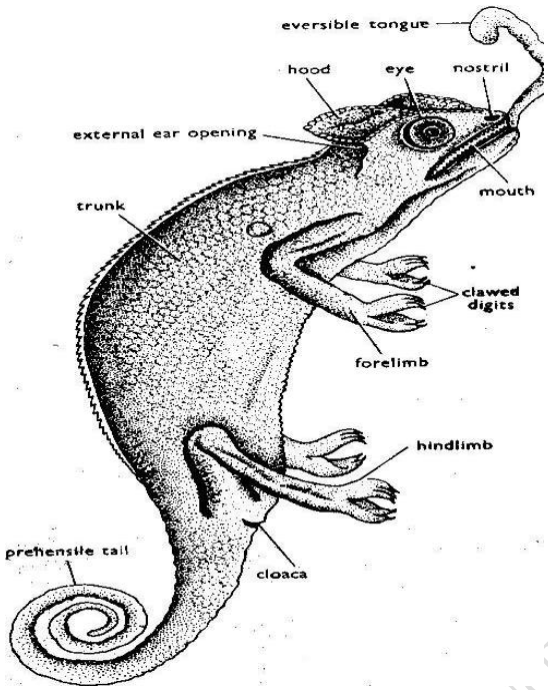
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Reptilia**
Order	:	**Squamata**
Sub Order	:	**Lacertelia**
Family	:	**Agamidar**



1) It is commonly called as flying lizard.
2) It is a tree lizard found in the forest area.
3) Body is dorsoventrally flattened divided into head, trunk and tail.
4) The eyes are with eyelids.
5) Gular pouch is present just beneath the neck. It is large in males. Spines of this pouches help in holding the leaves.
6) Fore limbs and hind limbs are present. Limbs are pentadactyl. Digits and toes ends in powerful claws.
7) Skin extends as on extensive patagium in between fore limbs and hind limbs.
8) Petagia are supported by fire soft rib like bones. They fly with the help of petagia.
9) Tail is long and whip like.
10) Unisexuals. Exhibit sexual dimorphism. Oviparous.

Chaemeleon :

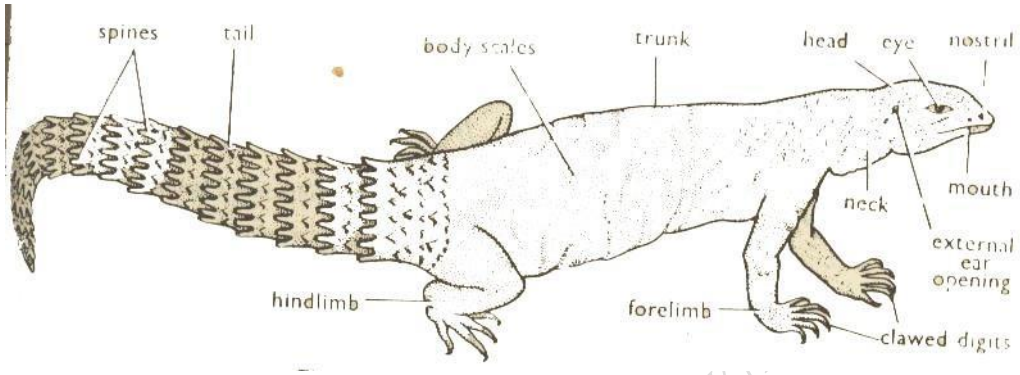
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Reptilia**
Order	:	**Squamata**
Sub Order	:	**Lacertelia**
Family	:	**Chamaeleontidae**



11) It is arboreal lizard exhibit mimicry.
12) Body is laterally compressed divided into head, neck, trunk and tail.
13) The head contains a pair of large eyes and show independent movement.
14) A pair of fore limbs and a pair of hind limbs are present. In fore limbs, the inner 3 and outer 2 fingers are fused to form two groups and in the hind limbs, the inner 2 and outer 3 fingers are fused to form two groups. These are used to grasp the branches of trees.
15) The tail is long and prehensile.
16) It has the power of changing its colour very often known as mimicry
17) Head contain a crown or hood.
18) Unisexuals and oriparous.

26) Uromastix

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Reptilia**
Order	:	**Squamata**
Sub Order	:	**Lacertelia**



1) It is commonly called as desert lizard.

2) Body is divided into head, neck, trunk and tail.

3) Skin is dry, rough and covered by scales.

4) A pair of fore limbs and a pair of hind limbs are present. Limbs are pentadactyl. Fingers contain claws.

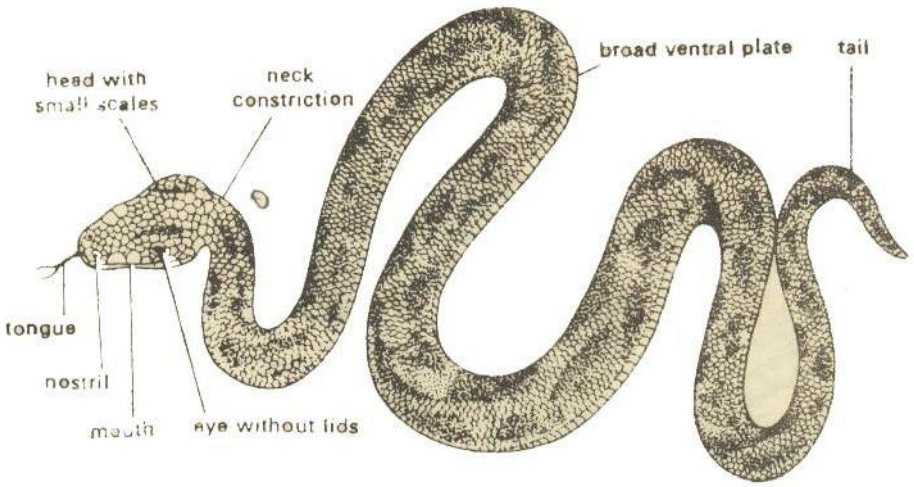
5) Tail is long and can regenerate when it lost.

6) Skull is of diapsid type.

7) Unisexuals and oviparous.

27) Vipera *russeli*

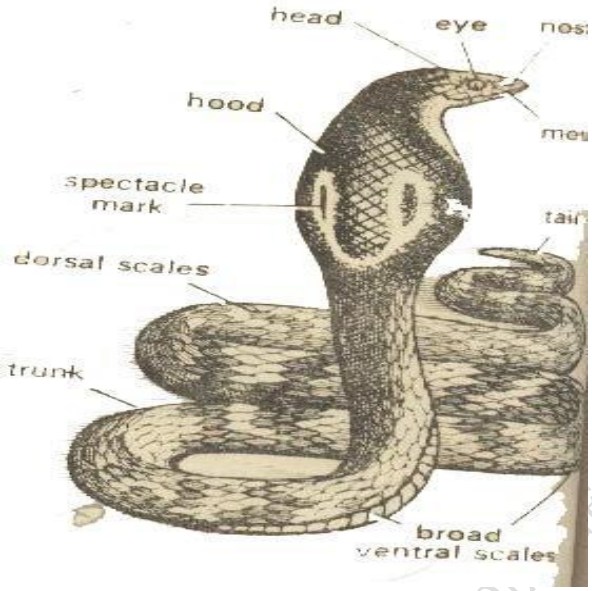
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Reptilia**
Order	:	**Squamata**
Sub-Order	:	**Ophidia**



1) It is commonly called as Russel's viper or Chain viper.
2) Body is long and stout divided into head, trunk and tail.
3) Head is triangular and is covered by scales.
4) It contains a pair of eyes with a vertical pupil inside.
5) A dorsal spot is present in between two eyes on the head.
6) Nostrils are large which produce hissing sound.
7) 3 rows of diamond shaped coloured rings are present over the body arranged in the form of chains.
8) Sub caudals are divided
9) Poisonous snake. Venom contain cardiotoxins and they affects on blood vascular system.
10) Unisexuals and oviparous.

Naja *naja*

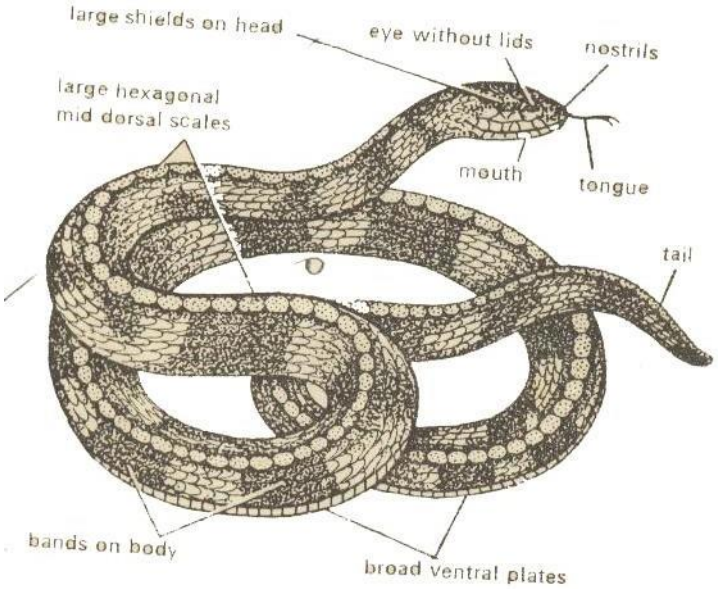
- Phylum :Chordata
- Sub Phylum :Vertebrata
- Super Class :Gnathostomata
- Class :Reptilia
- Order :Squamata
- Sub-Order :Ophidia
- Family : Elapidae



1. It is commonly called as Cobra.
2. It is a poisonous snake.
3. Body is divided into head, trunk and tail.
4. Anteriorly, the head is covered by plates.
5. Neck is expanded to form the hood with spectacle on the dorsal side and two black scars on the ventral side.
6. Third supra lebial toches the nostril and eye.
7. A tiny wedge-shield on the undersurface of the 4th and 5th lower labials.
8. Ventrals are wide and sub caudals are divided. Body is covered by smooth oblique scales.
9. Unisexuals and oviparous.
10. Venom contains neurotoxin and affects the nervous system.

Bungarus *coeruleus*

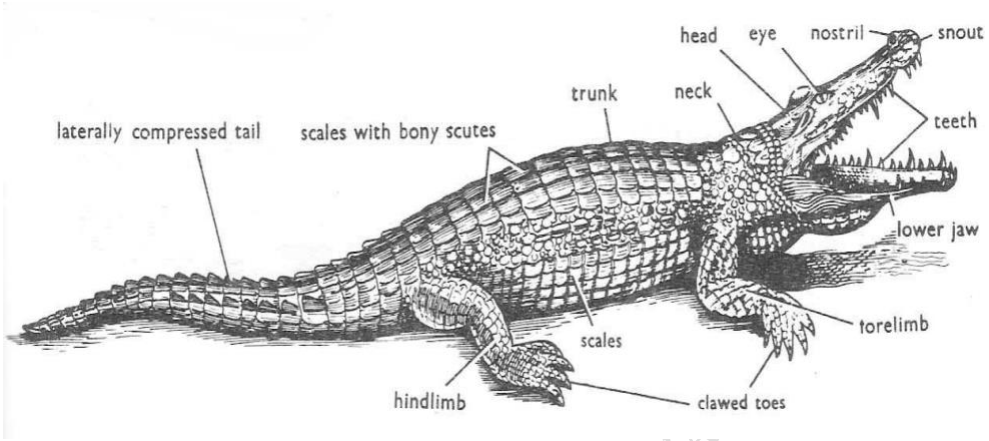
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Reptilia**
Order	:	**Squamata**
Sub-Order	:	**Ophidia**
Family	:	**Elaphidae**



1) It is commonly called as Krait.
2) It is a poisonous snake is four times powerful than the venom of Cobra.
3) Body is divided into head, trunk and tail.
4) Head is covered by bony plates. 4th sub labial is large.
5) Mid dorsal scales are hexagonal and ventrals are wide extending the entire ventral surface.
6) Sub caudals are entire and tail is tapering.
7) Unisexuals and oviparous. A female shows parental care.

CROCODILE

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Reptilia**
Order	:	Crocodilla

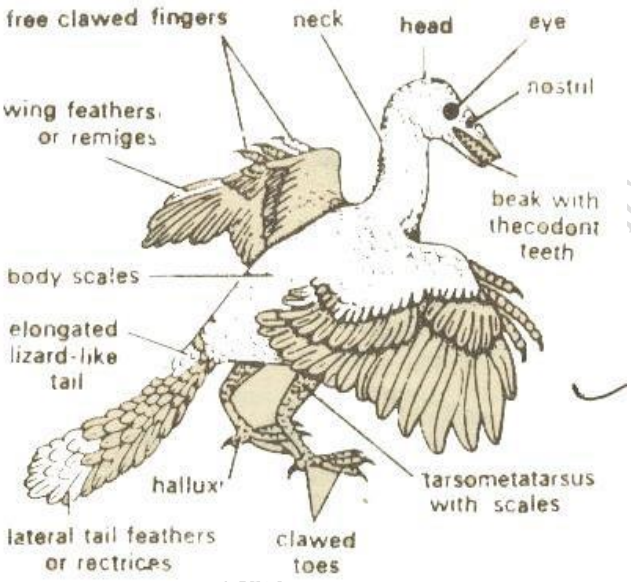


1. *Crocodylus* is commonly known as Crocodile or Mugger.
2. Body is stout, elongated, 4-6 metres in length and divided into head, trunk and tail.
3. Surface covered by leathery armour of osteoscutes arranged in transverse rows.
4. Upper part of the body is dark olive brown with black spots or bends.
5. Its head long and triangular and narrows towards snout which is not differentiated from the rest of the skull. Jaws long, powerful, rimmed with numerous bluntly conical and unequal teeth, dental formula 16-19/14-15. The first tooth fits into a pit and fifth mandibular tooth into a notch on the outer side of upper jaw.
6. Ear opening small and protected by a small flap of skin.
7. Tongue not protrusible.
8. Tail long, heavy and laterally compressed.
9. Fore and hind limbs short and pentadactyle, with 5 fingers and 4 toes, ending in claws and with webs.
10. Heart 4-chambered with separate ventricles. Bladder absent

AVES

Archaeopteryx

Phylum	:	Chordata
Sub Phylum	:	Vertebrata
Super Class	:	Gnathostomata
Class	:	Aves
Super Class	:	Neornithes



The fossil of Archaeopteryx lithographica belonging to late Jurassic period (140 millions ago), was discovered in 1861 from Bavaria, Germany. It has both reptilian as well as avian characters.

A. Reptilian characters:

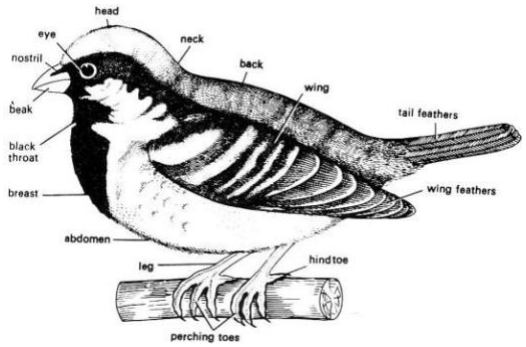
1) Epidermal scales over body and limbs.
2) Simple brain, cylindrical cerebral hemispheres and unexpanded cerebellum.
3) Jaws with peg-like homodont teeth lodged in sockets.
4) Vertebrae amphicoelous.
5) Sternum poorly developed, without keel.
6) Cervical vertebrae few (9 or 10).
7) Tail long, tapering lizard-like with free 20 caudal vertebrae.
8) Carpals and metacarpals free.

B. Avian characters:

1) Presence of feathers. Forelimbs modified as wings for flight bearing remiges and 3 digits each.
2) Two jaws like beak.

Passer

Phylum	:	Chordata
Sub Phylum	:	Vertebrata
Super Class	:	Gnathostomata
Class	:	Aves
Order	:	*Passeriformes*
Genus	:	*Passer.*
Species	:	*domesticus*



It is the common house sparrow . Its Hindi name is Gauriyya.

2. It is a small bird measuring 10-16 cm in length.

3. Sexual dimorphism is distinct. Female is ash white, while male is earthy brown with blackish throat and breast and white abdomen.

4. Eyes small and the beak is short and conical head.

5. Feet adapted for perching. Toes 3 in front and 1 behind.

6. Nesting practically throughout the year. Some make elaborate nests; lay 3-8 eggs.

7. Young naked and blind at hatching, require feeding and care by parents before becoming independent.

8. Special features: The sparrows are both useful and harmful to mankind. They destroy several agricultural pests. They destroy vegetable and flower buds.

Psittacula *crameri*

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Aves**
Super Class	:	**Neornithes**
Order	:	**Psittaciformes.**

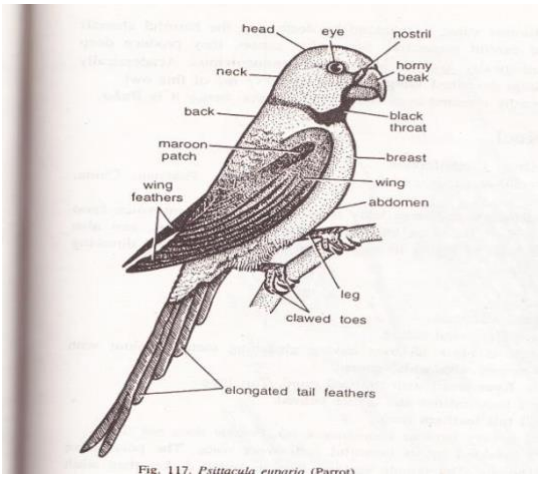
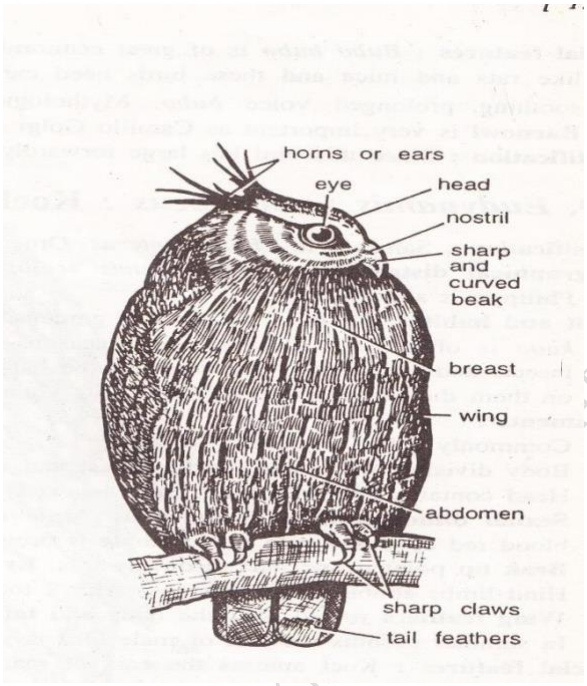


Fig. 117. *Psittacula eupatria* (Parrot)

1) It is commonly called as Parrot.
2) It is a pet bird living in stem pits and crevices of the walls.
3) Body is divided into head, neck trunk and tail.
4) Body is covered by attractive green feathers.
5) Beak is short and hooked. It is bright reddish in colour.
6) Tail feathers are longer than the contour and wing feathers.
7) Fore limbs are modified into wings. The hind limbs contain forwardly directed 2^{nd} and 3^{rd} toes and backwardly directed 1^{st} and 4^{th} toes to facilitate grip over the substratum.
8) Unisexuals and oviparous, Female is green all over, but, males have a pink girdle at the neck region and a black spot near the throat.

Bubo *bubo*

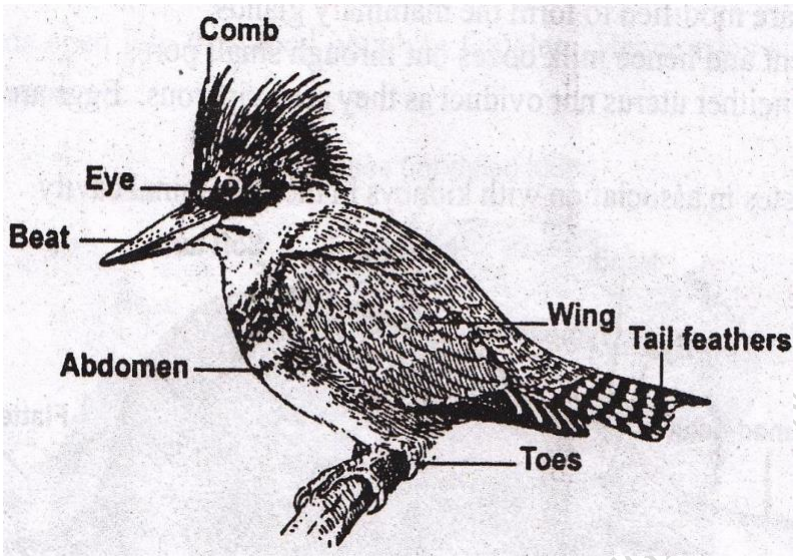
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Aves**
Super Class	:	**Neornithes**
Order	:	Streigiformes



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

Alcedo *athes*

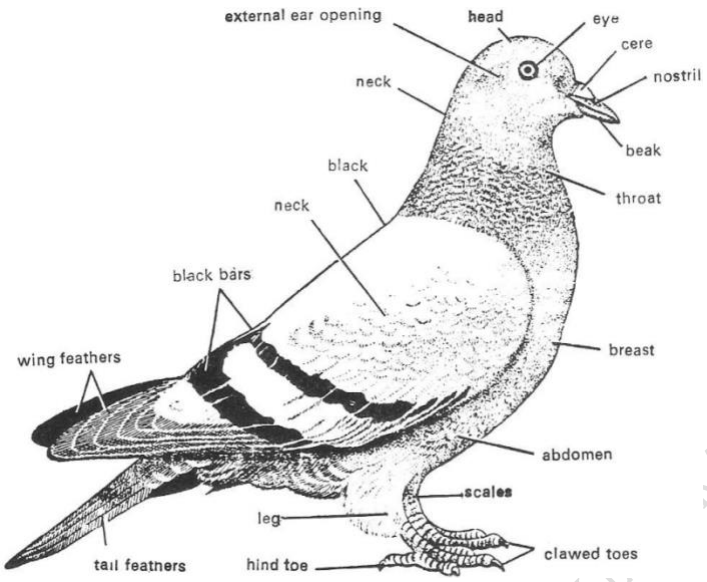
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Aves**
Super Class	:	**Neornithes**
Order	:	**Coraciformes**



1) It is commonly called as King fisher.
2) It is a small bird living along the bonk of ponds, lakes and rivers.
3) Body divisible into head, neck, trunk and tail.
4) The beak is long, straight and pointed.
5) Body is covered by deep coloured feathers.
6) Feet have 3 forwardly directed and 1 backwardly directed fingers. They help in holding the branches with a firm grip.
7) They live on the surface of water and feed on fishes, tadpoles and aquatic insects.
8) Unisexual and oviparous.

COLUMBA

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Super Class	:	**Gnathostomata**
Class	:	**Aves**
Super Class	:	**Neornithes**
Order	:	Columbiformes



1. *Columba* is commonly called as blue-rock pigeon and Kabutar in Hindi.

2. Body is divisible into head, neck, trunk and tail.

3. Plumage is grey with glistening metallic green and purple on breast and neck.

4. Head contains large eyes and slit-like nostrils. It is produced into a short and slender bill or beak. Upper and lower beaks are covered by the horny sheath, called rhamphotheca. At the base of the upper beaks there is a patch of skin called cere.

5. Eyes are large, rounded, with a well developed nictitating membrane and a rounded pupil.

6. Forelimbs are modified into Wings which contain besides skeleton flight feathers called as remiges. Feet are covered with epidermal scutes formed by the fusion of several reptilian epidermal scales.

7. Hind limbs are modified for bipedal locomotion. Tarsus usually shorter than toes.

8. Eggs white and unmarked.

MAMMALS

Ornithorhynchus :

Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Order	:	**Monotremata**

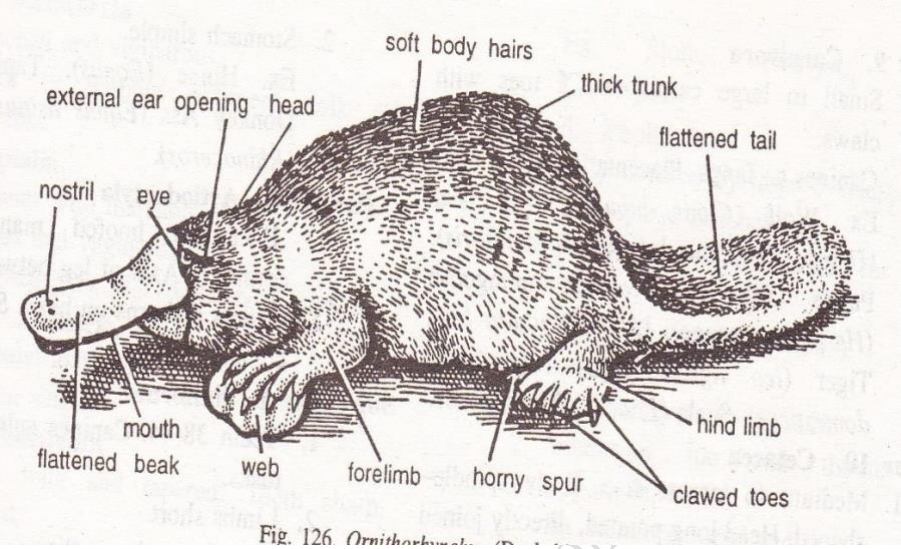
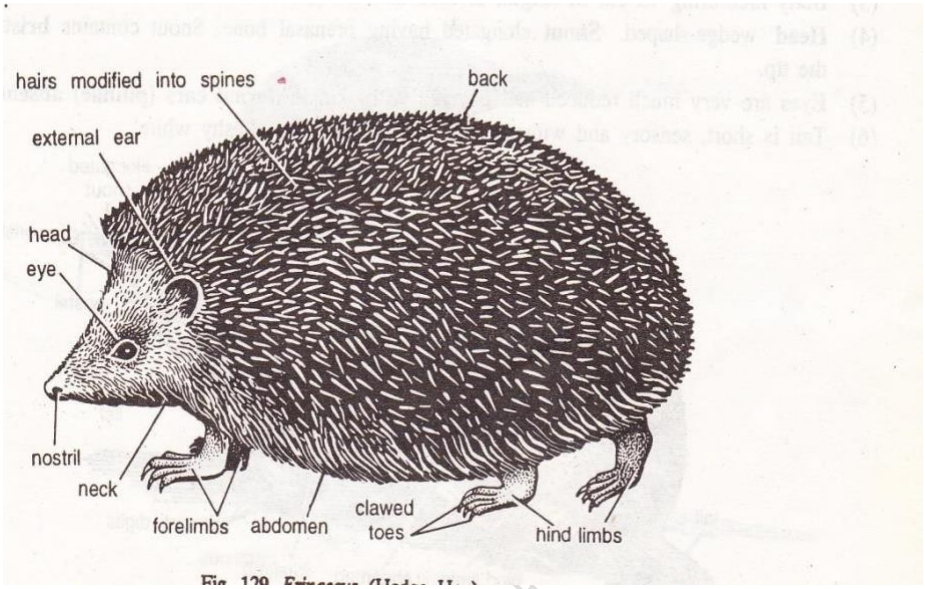


Fig. 126 *Ornithorhynchus* (Duck-billed platypus)

1) It is commonly called as duck-billed - platypus.
2) It lives in long burrows on river banks in Australia and Tasmania.
3) It is an aquatic egg laying mammal. The body is flattened and covered with soft brown fur.
4) Upper jaw forms a broad, flat muzzle like the bill of duck.
5) Eyes are small with nictitating membrane.
6) External ears are absent.
7) Tail is broad and flat for swimming.
8) Fore limbs are short and powerful with 5 digits with strong claws for digging. Web is present between the digits.
9) Hind limbs have five digits with sharp claws. The foot contain smaller web.
10) Unisexuals and oviparous.
11) In male, horny spur present on the inner side of the tarius and duct from the poison gland in the thigh.

Tachyglossus :

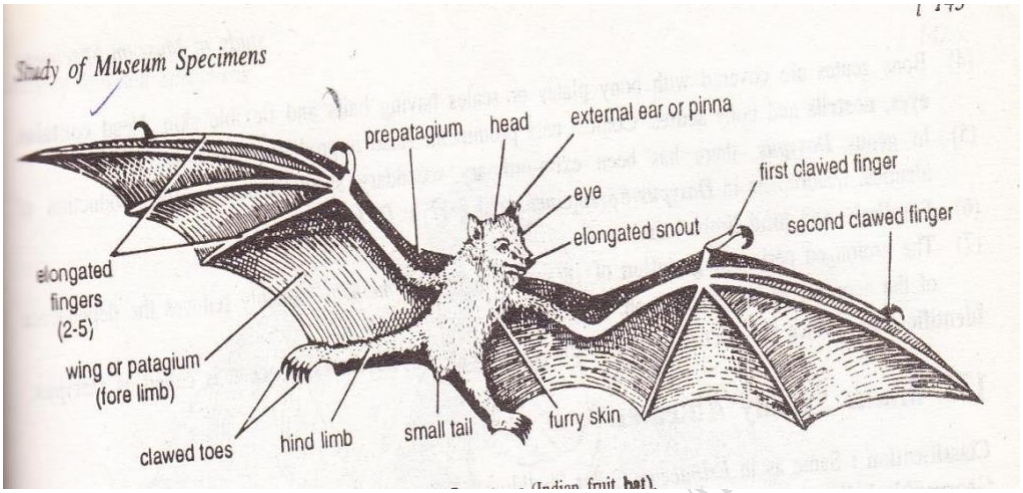
Phylum	:	**Chordata**
Sub Phylum	:	**Vertebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Order	:	**Monotremata**



12) It is commonly called as Echidna-Spiny ant-eater.
13) It is found in Australia and Tasmania.
14) The body is covered above with strong pointed spines and coarse hair but ventrally spines are absent.
15) Head contain long pointed snout.
16) Teeth are absent.
17) Eyes are small without nictitating membrane.
18) External ears are absent.
19) A pair of fore limbs and a pair of hind limbs are present.
20) In the hind limb 2nd digit has a long, curved toilet claw to clean the spines and hair.
21) Male possess horny poison spur on the tarsus and poison gland in the thigh.
22) They exhibit gynaecomastism.

Pteropus :

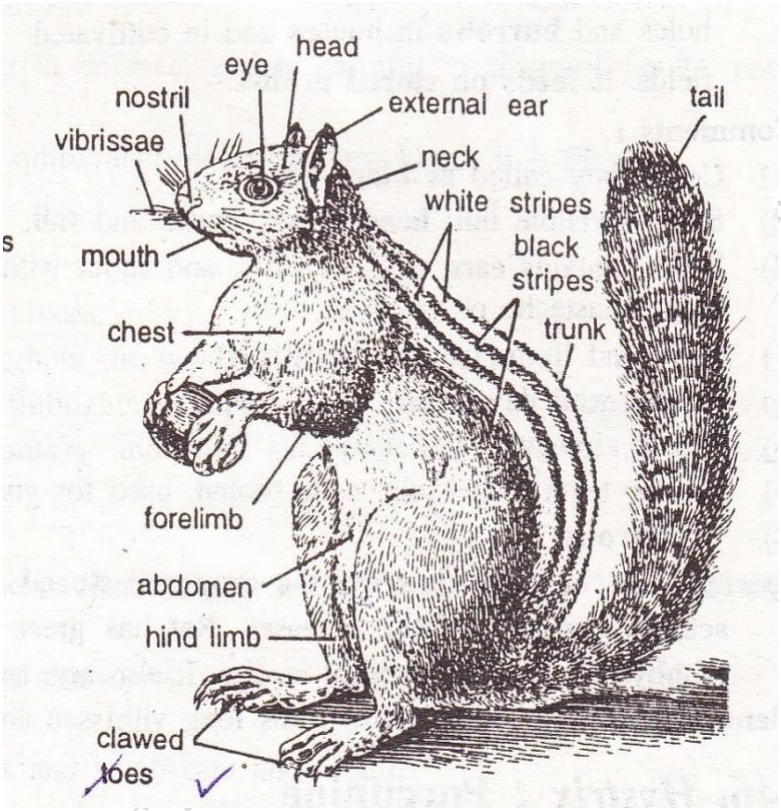
Phylum	:	**Chordata**
Sub Phylum	:	**Vretebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Order	:	**Chiroptera**



1) It is commonly called as flying fox.
2) The body is covered with brown fur.
3) Head contain long snout without nose leaf.
4) The face is like that of a fox in appearance
5) Eyes are large. Ears are oval and the two edges of the ear are in contact at the base.
6) Tail is absent.
7) The thumb and 2nd digit are clawed.
8) It is a large bat with a wing (poeticism) spread over five feet.
9) Unisexuals.

Funambulus :

Phylum	:	**Chordata**
Sub Phylum	:	**Vretebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Sub Phylum	:	**Vretebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Order	:	**Redentia**



1) It is commonly called as squirrel.
2) Body is elongated and covered with fur.
3) Body contains three white and grey stripes on dorsal side, absent on neck.
4) Eyes and pinna are large.
5) Tail is long and bushy.
6) Limbs with 5 clawed digits.
7) The soles of the fore limbs are necked and hind limbs are hairy.
8) Unisexuals.

Manis :

Phylum	:	**Chordata**
Sub Phylum	:	**Vretebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Sub Phylum	:	**Vretebrata**
Class	:	**Mammallia**
Sub Class	:	**Prototheria**
Order	:	**Pholidata**

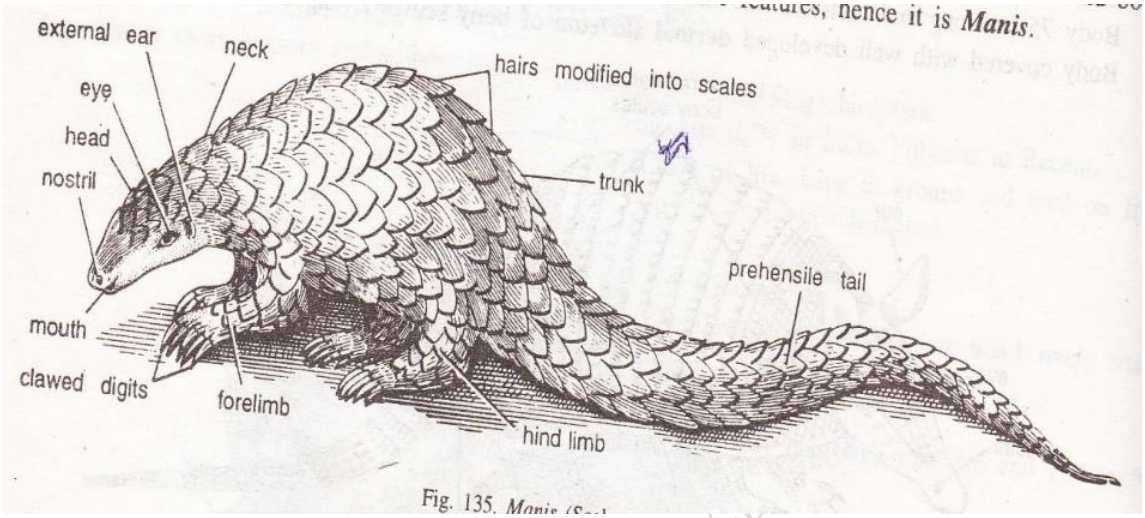


Fig. 135. *Manis* (Scal...

1) It is commonly called as scally ant-eater or pangolin.

2) The body is covered by rounded horny epidermal scales.

3) The head is small with a short pointed snout.

4) Eyes and pinna are small.

5) Teeth are absent and the tongue is long, viscous and extensible.

6) Limbs are short and strong with 5 clawed digits forelimbs contain long curved claws for opening ant and termite hills.

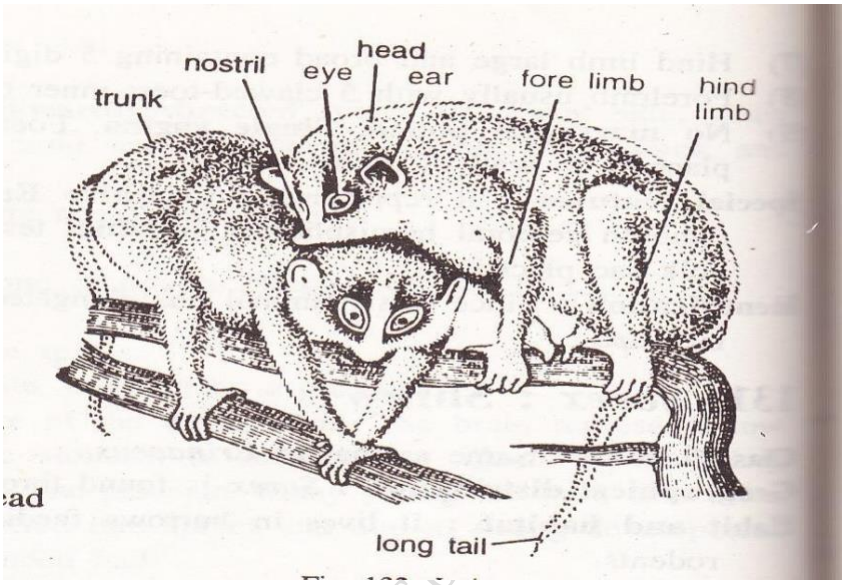
7) Tail is long and broad.

8) It is nocturnal in habit and insectivorous in diet. It has the habit of rolling into a ball as a protective measure.

9) Unisexuals.

Loris

Class	:	**Erinaceus**
Order	:	**Primates**
Suborder	:	**Lemuroidea**



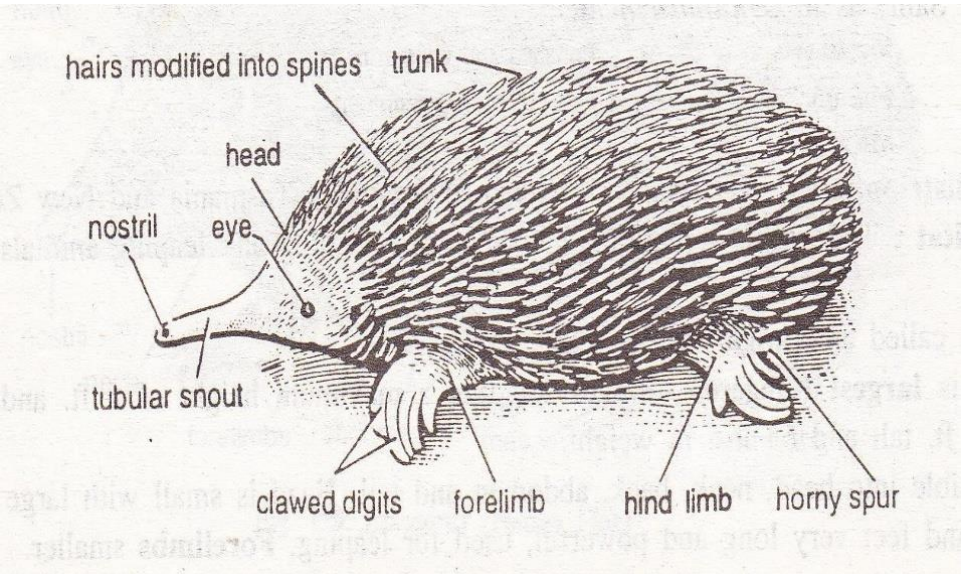
1) Body of Lories is covered with brownish fur with silver look. Fur is thick and wooly
2) Head small and produced into snout.
3) Eyes are closely placed. They are very distinct and bulging.
4) External ear or pinna is conical.
5) Nostrils in the form of small apertures.
6) Teeth thecodont and heterodont.
7) Tail long but not prehensile.
8) Limbs elongated. Some toes clawed, others with flat nails. Locomotion remarkably slow. It is often found hanging upside down.

Erinaceus :

Sub Class : **Theria**

Infra Class : **Eutheria**

Order : **Insectivora**



1) It is commonly known as hedge hog.
2) The body is covered by projecting spines which are modified hairs dorsally. Ventral surface has soft fur.
3) Head is small with a pointed snout.
4) Tail is small.
5) It has small black eyes and short pinna.
6) Legs are thin and short.
7) It is nocturnal animal and feeds on insects, slugs, fruits, birds and snakes.
8) It is immune to snake bite.
9) Unisexuals.

OSTEOLOGY

Varanus – Pectoral girdle.

1) Pectoral girdle provide protection to the heart and lungs. It provides support and space for attachment of fore limbs.

2) It contains two equal halves

3) Each half contain 4 bones – namely supra scapula, scapula, coracoid and clavicle

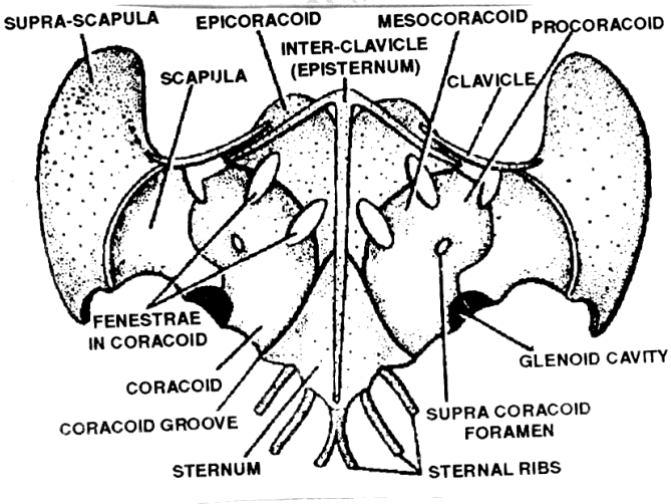
4) Scepula is a flat bone contains two large fenestrae which divides into procoracoid, mesocoracoid and coracoid proper.

5) Supra scapula is flattened, calcified and cartilaginous plate. It articulates ventrally with scapula.

6) At the junction between scapula and coracoids, a cup-shaped genoid cavity is present, in which head of humerus articulates and forms ball and socket joint.

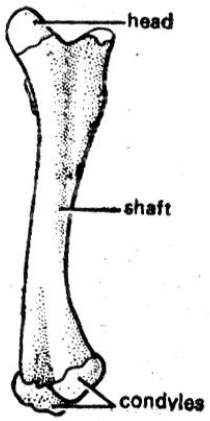
7) Scapula is flat and ossified bone.

8) Inter clavicle is T-shaped bone present between two halves



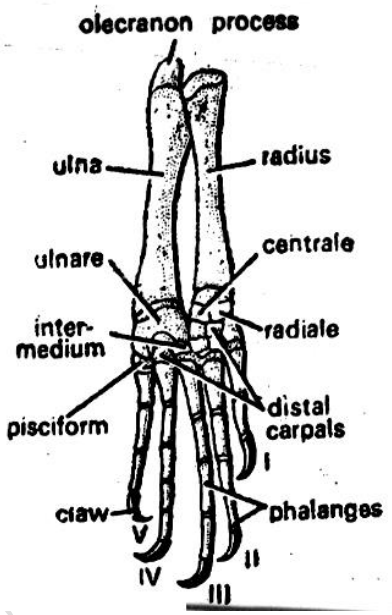
Humerus of Varanus:

1) It is the bone of the upper arm. It has an elongated shaft, both the ends are expanded.
2) The Proximal end bears the head which fits into the glenoid cavity forms ball and socket joint.
3) The distal end contain pulley-like articular surface, the trochlea divisible into radical condyl and ulnare condyle by which it articulates with the radius and ulna.
4) A prominent crest like deltoid ridge is present between the head – A bicipital fossa is enclosed near the medial process and head.



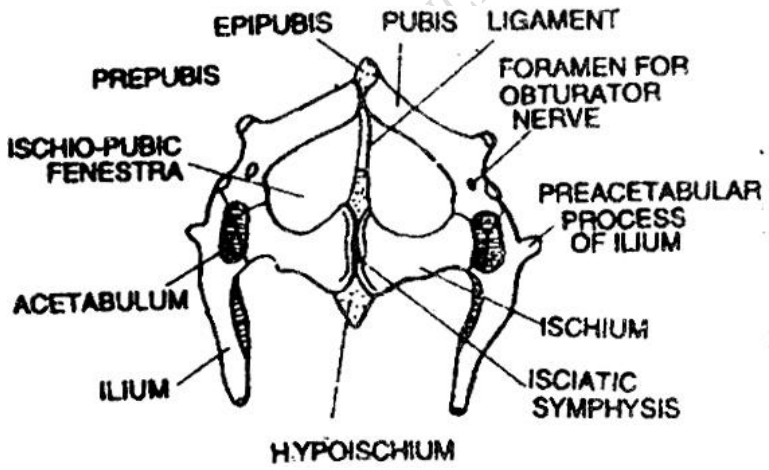
Varanus – Radius an ulna :

1) Radius and ulna are the bones of fore arm of the forelimb.
2) Radius is slender and consists of a shaft and two epiphyses.
3) At the distal and of radius is present a caneave articular facet for the carpus.
4) Ulna is somewhat stouter lying on the outer side of the radius.
5) The proximal end of ulna is produced into olecrenon process distally it bears a concave articular surface for the carpus.



Varanus – Pelvic girdle :

1) Pelvic girdle is present posteriorty and provide support to the hind limbs.
2) Pelvic girdle contain two identical halves each half is called os-innomiantum.
3) Each os-innominatum contain ileum, ischium and pubis.
4) Ilium is a long rod shaped bone. It has an iliac crest dorsally and articulates with sacral vertebrae.
5) Pubis is some what curved bone passing down wards and forwards from the acetabulum to meet the pubis in the other half and form a pubic symphysis.
6) Ischium is flat, broad bone runs down wards and inwards from the ilium to meet and unit with the ischium of the other half to form a Isciatic symphysis.
7) On the outer surface where Ilium, pubis and Ischium bones join, there concave depression is present called acetabulum for head of femur bone.



Pigeon pectoral girdle :

1) Pectoral girdle provide protection to the heart and lungs. It provides support and space for attachment of wings.

2) It contain two identical halves.

3) Each half of pectoral girdle is made up of coracoids, scapula and clavicle.

4) In birds, pectoral girdle is strong ossified structure.

5) Coracoids articulates with scapula anterioventrally. Its anterior part forms glenoid cavity for head of humerus.

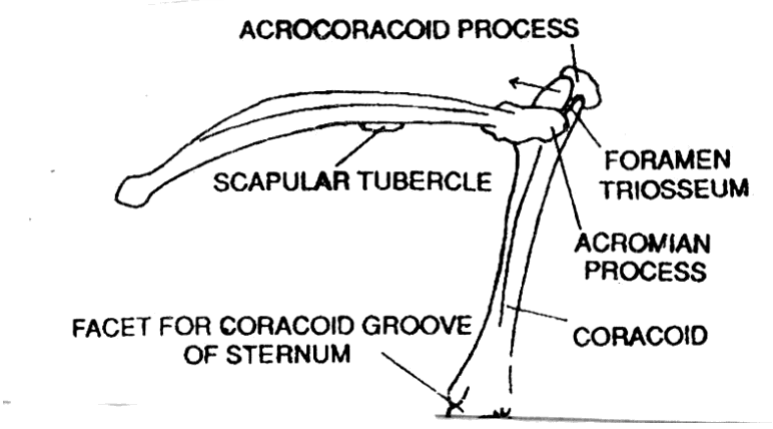
6) Coracoid is a short, stout and rod shaped bone.

7) Scapula is a sabra like bone. It contain scapular tubercle.

8) Clavicle is present at the junction between coracoids and scepula anterioventraly. Clavicles are fused to form v-shaped furcula or wishbone.

9) Ventrally both clavicles are fused to form interclavicles.

10) At the junction between coracoids, scapula and clavicle, trioste formen is present.

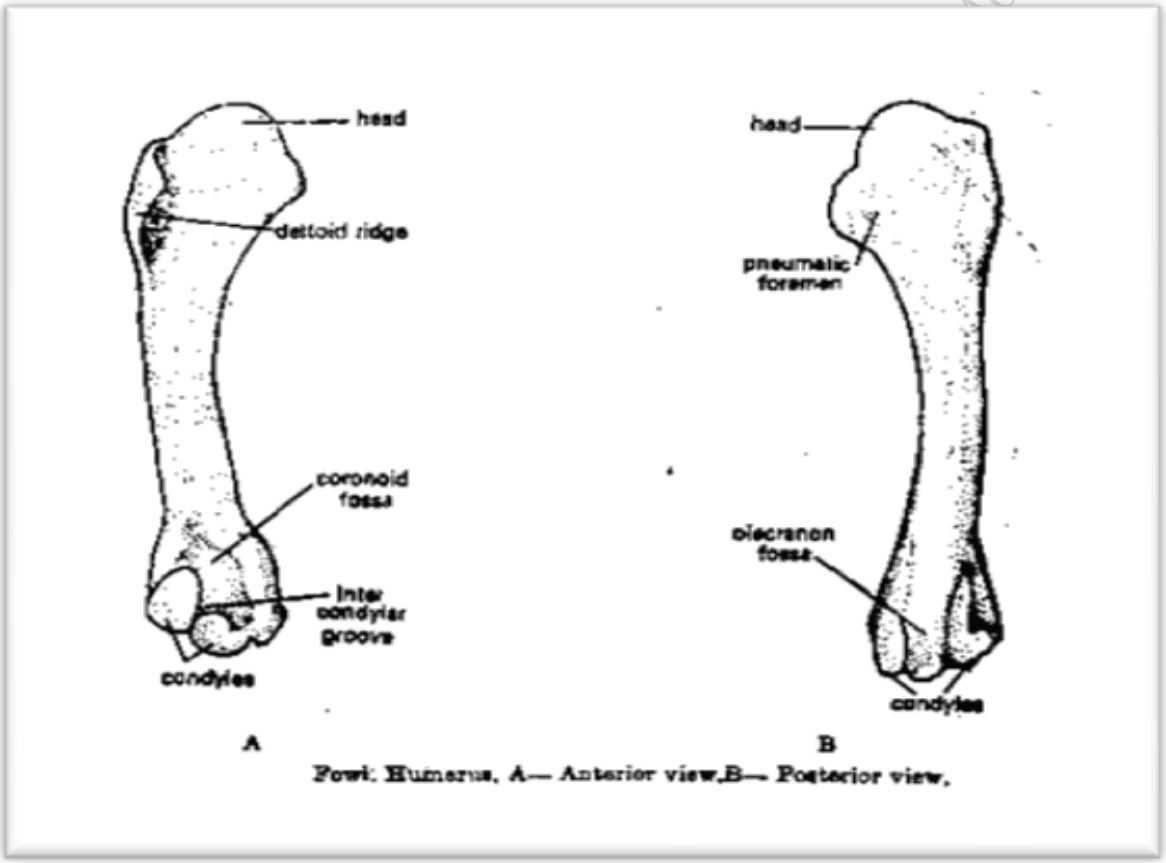


Humerus of Pegeon:

1) It is the bone of upper arm. It is an elongated bone expanded at both the ends.

2) The head of humerus is bordered by preaxial and post axial tuberosities from the preaxial tubergity extends in front a short deltoid ridge. The postaxial tuberosity is larger and has a pneumatic foremen.

3) The distal end possesses a trochlear surface for the articulation with the radius and ulna.



Fowl: Humerus, A— Anterior view,B— Posterior view.

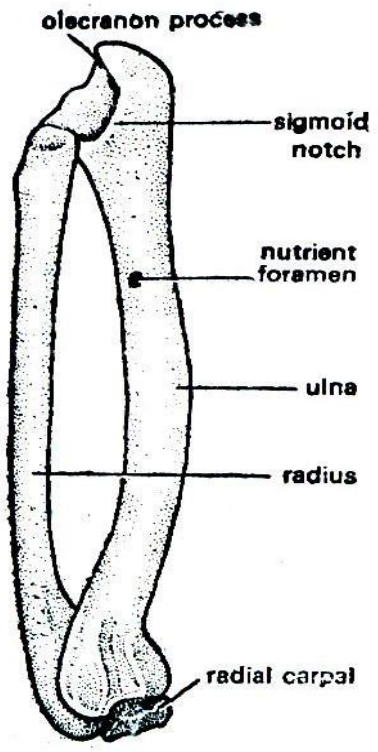
Radius and Ulna of Pegeon:

1) Radius and ulna are the bones of the fore arm.

2) Radius is slender and straight bone. Proximaly it has a cup-shaped articular surface for the trochlea of humerus. Distally it articulates with the carpus.

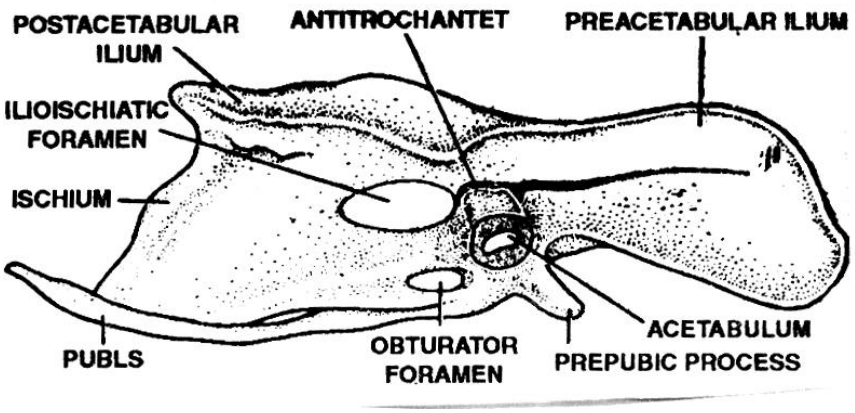
3) Ulna is stouter and larger proximally it bears a small olecrenon process and a large articular facet for the inner condyl of the humerus.

4) Distally ulna articulates with the carpus and radius.



Pelvic girdle of Bird (pigeon) :

1) Pelvic girdle is present posteriorly and provide support to the hind limbs.
2) It contains two identical halves. Each half is called os-innaminatum.
3) Each os-innominatum contain ileum, ischium and pubs.
4) Ileum is a large, elongated lamellar bone attached to the inner border of the transverse processes of the sacral vertebrae.
5) Inner border of ilium is firmly united with the transrverse processes and neural spines of synsacrum.
6) Ischium is a broad bone present behind the acetabulum. It is fused posteriorly with the post-acetabular part of the ilium
7) Pubis is a long, curved and slender, bone extending along the lower border of ischium.
8) The free posterior end of pubis extend backwards for shart distance beyond the Ischium.
9) Ischiopubic or obturator foramen present in between pubis and ischium.



Rabbit – Pectoral girdle :

1) Pectoral girdle provide protection to the heart and lungs. It provide support and space for attachment of forelimbs.

2) It contain two identical halves

3) Each half contain coracoid, scapula and clavicle.

4) Two halves of pectoral girdle are repeated due to the presence of thoracic ribs.

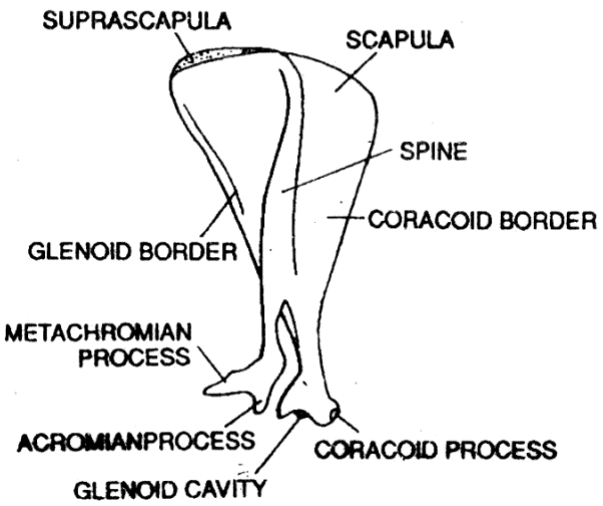
5) Coracoid is reduced and articulates with scapula forms coracoid process. Antervioty it contain glenoid cavity for head of humerus.

6) Scapula is a flat, triangular plate.

7) A vertical spine divides outer surface of scapula and it terminates below on acromian process.

8) Thin, cartilaginous supra-scapula is present and attached to the dorsal edge of scapula.

9) Posterior edge of scapula grows into metacromian process.



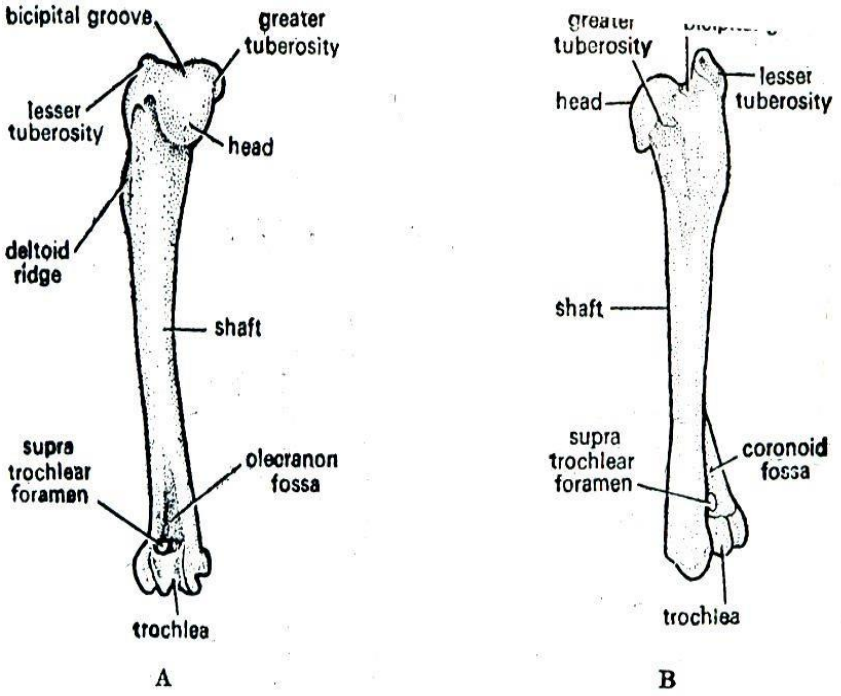
Humerus of Rabbit:

1) It is the bone of upper arm with long rounded head.

2) The proximal end as the humerus is provided with a bicipital groove in between the two tuberosities for the attachment of muscles.

3) The anterior surface of the humerus below the head has a deltoid ridge. The head is articulates with glenoid cavity forms ball and socket joint.

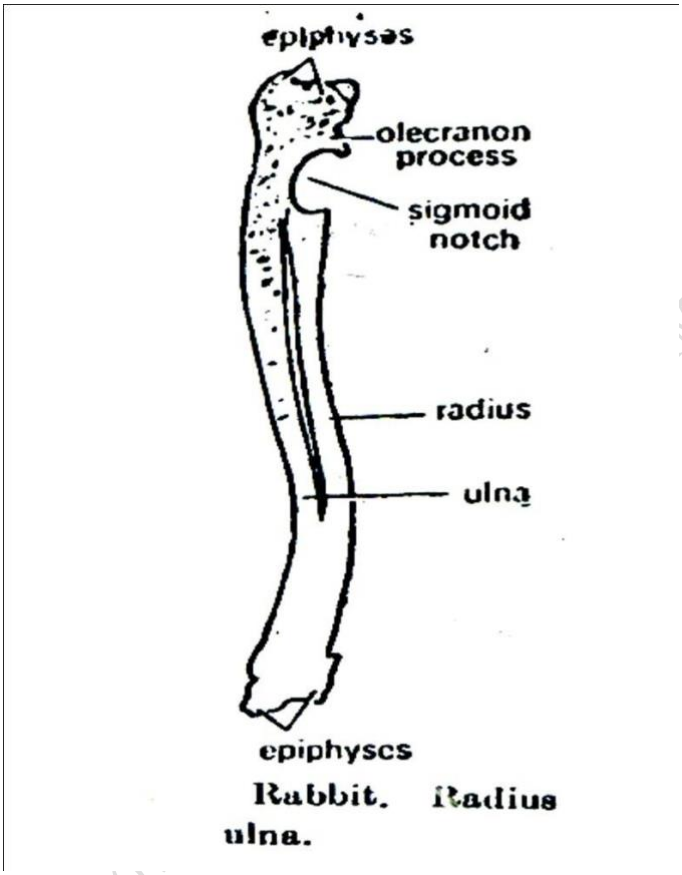
4) The distal end is expanded into epicodyles and provided with a pulley like trochlea enclosing a deep groove called olecrenon fossa.



Rabbit. Humerus. A—Lateral view. B—Posterior view.

Rabbit – Radius and Ulna:

1) Radius and ulna are separate bones in the fore arm.
2) The radius is the smaller bone, articulate with the wrist bones distally.
3) The ulna is the long bone and bears a deep sigmoid notch for articulation with the trochter of the humerus.
4) The ulna bears an olecranon process proximally.



Rabbit. Radius ulna.

Rabbit – Pelvic girdle :

1) Pelvic girdle is present psoteriorly and provide support to the hindlimbs.
2) It contains two identical halves. Each half is called os-innominatum
3) Each os-innominatum contain ilum, ischium and pubis.
4) Ileum forms the anterior part of the innominate and narrow behind and expanded infront, articulates into sacral vertebrae.
5) Ischium forms the psoterio dorsal part of the innominate bone.
6) Pubis is a small, slender bone forms the ventromedian part of Innominate bone. Posteriorly it attaches with ischium.
7) A small cotyloid bone prevents pubis from reaching acetabulum.
8) Pubis is separated from ischium by obturator foramen.
9) Acetabulum is formed by ileum, ischium and cotyloid bones.

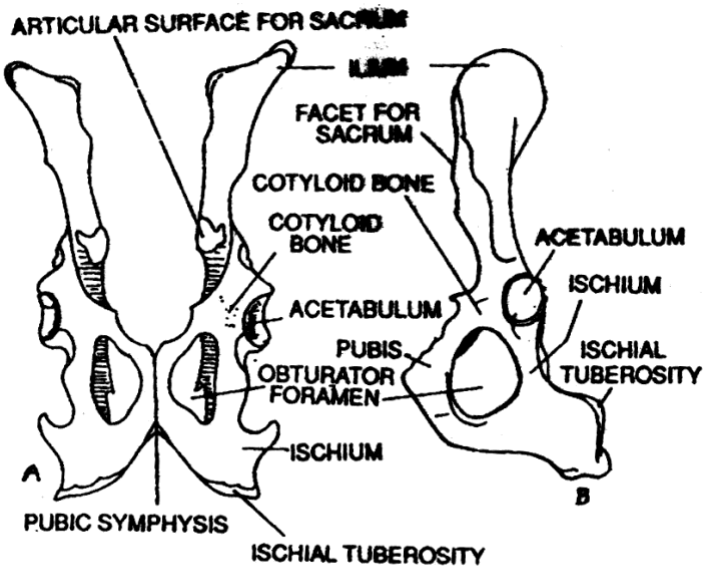


Fig. 235 : Rabbit - Pelvic Girdle
(A) Front view (B) Lateral view

HISTOLOGY

T.S OF LIVER:

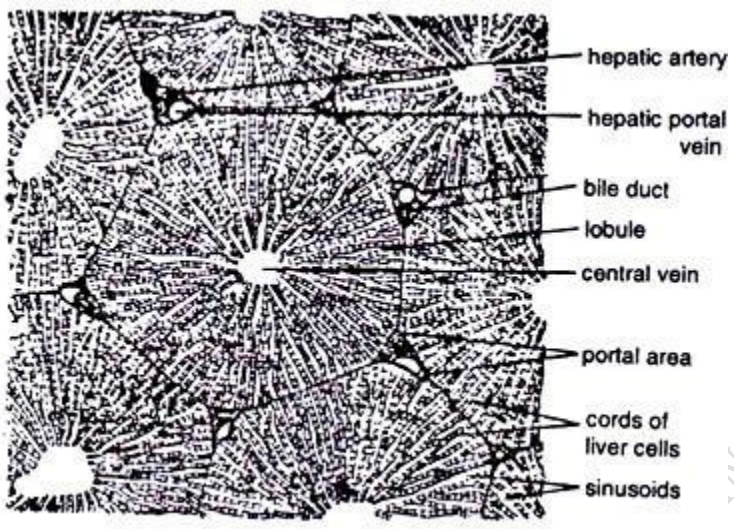


Fig. 41.8 : Liver. Mammalia. Section

1. Consists of a large number of lobules compactly held together.

2. Lobules are polyhedral, with 5 to 7 sides and separated from one another by Glisson's capsule made of connective tissue.

3. An intra-lobular vein present in the middle of each lobule.

4. Presence of a portal canal consists of an interlobular vein, branches of hepatic artery, the interlobular bile ducts and lymphatic vessels.

5. Liver cells (hepatocytes) are polyhedral with coarsely granular cytoplasm or 'empty'.

6. Nucleus one or two, large, round and vesicular.

7. Liver cells are arranged in the form of branching and anastomosing plates, termed muralium.

8. The plates separate adjacent lacunae formed by blood containing sinusoids. Kupffer cells or stellate cells present on the walls of the sinusoids.

9. The hepatic parenchyma consists of a continuous mass of cells traversed by a complex system of lacunae.

T.S OF PANCREASE:

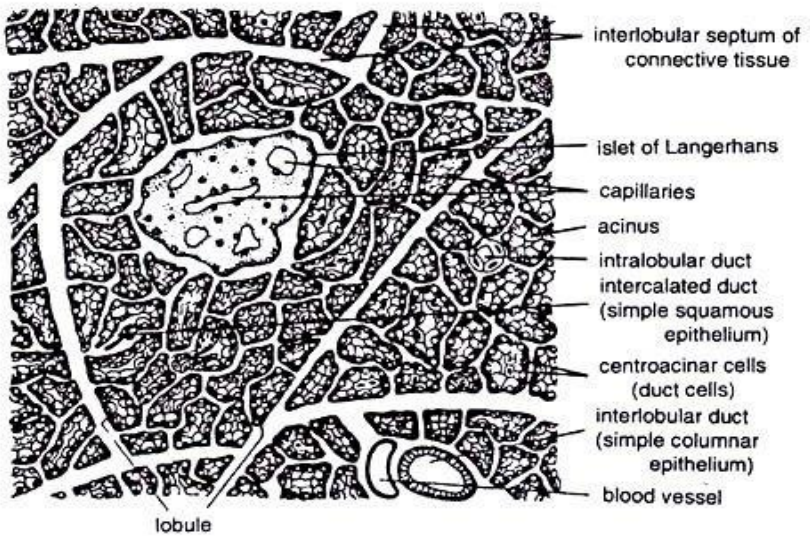


Fig. 41.9 : Pancreas. Mammalia. Section

1. Consists of a number of secretory alveoli, the exocrine component. Endocrine components or islet of Langerhans, are scattered amongst the exocrine tissues.

2. Exocrine component:

a. Most of the alveoli are tubular and surrounded by a lamina.

b. Cells lining the lumen of the alveolus are somewhat conical with a granular cytoplasm and a spherical nucleus.

c. In a resting alveolus, the lumen is small and the cells are packed with zymogen granules except for a narrow outer zone.

d. In an active alveolus, the lumen is distended and the granules restricted only to the innermost part of the cell.

3. Endocrine component:

a. Solid groups of lightly staining cells, marked off from the alveolar portion by a thin reticular membrane.

b. Blood supply extremely rich.

c. The cells contain granules and are of four types,

i. coarsely granular α cells, less in number.

ii. β cells containing small granules, much more numerous.

iii. δ and F cells contain small granules and are less in number.

T.S OF KIDNEY:

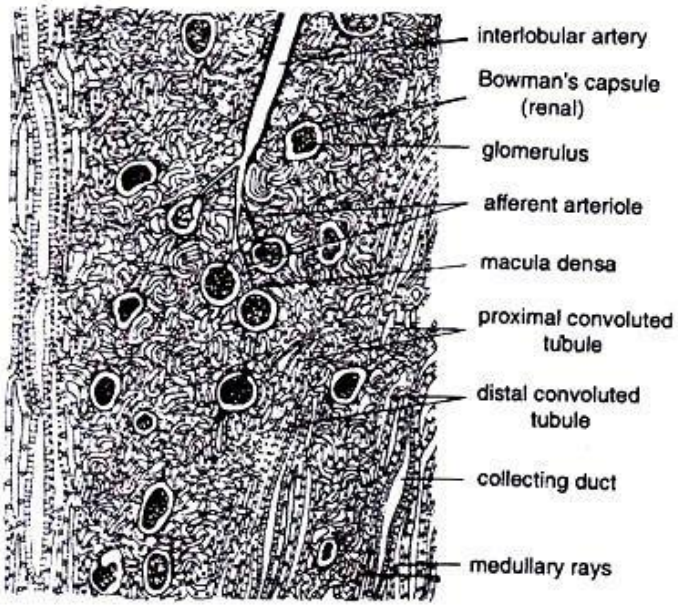


Fig. 41.14 : Kidney. Mammalia. Sagittal section passing through cortex

1. Enclosed in a capsule of connective tissue.
2. Kidney consists of an outer granular cortex and a radially striated inner medulla.
3. Medulla consists of a number of conical masses, the renal pyramids.
4. The bases of the pyramids are adjacent to the cortex and apices, the renal papillae, point towards the renal pelvis.
5. The pelvis is extended and forms the beginning of the ureter;.
6. Closely packed uriniferous tubules are present both in cortex and medulla.
7. The amount of interstitial connective tissue is small-in the cortex and more in the medulla.
8. The functional unit of kidney is the nephron.
9. A nephron consists of a renal capsule with glomerulus, proximal convoluted tubule, loop of Henle divided into descending and ascending limbs.
10. Leaving medulla, the tubule enters cortex as distal convoluted tubule, near renal capsule.
11. The tubule is connected with a collecting tubule through a short junctional tubule.
12. The collecting tubule receives other junctional tubules, and several of these form a papillary duct.
13. The papillary duct opens at the apex of the pelvis.

T.S OF STOMACH:

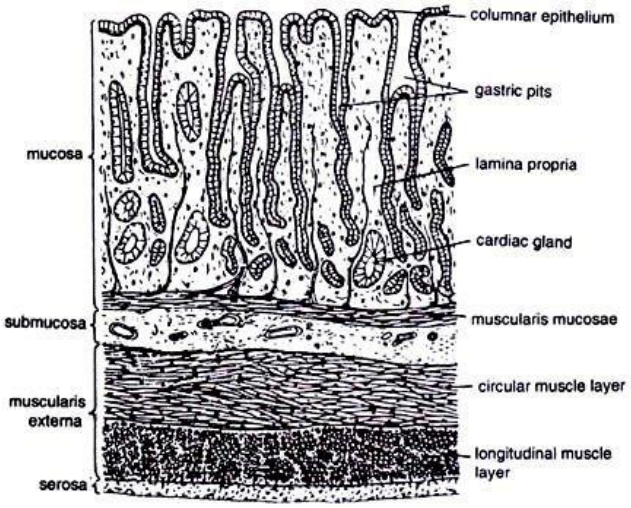


Fig. 41.6A : Stomach. Cardiac region. Mammalia. Transverse section

1. Serous coat (serosa):
A thin layer of connective tissue.
2. Muscular coat:
Consists of ill defined layers, an outer longitudinal, a middle circular and an inner oblique layer.
3. Submucosa:
A layer of loose connective tissue containing fat cells, lymphocytes, mast cells and lymphatic's.
4. Mucous membrane (mucosa):
It has three layers:
a. Muscularis mucosae:
Consists of smooth muscles arranged as an inner circular and an outer longitudinal layer.
b. Lamina propria (stroma):
Consists of loose connective tissue, which project into the indented mucosae.
i. Fundic glands:
These occupy almost whole of the lamina propria. The gland cells are mainly three types- chief cells, oxyntic cells and mucoid cells.
c. Epithelium:
The lining epithelium is of tall, columnar cells, most of which are mucocytes.

T.S OF INTESTINE:

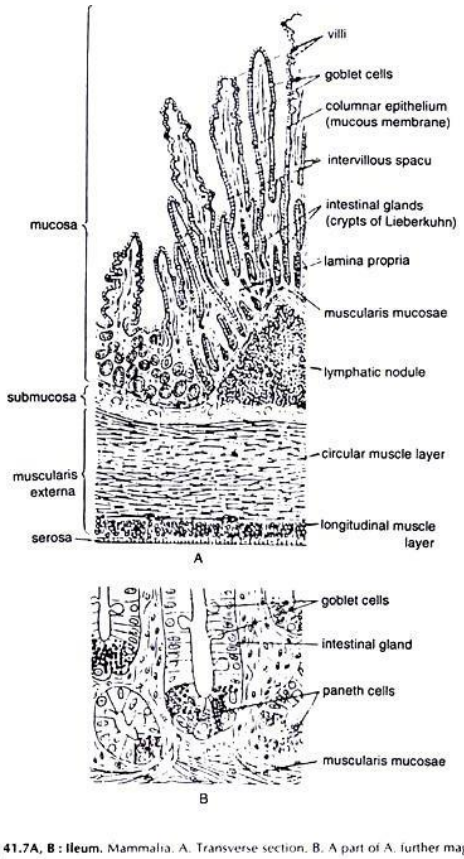


Fig. 41.7A, B : Ileum. Mammalia. A. Transverse section. B. A part of A. further magnified

1. Serous coat:A layer of mesothelial cells with underlying sub-serous layer of elastic and collagen tissue.
2. Muscular coat: Consists of well differentiated external longitudinal and internal circular layers.
3. Submucosa:A layer of loose connective tissue containing large blood vessels, nerve plexus, adipose tissue and lymphatic plexus.
4. Mucous membrane (mucosa):It has three layers:
a. Muscularis mucosae: Consists of an outer longitudinal and an inner circular layer of smooth muscles.
b. Lamina propria (stroma):A layer of loose connective tissue packed with tubular intestinal glands. A group of pyramid-shaped cells, the paneth cells are present at the base of each intestinal gland Muscularis mucosae and stroma together are thrown up into minute projections, the villi.
c. Epithelium: Covers the villi and consists of a single layer of columnar epithelium containing many goblet cells.
The muscle layers (stomach and ileum): The muscle layers of the stomach and ileum look different in transverse and longitudinal sections under the microscope.
Transverse section:
1. Circular muscle layers: The muscle fibres are cut lengthwise and appear as long and short threads running side by side.
2. Longitudinal muscle layers: The muscle fibres are cut across and appear as bundles of closely packed, small round cells.

T.S OF LUNGS:

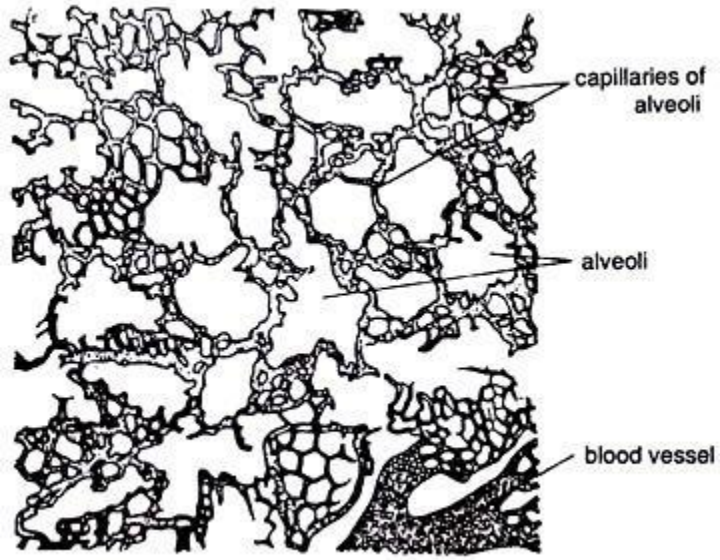


Fig. 41.12 : Lung. Mammalia. Transverse section

1. Presence of a network of empty spaces (alveoli) enclosed by thin walls, portions of the walls of bronchi, bronchioles and blood vessels.
2. The walls between the alveoli are extremely thin.
3. It consists of a stroma containing numerous anastomosing capillaries and a network of fine reticular and elastic fibres.
4. Some macrophages and fibrocytes are present in the wall.
5. Alveolar pores present in the interalveolar septa.
6. Alveoli are lined with a complete epithelium of squamosal cells.

T.S OF ARTERY:

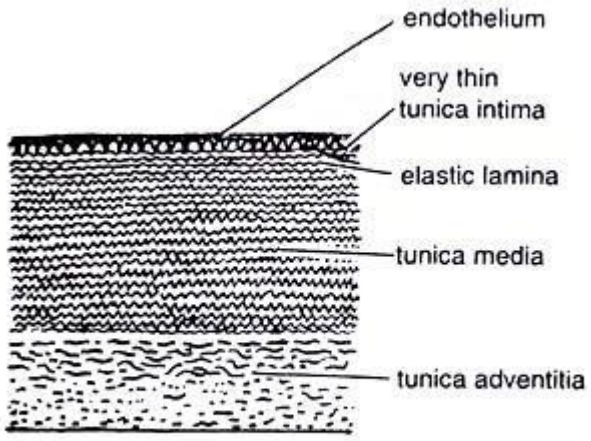


Fig. 41.10 : Artery. Vertebrata. Transverse section

1. Circular, hollow, the thick wall consists of three distinct layers.

2. Tunica intima or internal layer:

a. Lined by an endothelium of squamous cells.

b. Sub-endothelial elements oriented longitudinal to the vessel.

c. Separated from tunica media by a membrane, internal elastic lamina.

3. Tunica media or middle layer:

a. The thickest layer and consists chiefly of elastic tissue (elastic artery) or smooth muscles (muscular artery).

b. Elements are arranged circular to the vessel.

c. External elastic lamina separates it from the outer coat.

4. Tunica adventitia or outermost layer:

a. Usually thinner and gradually merges with the tissue surrounding the artery.

b. Consists chiefly of elastic fibres.

c. Elements are usually directed longitudinally.

T.S OF VEIN:

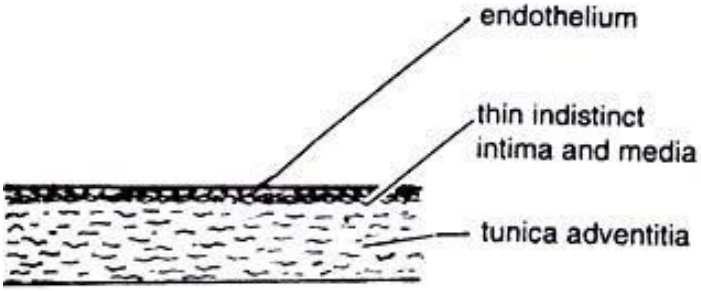


Fig. 41.11 : Vein. Vertebrata. Transverse section

1. Circular, hollow, the thin wall consists of three layers, less clearly differentiated.

2. Tunica intima or internal layer:

a. Lined by poorly differentiated squamous endothelial cells.
b. Consists chiefly of elastic fibres, usually directed longitudinally.
c. The layer merges with the tunica media.

3. Tunica media or middle layer:

a. Relatively thin and consists of a little elastic tissue, smooth muscle and considerable collagen fibres.
b. Elements are arranged circumferentially but sometimes longitudinally in the innermost part.
c. It is continuous with the outer layer.

4. Tunica adventitia or outermost layer:

a. Well developed and thickest of all the layers.
b. Consists of smooth muscles, collagen and elastic fibres.
c. Elements are usually directed longitudinally.

BONE T.S

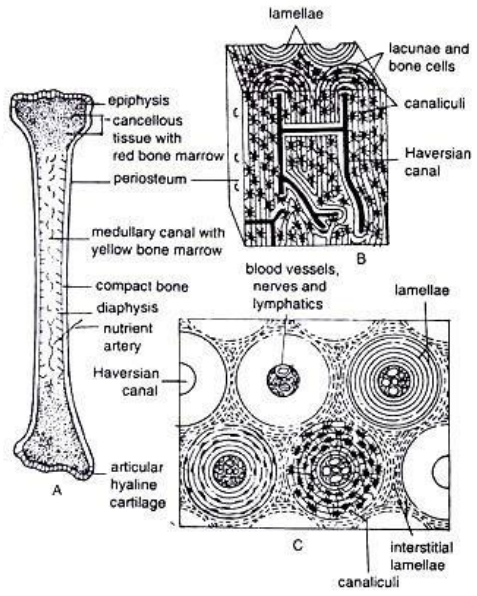


Fig. 41.19 : Long bone.
A. Longitudinal section; B. Longitudinal section (magnified); C. Transverse section (magnified)

1. The bone is en-sheathed by a vascular connective tissue, the periosteum.
2. A thick, compact wall surrounds a large, central cavity containing bone marrow.
3. The wall consists of circumferentially arranged bone lamellae and Haversian system or osteones, arranged in the long axis of the bone.
4. In a Haversian system 20 to 40 lamellae lie concentrically around a central space, the Haversian canal.
5. Osteones are united to each other by oblique communications.
6. The spaces between the individual systems are filled with interstitial lamellae arranged irregularly.
7. At the periphery of each osteone, a narrow fibre free band, the cement line is present.
8. Circumferential lamellae enclosing all the osteones are present beneath the periosteum and also lining the marrow cavity.
9. Bone cells lie in the lacunae between or within the lamellae and in the Haversian canals.

T.S OF SPINAL CORD:

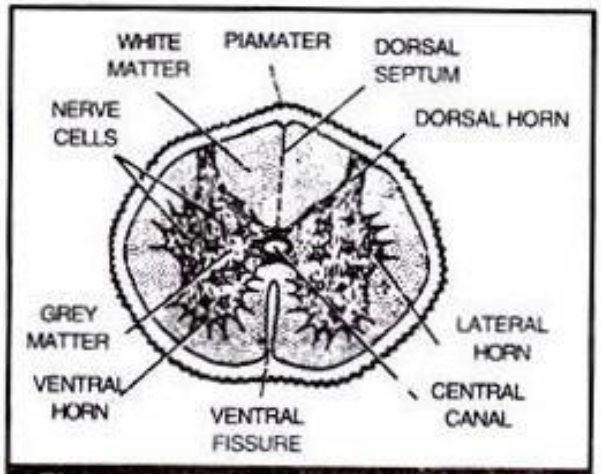


Fig. 1.15 T.S. mammalian spinal cord.

1.Medulla oblongata continues backward as a large cord called spinal cord. It is about 45 cm in length.

2. It comes out of the skull through an opening at the back side called foramen magnum and extends backward through neural canal of the vertebral Colum up to 2nd lumbar vertebra.

3. The end of the spinal cord narrows to form filum terminale .

4. The fourth ventricle or metacoel continues inside the spinal cord as central canal and is filled up with cerebrospinal fluid. The spinal cord is covered by the same three membranes—duramater, arachnoid and piamater. The spinal cord swells in the region of neck and lumbar so as to form two swellings. In the transverse section, the spinal cord has a spherical shape having a central canal.

5. It is formed of grey and white matter. The inner grey matter is butterfly shaped and forms two large ventral horns and two smaller dorsal horns and lateral horns. The spinal cord is divided into two halves by the presence of a narrow dorsal septum and a deep ventral fissure .

6. A large number of nerve fibres ascend or descend along the white matter of the spinal cord. These nerve fibres that originate and terminate at similar sites are called as nerve tracts.

Dissections

Digestive system of Rohu

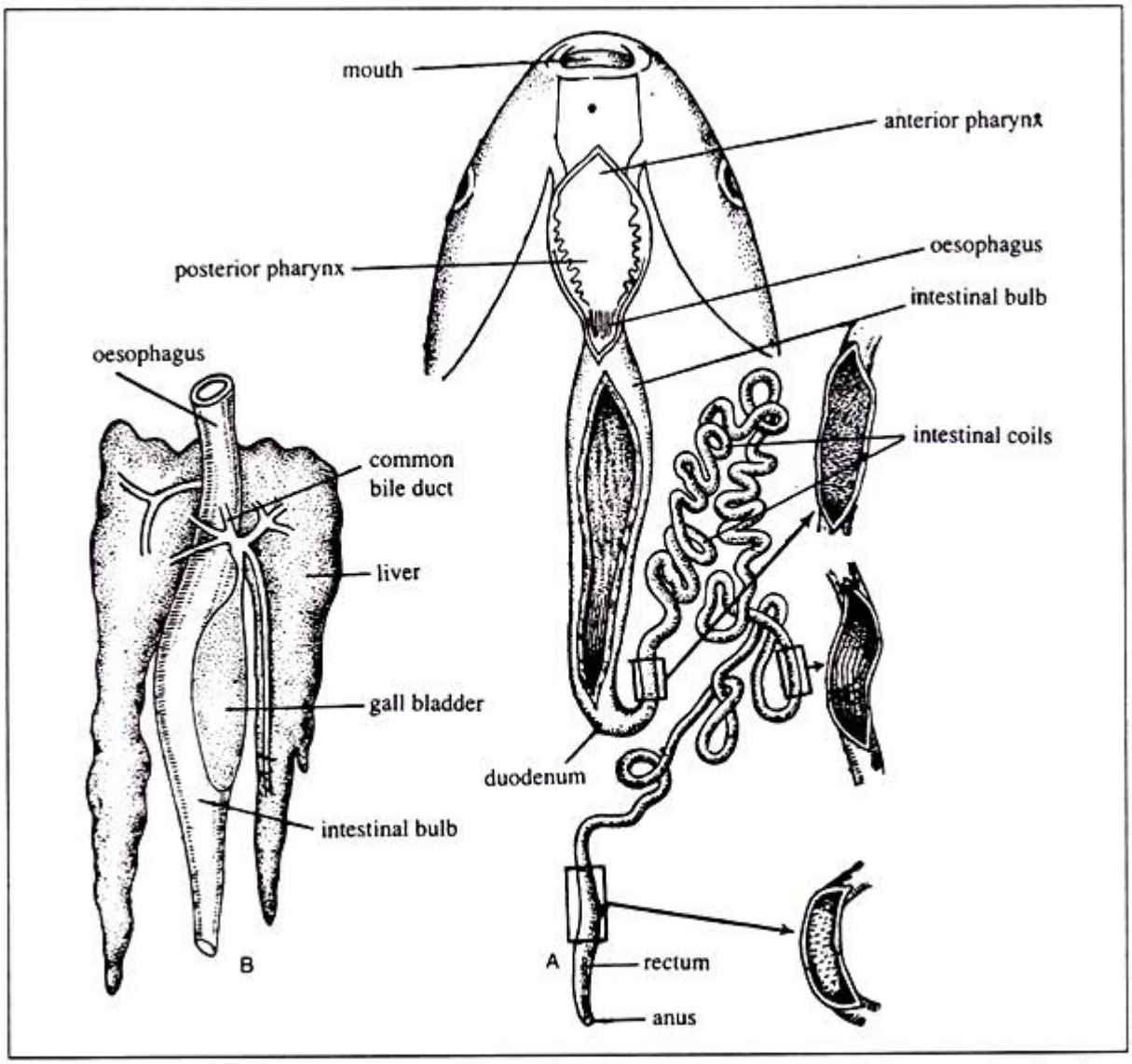
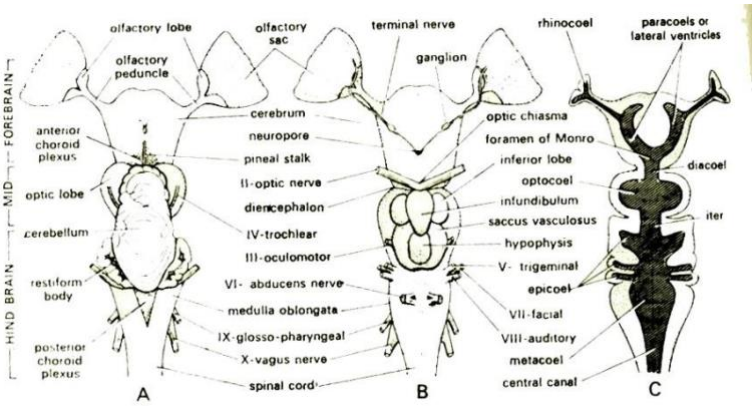


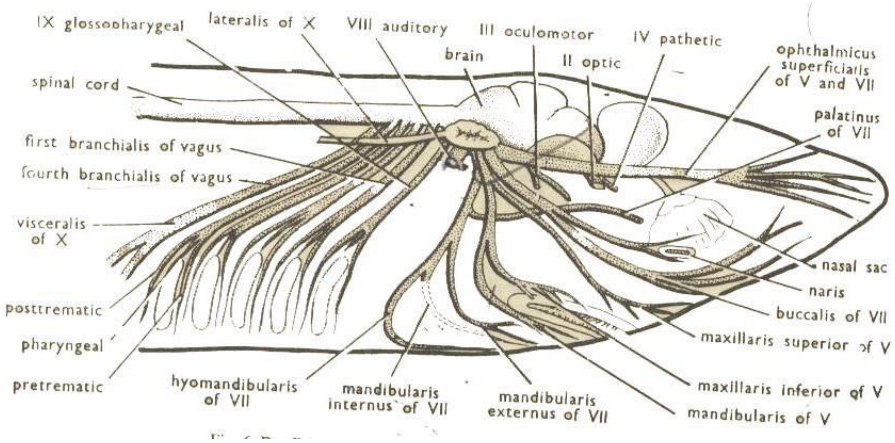
Fig. 6.23 : Digestive system of *Labeo*. A. Entire digestive tract. Some regions of the tract are dissected to show internal details. B. Showing the relationship of the liver with the alimentary canal.

Brain of Scoliodon:



V and VII cranial nerves of Scoliodon

V Nerve or Trigeminal Nerve: It leaves the brain the at the sides of the anterior part of the medulla oblongata beneath the corpus restiformia. It is a mixed nerve, having somatic sensory and somatic motor fibres. It bears a large gasserianganglion soon after its origin and divides into three branches.



a)

Opthalmicus : It again divides into two

i) Ophthalmicus superficialis – it extends along the upper border of the orbit and supplies the skin of the snout in front of the olfactory capsule. It is a sensory branch.

ii) Ophthalmicus profundus – it enters the orbit where it gives off a slender ciliary nerve to the eyeball. It then enters the cranium, which it again leaves to innervate the skin on the dorsal surface of the snout. It is a mixed nerve.

b) Maxillaris : It is the main branch of the trigeminal. It runs along with the buccalis branch of the facial nerve for a short distance and then divides into branches that supply the skin of the upper jaw, upper lip and lower eyelid and teeth of upper jaw. It is a sensory nerve.

c) Mandibuloaris : It runs alongside the maxillaries for a short distance and then runs to the lower jaw to innervate its skin and muscles. It is a mixed nerve.

VII Nerve or Facial Nerve : It arises from the side of the medulla oblongata just behind the trigeminal nerve. It is a mixed nerve, having somatic sensory, visceral sensory and visceral motor fibres. It divides into five branches.

a) Ophthalmicus Superficialis : It runs along the upper border of the orbit and supplies the lateral lines sense organs on the upper surface of the snout. It is a sensory branchBuccalis : It runs for a short distance alongside the maxillaris of the fifth nerve and then separates to get distributed to the lateral line sense organs of the maxillary region. It is a sensory nerve.

b) Mandibularis externus : It innervates the lateral line sense organs of mandibular region. It is a sensory nerve.

c) Hymandibularis : It sends several fine branches to the lateral line sense organs of the mandibular region and a mandibularisinternus branch to the mucous membrane of the buccal cavity. Then it goes to the muscles of the throat as the hyoidius nerve. It is a mixed nerve.

d) Palatinus : It branches off from the hyomandibularis, extends forwards and supplies the roof of the pharynx and roof of the buccal cavity. It is a sensory nerve.

B IX and X cranial nerves of Scoliodon

IX Nerve or Glossopharyngeal Nerve : It arises from the side of the medulla oblongata near its hind end. It bears a petrosalganglion near its orgin, passes backwards and downwards to the region of the first gill slit, where it divides into three branches :

a) Pharyngeal Branch: It supplies the receptors present in the mucous membrane of the pharynx. It is a sensory branch.

b) Pretrematic : It innervates the hemibranch in front of the first gill slit. It is also a sensory branch.

c) Posttrematic : It is distributed to the hemibranch behind the first gill slit and visceral muscles. It is a mixed branch.

X Nerve or Vagus : It emerges from the medulla oblongata close to the ninth nerve and has a very wide distribution (vagus = wandering). It is a mixed nerve, having somatic sensory, visceral sensory and visceral motor fibres. It divides into 3 main branches.

b) Branchialis : It consists of four nerves that pass backwards and downwards to the region of the second, third, fourth and fifth gill slits. Each of these four nerves sends a pharyngeal branch to the roof of the pharynx, a pretrematic branch to the hemibranch in front of the respective gill slit and a postrematic branchto the hemibranch behind the respective gill slit. These three branches resemble in nature with the corresponding branches of the ninth nerve. The branchialis is a mixed nerve.

c) Visceralis : It enters the trunk and innervates the alimentary canal and the heart. It is a mixed nerve.

d) Lateralis : It runs backwards deep in the lateral body wall and innervates the lateral line sense organs. It is a sensory nerve.

Question Bank and Scheme of Evaluation

ZOOLOGY - CORE PAPER - II

Animal Diversity- Vertebrates

Time: 3 Hrs. Max. Marks: 25

1. Dissection----------Diagram + Description 2+2=4

2. Spotters

(5 chordates+1 Osteology+1 Histology) 7x2=14

3. Animal Album +collection of different feathers 02

4. Viva voce 02

5. Certified Record 03

Total: 25

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