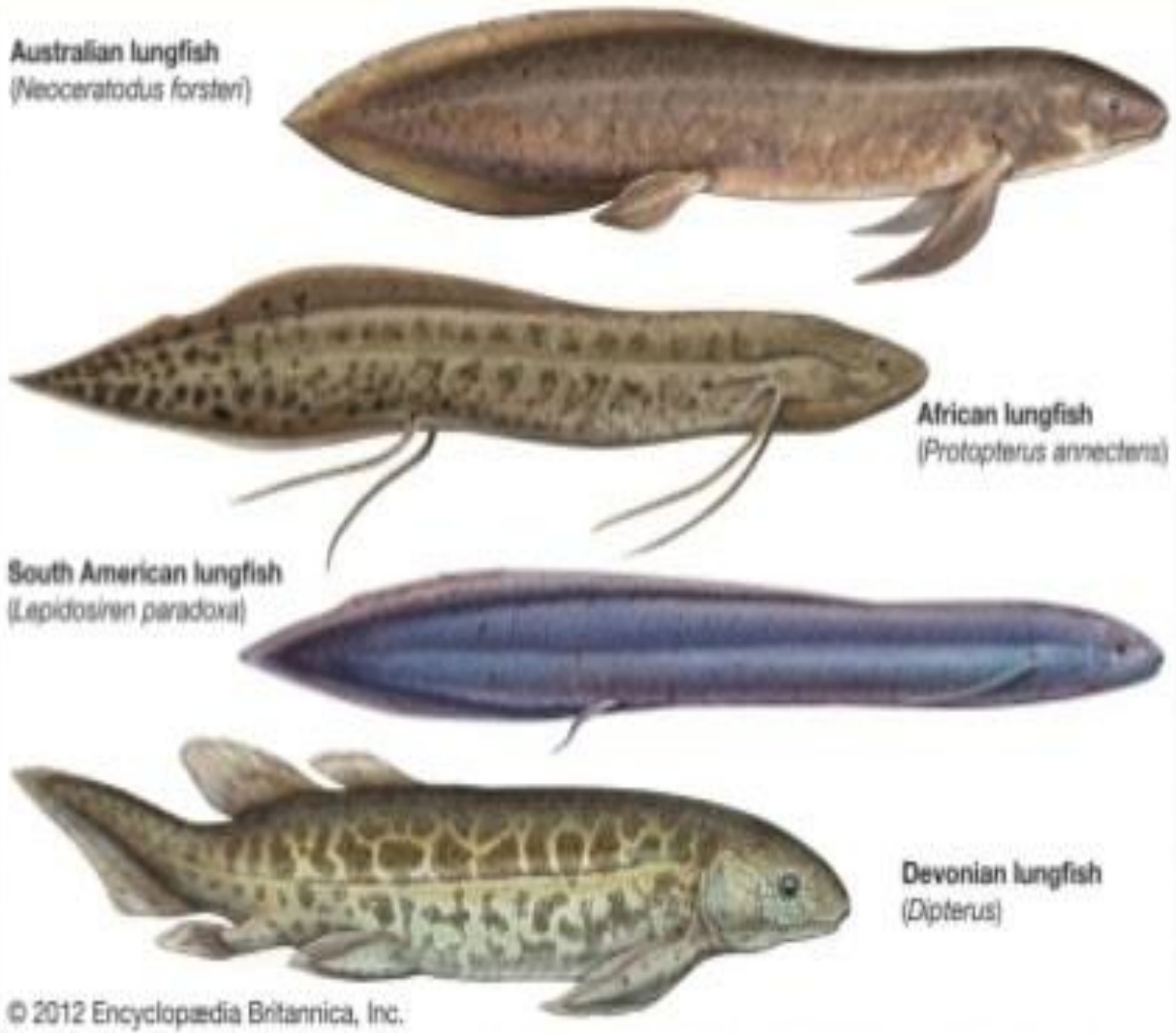
DIPNOI

Introduction

- Dipnoi (Gr. di-two, pnoe-breathing) is a small order of fresh water bony fishes.
- They are a group of sarcopterygiian fish, are commonly known as the lungfish.
- They respire by gills and lungs.
- Dipnoi evolved during Devonian period.
- They are characterized by short jaws, crushing plate like teeth, internal nares, reduced exo- and endo- skeleton, and diphycercal tail.



By Somarah Saloo

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- They are characterized by short jaws, crushing plate like teeth, internal nares, reduced exo- and endo- skeleton, and diphycercal tail.
- The air bladder i.e., so called ‘lungs’ are one or two. They are functional with related changes in the circulatory system and in the heart.

Distribution

- Modern lung fishes show discontinuous distribution.
- The three surviving genera of lung fishes are *Neoceratodus*, *Protopterus* and *Lepidosiren*. All are inhabitants of river.
- *Neoceratodus* is found only in the Burnett and Mary rivers of Queens-land in Australia, so commonly called as 'Burnett Salmon' or Australian lungfish.
- *Protopterus* lives in large lakes and rivers of tropical Africa. It is commonly called as 'Nile lungfish' or African lung fish.
- *Lepidosiren* is found in river Amazon and Paraguay basin in South America.
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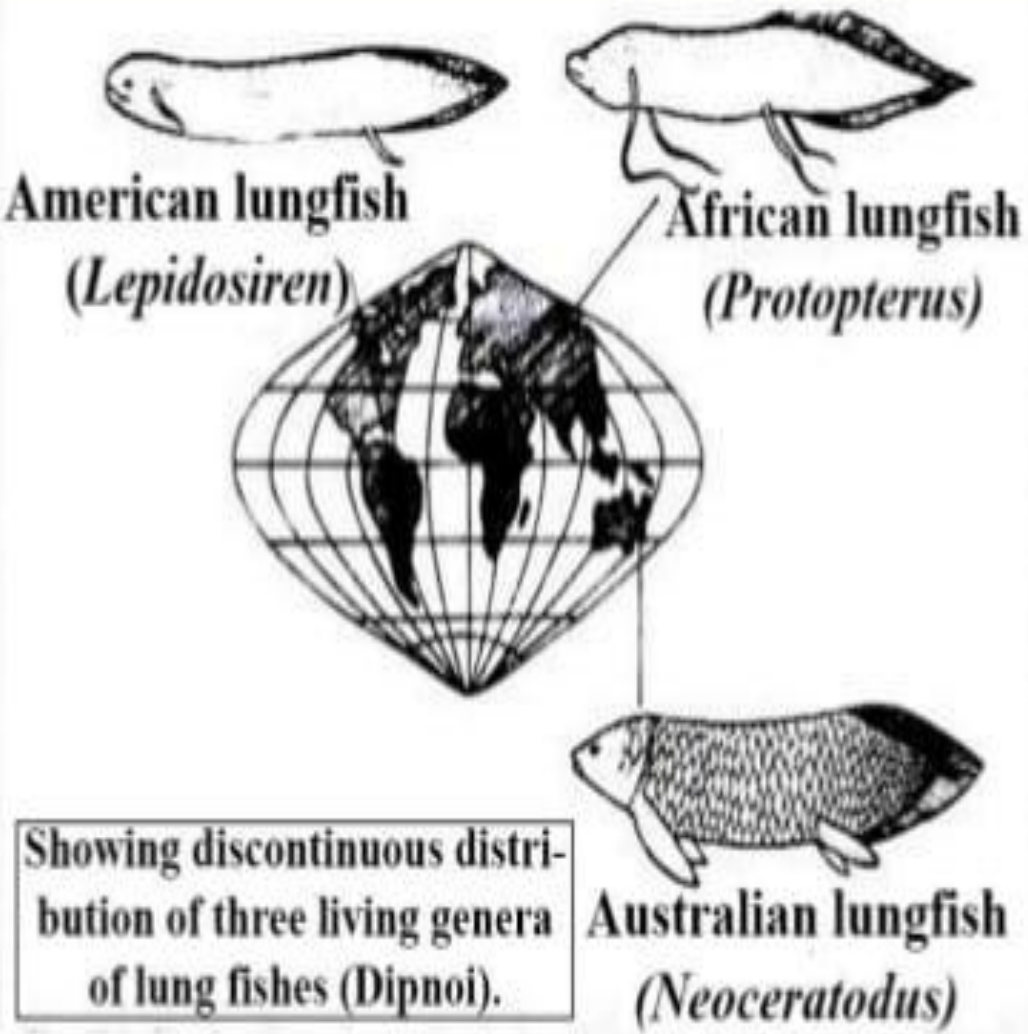
- Distribution of Dipnoi:
- Modern lung fishes show discontinuous distribution.
- The three surviving genera of lung fishes are Neoceratodus (=Epiceratodus) Protopterus and Lepidosiren - RIVER.
- Neoceratodus -only living genus of the family Ceratodontidae, the other being extinct Ceratodus. In Burnett and Mary rivers of Queens-land in Australia, 'Burnett Salmon' or Australian lungfish.
- Protopterus lives in large lakes and rivers of tropical Africa. It is commonly called as 'Nile lungfish' or African lung fish.
- Lepidosiren is found in river Amazon and Paraguay basin in South America. 'Amazon lungfish' or South American lungfish.

Primitive characters of Dipnoi

1. Unconstricted notochord.
2. Presence of cloaca.
3. Spiral valves in intestine.
4. Valves in the conus.
5. Diphycercal tail.
6. Ventral inferior nostril.
7. Persistent notochord without any constriction.
8. Cartilaginous autostylic skull.



Showing discontinuous distribution of three living genera of lung fishes (Dipnoi).

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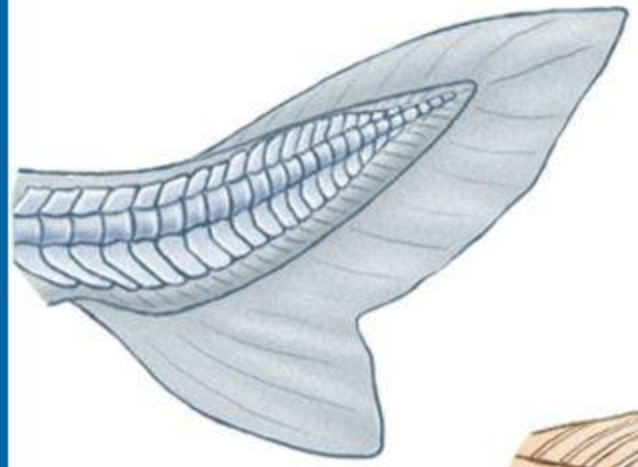
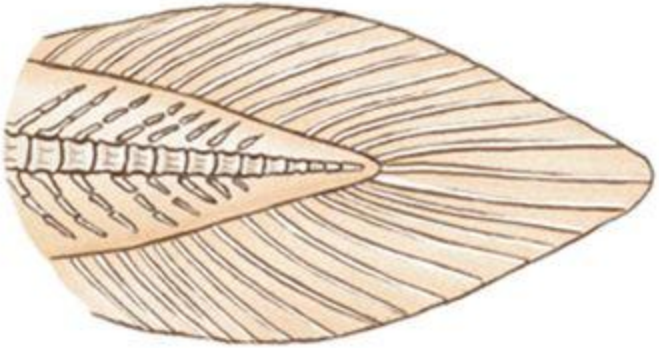
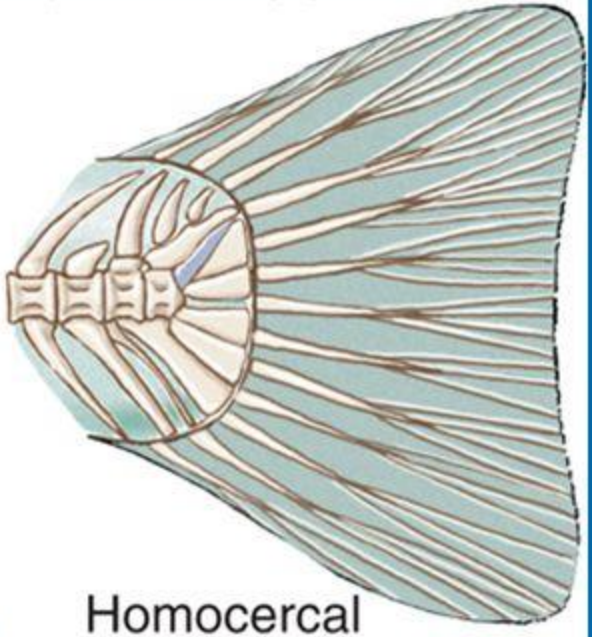
Types of Tail Fins among Fishes



Heterocercal
(shark)



Diphycercal
(lungfish)



Homocercal
(perch)

Specialized characters

1. Internal nares, possibly help in breathing through the nose.

2. Respiration by lungs (modified air bladder) in addition to gill-respiration.

3. Auricle is partly divided into two and nearly three-chambered heart.

4. One of the paired auricles receives oxygenated blood through a special pulmonary arch from the lungs.

5. Conus arteriosus spirally twisted and contractile in nature.

6. Separation of pulmonary and systemic circulation.

7. Large paired cerebral hemispheres.

8. Well-developed Mullerian duct.

9. Presence of characteristic tooth plates, used for crushing of shelled invertebrates.

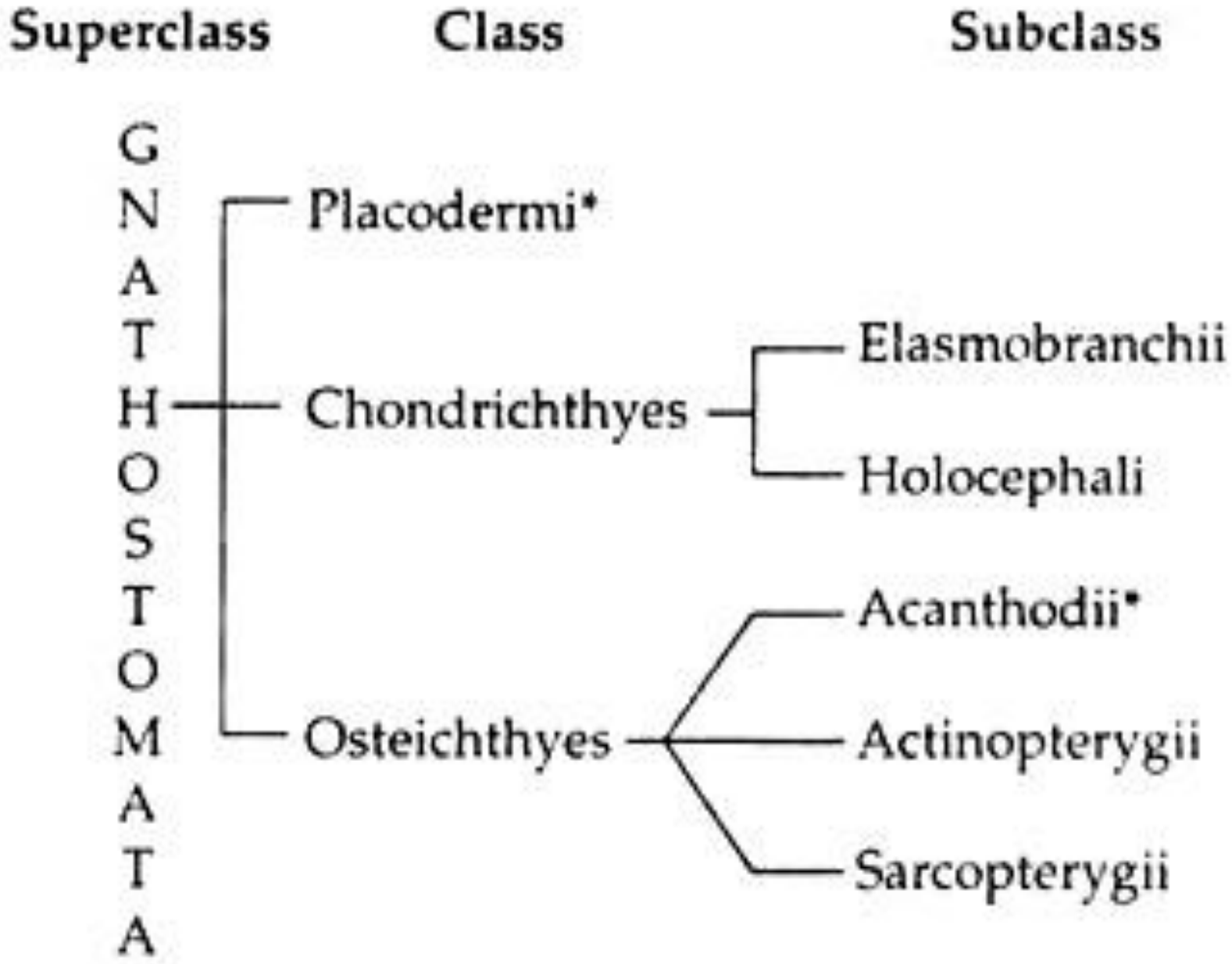
10. Bones absent in the jaw.

Affinities of Dipnoi

Relationship with other group of animals

Affinities of Dipnoi

- To study the evolutionary significance of any organisms, first we have to study their different characters.
- Then we have to compare their characters with other groups of organisms to find out the degree of similarities and dissimilarities of that organism with others.
- Accordingly we can predict their evolutionary position and their significance or roll in phylogenetic diversification.


Superclass
Class
Subclass
GNATHOSTOMATA
Placodermi*
Chondrichthyes
Elasmobranchii
Holocephali
Osteichthyes
Acanthodii*
Actinopterygii
Sarcopterygii

Classification of the Major Taxa of Fish

	examples
Phylum Chordata	
Subphylum Vertebrata	
Supraclass Agnatha	jawless fishes
Order Osteostraci	
Order Anaspida	
Order Heterostraci	
Order Coelolepida	
Order Cyclostomata	
Class Myxinoidea	hagfish
Class Petromyzontida	lampreys
Class Placodermi	
Order Arthrodiriformes	
Order Antiarchiformes	
Supraclass Gnathostomata	jawed fishes
Class Chondrichthyes	
Subclass Elasmobranchii	
Order Cladoselachiformes	extinct Paleozoic sharks
Order Xenacanthiformes	Paleozoic freshwater sharks
Order Selachii	typical sharks
Order Batoidea	skates and rays
Subclass Holocephali	
Order Chimaeriformes	chimaeras or ratfishes
Class Acanthodii	various extinct fishes
Class Osteichthyes	higher bony fishes
Subclass Actinopterygii	ray-finned fishes
Infraclass Chondrostei	sturgeon, paddlefish; primitive ray-finned fishes
Infraclass Holostei	gars, bowfins; dominant ray-finned fishes of Mesozoic
Infraclass Teleostei	most bony fish; dominant in Cenozoic and recent times
Subclass Sarcopterygii	lobe-finned fishes
Order Crossopterygii	ancestors of land vertebrates
Order Dipnoi	lungfishes

Affinities with fishes

General affinities with fishes

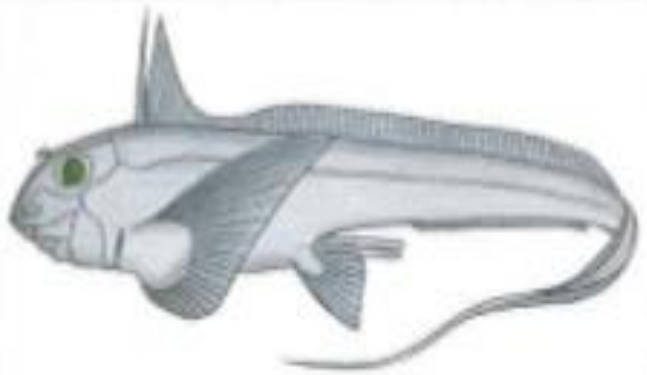
1. Spindle-shaped, eel-like body.
2. Body covered with scales (Cycloid).
3. Presence of paired fins.
4. Diphycercal caudal fins.
5. Persistent notochord.
6. Skull with little ossification.
7. Paired gill-slits.
8. Branchial respiration.
9. Lateral line sense organs.

Affinities with Elasmobranchi

1. Endoskeleton mostly cartilaginous.
2. Intestine with spiral valves.
3. Conus arteriosus with valves.
4. Each gill with two efferent arteries.
5. Absence of nephrostome in uriniferous tubules.
6. Small diencephalon with vascular roots.
7. Similar female reproductive organs.

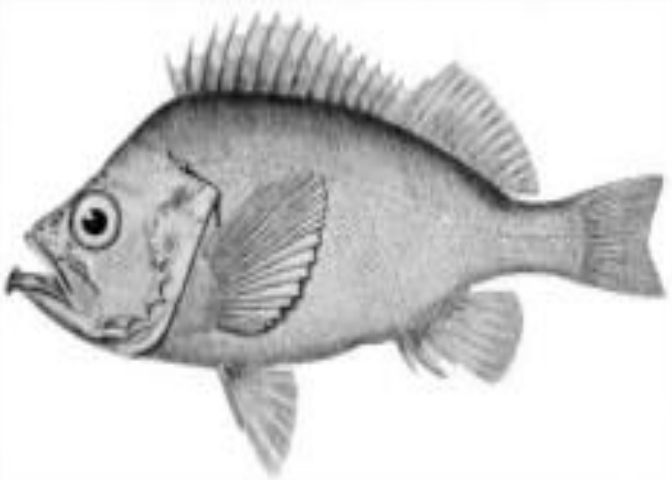
Affinities with Holocephali

1. Excurrent nostrils opening into mouth cavity.
2. Autostylic jaw suspensorium.
3. Gills covered with operculum.
4. No distinct stomach.
5. Intestine with a spiral valve.
6. Teeth fused to form dental plates.
7. Identical kidneys, gonads and gonoducts.
8. Two efferent arteries in each gill.



Affinities with Actinopterygii

1. Blunt snout with ventral nostril.
2. Presence of cycloid scales.
3. Strong palate and splenial teeth.
4. Presence of operculum covering gills.
5. Presence of swim bladder.



Affinities with Crossopterygii

1. Diphycercal caudal fin.
2. Powerful leg-like lobate fins.
3. Identical skull bones.
4. Vertebral column upto the tip of caudal fin.
5. Air bladder for pulmonary respiration.
6. Internal nostrils.
7. Presence of contractile conus arteriosus.

Affinities with Amphibia

Similaries with Amphibia

1. Semiaquatic habitat.
2. Internal nostrils
3. Vomerine teeth.
4. Autostylic jaw suspensorium.
5. Multicellular cutaneous glands.
6. Pulmonary respiration.
7. Dermal scales as in Apoda.
8. Ventral aorta short or absent
9. Presence of anterior abdominal vein, posterior vena cava, pulmonary artery and veins.
10. Thin walled pericardium.
11. Long and narrow cerebral hemispheres.
12. Similar structure of egg and development

Dissimilarities with Amphibia

1. Paired lobate-fins
2. Maxillae and premaxillae are absent.
3. Peculiar crushing tooth plates.
4. Few anterior vertebrae fused with skull.
5. Cartilagenous skull.
6. Lungs lie dorsal to gut.
7. Urinary bladder from dorsal wall of cloaca.

Conclusion

- The above affinities indicate that dipnoans are not most advanced Pisces from which amphibians could evolve. They are degenerate descendants of Crossopterygii.
- According to Jarvik (1968) dipnoans are more specialized than crossopterygian.
- According to latest view, both dipnoans and amphibians have originated from some crossopterygian like ancestor.
- There must have been a common ancestor for Dipnoi, Crossopterygii and Labyrinthodont amphibia.
- So most probably, dipnoans are not the "fathers of the amphibia", but "uncles of the amphibian".
- However, Jarvik (1980) considers that the Dipnoi may be related to elasmorbranchs than any other animals.