B.Sc. Part-2
Group – A

DIPNOI

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Dipnoi (Gr. di-two, pnoe-breathing) is a small order of fresh water bony fishes. They respire by gills and lungs.

Fishes with two nostrils are included in dipnoi. They also contain lungs and is called as lung fishes. They have originated from crossopterygian fishes in Devonian period.

Following three lung fishes are found in the world: -

1. **Necerratodus -** It is found in the fresh water rivers of queen-land in Australia.
2. **Protopterus -** Found in river Nile and Lake Victoria in Africa.
3. **Liepidosiren -** It is found in South America.

Characteristic features:

Habit and habitat:

1. Lung fishes respire by both gill and lungs.

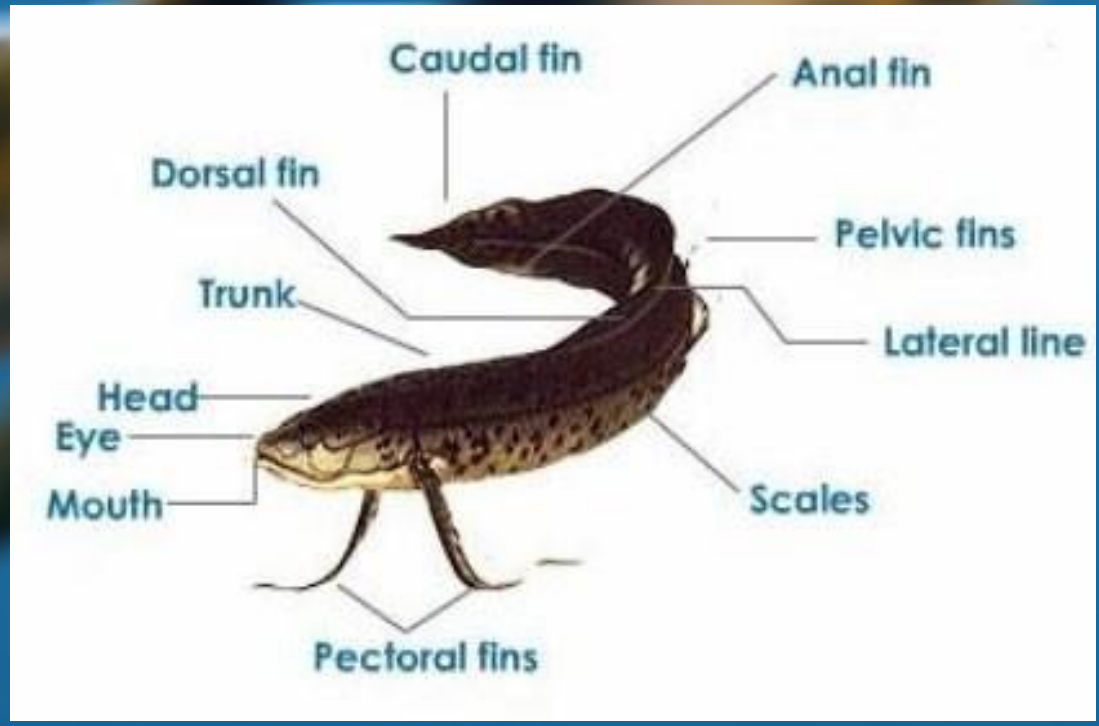
2. Protopterus and Lepidosiren aestivate during summer, when the pound becomes dry. They form a water-proof cocoon which connected to outside by a breathing tube.

3. Lung fishes feed on molluscs, insects and small fishes.

4. Swimming is anguilliform type. Protopterus and Lepidosiren walk by their pectoral and pelvic fins.

EXTERNAL STRUCTURE:

1. The body is cylindrical and elongated. Protopterus measures about 5 feet to 7 feet.
2. The body is covered by bony imbricating cycloid scales.
3. The dorsal, caudal and anal fins are continuous. The fins contain fiber like dorsal rays and endoskeleton radial. Caudal fin is diphycercal.



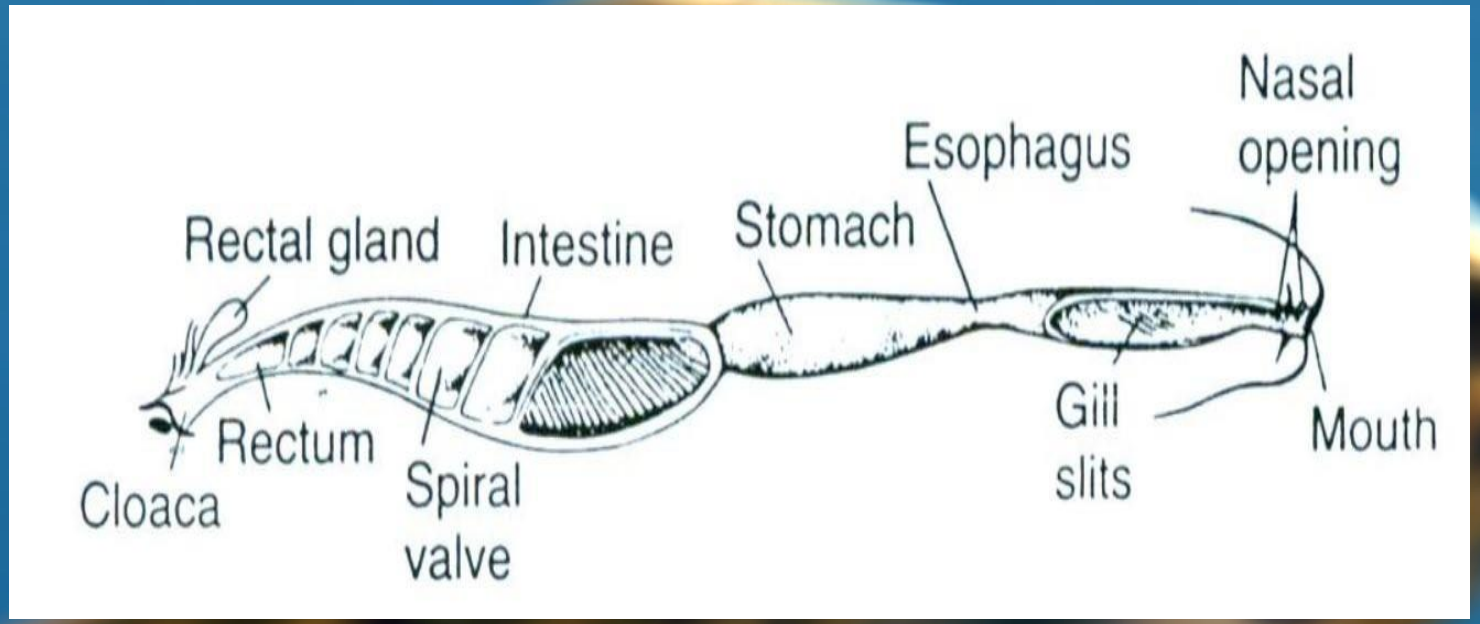
4.One pair pectoral and one pair of pelvic fins are found and are elongated and filamentous, but in Neo-ceratodus the fins are broad and leaf like.

5.There are two external nares in the upper lip near the mouth. Internal nares are found in the anterior part of the mouth cavity. The branchial opening is guarded by an operculum. The spiracle is a absent. The eye is small.

6. The lateral line system is developed especially in the head.

7.The cloaca is present about 2/3rd distance from the snout. The two abdominal pores open in the cloaca.

ALIMENTARY CANAL-



1.The upper and lower jaws bear many teeth. Each tooth bears three cusps. These teeth are found on the palatopterygoid and pre-vomer in the upper jaw and on the coronoid in the lower jaw.

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2. A pair of vomerine teeth are found.

3. The intestine contains spiral valve.

4.The liver is large and divided into two lobes. The anterior lobe is small and the posterior is large and in between the two, a median gall bladder is found.

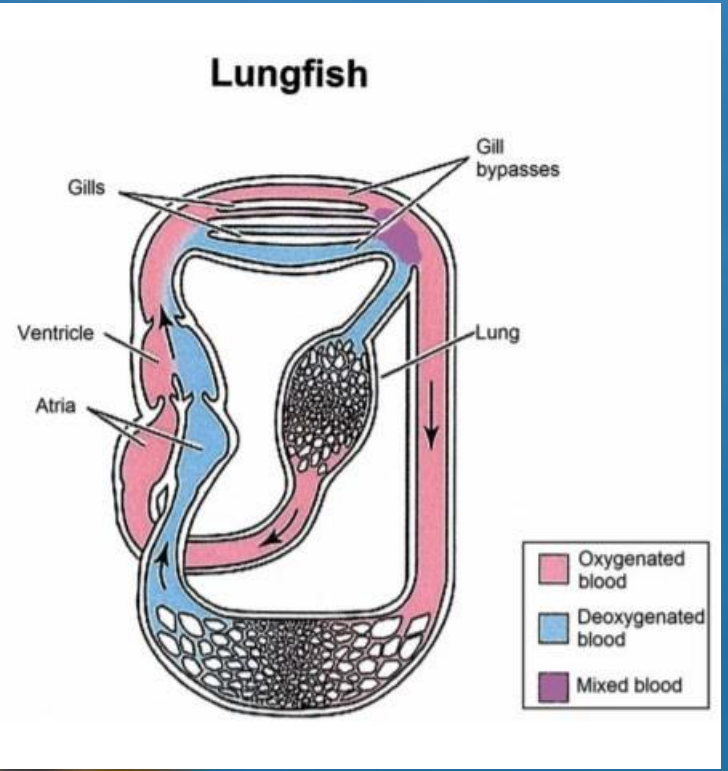
5.The pancreas is developed. It is found in the wall of the stomach and intestine. The pancreatic duct opens in the bile duct which ultimately opens in the intestine.

RESPIRATORY SYSTEM:

1. There is gill for aquatic respiration and the lung for aerial respiration.
2. There are six branchial arches and five gill clefts. The first and 6^{th} arches are hemibranch,2^{nd} and 3^{rd} a branch and 4^{th} and 6^{th} are holobranch.
3. The larva bears four pair of external gills.
4. There are two lungs in Protopterus and Lepidosiren and one in Neoceratodus.
5. Both lungs are elongated dorsal sac which open by a common pneumatic duct in the ventral side of the esophagus by the glottis. The glottis is covered by a fibrocartilaginous plate like epiglottis.
6. The lung is internally divided into many alveoli. Each alveolus is again divided into many smaller chambers. Each chamber bears many small saccules.
7. Pulmonary artery carries impure blood to the lung and pure blood is collected by pulmonary vein and carried to the heart.

BLOOD VASCULAR SYSTEM:

1. The heart is surrounded by a stiff pericardium. It is found below and behind the gills.
2. The sinus venosus and ventricle is incompletely divided and auricle is completely divided.
3. The conus arteriosus is spirally twisted. It is completely divided into two chambers, 6 in Lepidosiren and Protopterus.



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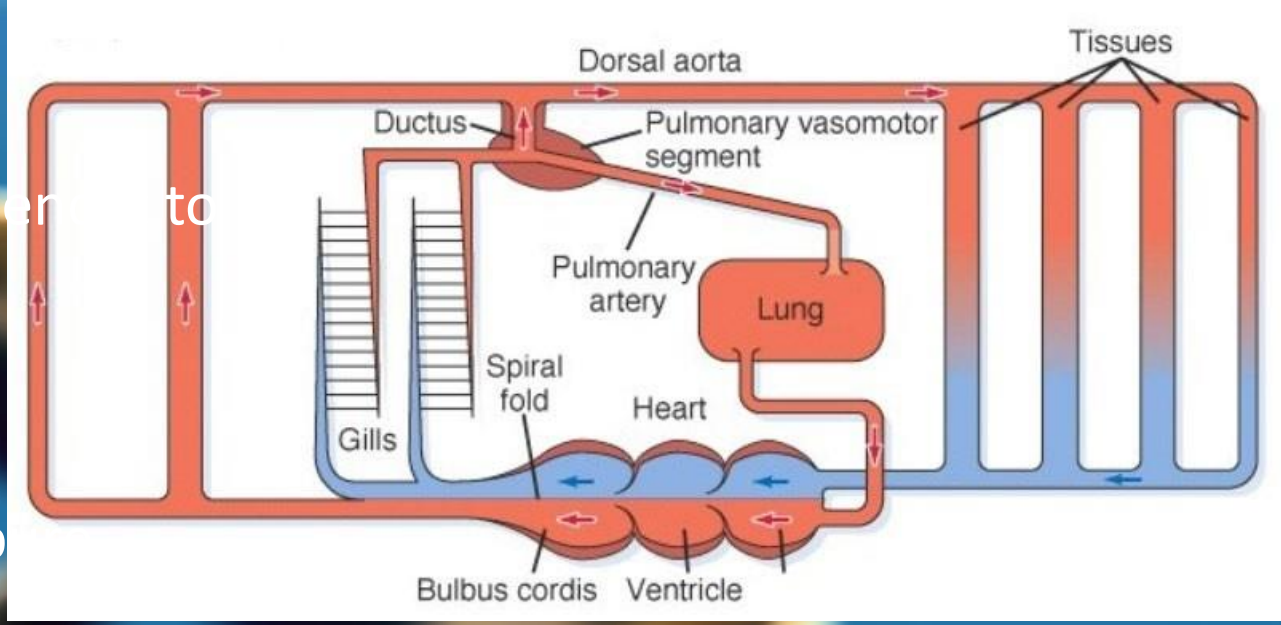
*(a). **Dorsal chamber –***

It contains impure blood and s to the gill.

*(b). **Ventral chamber -***

It contains p blood which is carried to heart.

In Neoceratodus the conus arteriosus is incompletely divided.



1. The atrio-ventricular aperture is guarded by a fibrous plug. It is not a true valve.
2. The ventral aorta is very reduced.

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4.The atrio-ventricular aperture is guarded by a fibrous plug. It is not a true valve.

5.The ventral aorta is very reduced.

6.Four afferent branchial vessels are found. The first supplies blood to the head and a recurrent branch to the first hemi branch. In the second and third arches the afferent and efferent vessel is continuous. 3rd and 4th afferent branchial supply blood to 4th,5th,6th branchial arches. The blood is collected from these arches by the efferent vessel.

7.The second afferent vessel and the 4th, 5th, and 6th efferent vessel unite to form epibranchial vessel which open in the paired dorsal aortae. Both lateral dorsal aortas unite to open in the median dorsal aorta.

8.The pulmonary artery arises from the junction of paired dorsal aorta and epibranchial vessel.

9. There are two precaval and one postcaval. The precaval is formed by three vain.

a. Inferior jugular vein.

b. Anterior car dual vein.

c. Subclavian vein.

The posterior cardinal vein opens in the left precaval. The precaval and postcaval open in the sinus venosus.

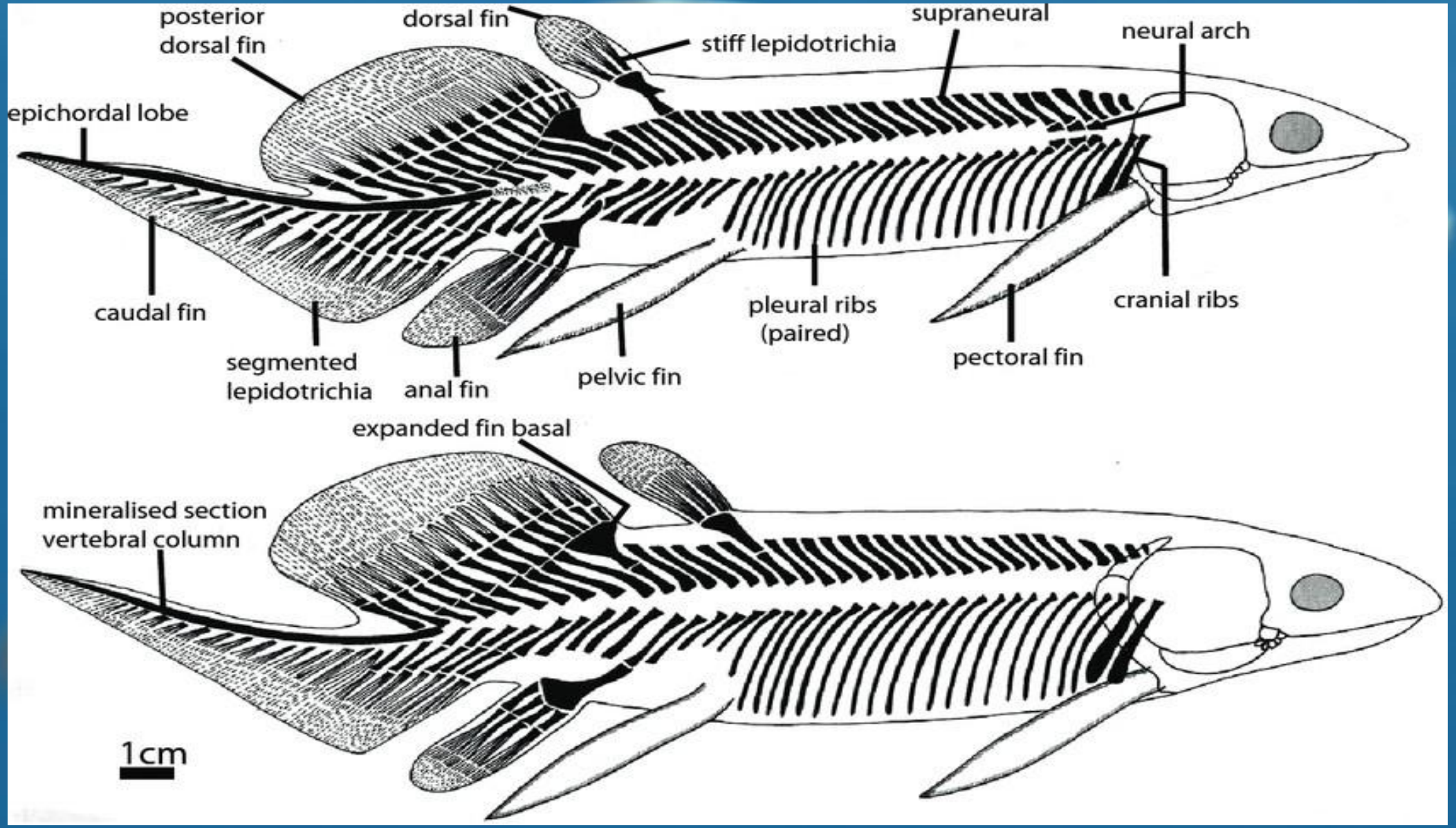
10. One caudal vein divides to form two renal portal veins.

11. The pulmonary vein carries blood from the lung to the left auricle.

NERVOUS SYSTEM-

1. The brain is elongated and narrow.
2. The cerebral hemisphere is developed.
3. The olfactory lobe is sessile.
4. There are one optic lobe in the Protopterus and Lepidosiren and two Neoceratodus.
5. The cerebellum is reduced.
6. The pineal body is situated on a conical pineal pillow.
7. There are many endolymphatic sacs on the medulla oblongata.

SKELETAL SYSTEM-



1. The notochord is covered by a thick fibrous sheath.

2. The basidorsal and basiventral is attached to the notochord and is not constricted.

3. There is no distinct joint between skull and the notochord.

4.The roof and the wall of the skull is formed of parietal bone. The frontal bone is found above and lateral to the parietal.

5. There are two exoccipital in the skull.

6. Jaw suspensory Autostylic type.

7. Hyomandibular, premaxilla, maxilla and nasal are absent.

8.Lower jaw consists of Meckel cartilage. True dentaries and spinal are absent in Protopterus but present in Neoceratodus.

9. Hyoid and branchial arches are cartilaginous. There are no branchial rays.

10. The pectoral girdle is attached to the skull by a ligamentous band.

11.There is one pelvic girdle and lozenge shaped. There is median epipubic process anteriorly and is flanked by prepubic process.

12.The pectoral fin has an elongated basal cartilaginous and a central axis of many small cartilaginous rods. On the preaxial face of the central axis a row of jointed cartilaginous rays is found. Thus, the fin is of Arche pterygium type. The pelvic fin is similar to the pectoral fin but there are no preaxial rays.

EXCRETORY ORGAN-

1.There are two elongated kidneys. It is separated anteriorly but fused behind, but in Lepidosiren the kidney is not fused posteriorly.

2. A thick walled ureter arises from each kidney. They open separately into the cloaca.

3. There is a cloacal urinary bladder.

REPRODUCTIVE ORGAN-

1. Lung fishes are unisexual.

2.There are two ovaries in the female on each lateral side of the kidney. These are two oviducts with their opening at the anterior end of the visceral cavity. The oviducts fuse to form one oviduct which opens in thecloaca on a genital papilla.

3.In male the testis is an elongated structure on each side of the kidney. It is divided in two parts- ***(a) Anterior spermatogenic parts.***

(b) Posterior tubular parts.

Which also acts as a vesicularseminalis. There is a vestigial Mullerian duct in male. The vas-deferens open on genital papillain the cloaca.

AFFINITIES OF DIPNOI-

A dipnoi forms a connecting bridge between fish and Amphibians.

Similarities with Fish-

1. Notochord present.
2. Skull with little ossification.
3. Four to six branchial arches present.
4. Presence of cycloid scales.
5. Respiration by lungs.
6. Presence of lateral line system.

With elasmobranch-

1. Conus arteriosus is similar.
2. Presence of spiral valve in the intestine.
3. Female reproductive organs similar in both cases.

With Actinopterygii-

1. Presence of lobate paired fine and paired inferior jugular vein.
2. Presence of operculum.
3. The swim bladder of Actinopterygii modified into the lungs in the dipnoi.

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With Crossopterygians-

1. Tail fin diphycercal.
2. cosmic covering over the scales.
3. Presence of external gills in the larva.
4. Presence of spiral valves.
5. Similar skull bones.

With Holocephalan-

1. Presence of mandibular and palatine tooth plate.
2. Similar cranial muscles.
3. Similar kidneys, gonads and the ducts.

But dipoans differ from these fishes in characteristics.

Relationship with Amphibians-

Similarities:

1. Presence of vomerine teeth.
2. Lung for respiration and presence of pulmonary artery and vein.
3. Jaw suspensorium autostylic.
4. Cerebral hemisphere and cerebellum similar.
5. Mesonephric duct acts to expel sperm to outside.

The amphibians also differ in many characteristics with the depnoans.

1. Skull largely cartilaginous in dipnoi.
2. Lung located dorsal to the gut in dipnoi.
3. Some anterior vertebrae fused with the skull.

On the basis of the above discussions the dipnoans are recognized as ***'grand uncle'*** of the amphibians. The dipnoi represents as one of the blind off short of the evolutionary tree.


Dear Students
Welcome for Discussion
THANK YOU