

# CHARACTERS AND CLASSIFICATION OF VERTEBRATE GROUPS(PISCES)

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Fishes are essentially aquatic, jaw bearing vertebrates. They evolved during Silurian period and became the most flourishing group of aquatic vertebrates in Devonian period. Devonian period is the golden age of fishes. They are first group of vertebrates with biting jaws in the evolution of vertebrates. The earliest gnathostomes were acanthodians (climatus). Placoderms appeared shortly after acanthodians. Acanthodians gave rise to bony fishes. Placoderms gave rise to Cartilaginous fishes. Smallest fish is Paedocypris progenetica. Largest fish is Rhinodon typus

## GENERAL CHARACTERS:

1. They are cold blooded Vertebrates.
2. They are aquatic live in fresh water, sea water and brackish water.
3. Body is usually streamlined, but some are elongated and snake like, while a few are flattened dorsoventrally.
4. Neck is absent as an adaptation to aquatic life.
5. There is an exoskeleton of scales, denticles or bony plates developed from mesoderm.
6. The skin glands are multicellular mucous glands. Their secretion helps in reducing the friction during locomotion.
7. They have paired and unpaired fins supported by soft or spiny rays.
8. Dorsal, anal and caudal fins are unpaired. They help in maintaining the balance of the animal.
9. Pectoral and pelvic fins are paired. They help in steering, stopping and hovering.(locomotion)
10. The caudal fin present on the tail is helpful in propulsion.
11. All fish vertebrae are Amphicoelous
12. All viscera except kidney are enclosed by pleuroperitoneal cavity
13. Nostrils are paired. They do not open into pharynx except in lung fishes.
14. Eyelids are absent. Organs of respiration are gills.
15. Gills are supported by gill arches.
16. Counter current flow of blood in gills enhances oxygenation of blood
17. The anterior or posterior wall of gill surface has hemibranch or demibranch
18. The functional surface of hemibranchs consists of a large number of transverse folds called Lamellae
19. The two hemibranchs of a single gill arch together with interbranchial septum constitute Holobranchs
20. In certain fresh water bony fishes, there are accessory respiratory organs. In lung fishes they have a lung to meet the drought conditions.

21. Heart is two chambered with one auricle and one ventricle.
22. The flow of the blood is only towards gills and hence the heart is called Branchial heart. As the blood flows only to the respiratory organs from the heart, the circulation is called single circulation.
23. As the blood in the heart is always impure, the heart is also called as Venous heart.
24. Brain is covered by a single membrane *Manix primitiva*.
25. Cranial nerves are ten pairs.
26. Only internal ear is present and it serves mainly as a balancing function and also hearing.
27. Lateral line sense organs or neuromast organs, characteristic of fishes. They are Rheoreceptors and help in maintaining the balance against water currents.
28. Excretory organs are Mesonephric kidneys.
29. The excretory product is Ammonia hence the fishes are called ammonotelic animals.
30. However, Cartilaginous fishes excrete urea.
31. Sexes are separate.
32. Fertilisation is external or internal.
33. Amnion is absent in the embryonic stage.
34. Hence, fishes are included under Anamniota.

### **CLASSIFICATION OF PISCES:**

- About 25,000 species of extant jawed fishes are known.
- Pisces are classified into Placodermi (extinct), Chondrichthyes and Osteichthyes.(living)

### **I. Class Placodermi: (Plate skin)**

- a) They originated from ostracoderm during Silurian period and became extinct by the beginning of Mesozoic era.
- b) Placoderms are regarded as progenitors of modern fishes.(ancestors of Chondrichthyes)
- c) Their body is protected by heavy bony armour, the feature which gives their name 'Placodermi'.
- d) The spiracle is represented as a gill.
- e) e.g. Bothryolepis, Dunkelosteus

### **II. Class: Chondrichthyes**

- a) Mostly marine and predaceous.
- b) The endoskeleton is entirely cartilaginous without true bones.
- c) Placoid scales form the exoskeleton.
- d) Caudal fin is heterocercal.
- e) Mouth is long, crescentic and ventral.
- f) Gill slits are 4 to 7 pairs without operculum.
- g) Gills are lamelliform
- h) Intestine has Spiral valve or scroll valve
- i) Air bladder is absent.
- j) Cloaca lies between two pelvic fins.
- k) Ureotelic animals. In males the pelvic fins are provided with claspers.
- l) Fertilization is internal.
- m) Most Sharks and all rays are Viviparous and possess yolk sac placenta.

- **Subclass of chondrichthyes are Elasmobranchii and Holocephali**

### **Subclass Elasmobranchii**

- Includes sharks, skates and rays
- Skin covered by placoid scales
- Operculum absent
- Gill slits are 5 to 7 pairs, naked and without any operculum. In Hexanchus, there are 6 pairs and Heptanchus there are seven pairs of gills slits

#### **A. SHARKS:**

- a) They occur in the warm waters of tropics.
- b) They have an acute sight and smell.
- c) Sharks are very large animals.
- d) They are active predaceous animals and they are pleurotrematic elasmobranches with lateral gill openings.
- e) Sharks are viviparous animals.

#### **Rhinodon or Rhincodon**

- It is commonly called the whale shark.
- This is the largest of all fishes and second largest vertebrate.

#### **Scoliodon :**

- It is called the Indian dogfish.
- This is used for study in laboratories because of their small size.
- The dried skin of shark is called shagreen. It is used in polishing industry.

#### **Stegostoma: (Tiger or Zebra shark)**

- It exhibits brilliant colouration of dark stripes over yellow background.

#### **Sphyrna (Zygaena) :**

- Abundant in Indian Ocean, commonly called as hammer-headed shark.
- The head is mallet shaped due to a prominent lateral lobe on either side bearing an eye on its distal end.

#### **B. Rays and Skates:**

- They are more diverse than sharks.
- They are specialised for bottom dwelling.
- Their body is greatly flattened dorsoventrally.
- They are hypotrematic elasmobranches with ventrally placed gill slits.

#### **Myliobates :**

- Sea Vampire or Eagle ray.

#### **Torpedo:**

- Torpedo is called Electric ray.
- They have well developed electric organs for defence and predation.
- Certain dorsal muscles have become modified to powerful electric organs.

Rhizomatous:

- Commonly called a Guitar fish.
- A skate with depressed body and tapering snout.

Pristis: (Saw fish)

- Snout is greatly elongated and blade like with row of sharp teeth like scales, the saw forms a formidable weapon for defence as well as for food capture.

Trigon (Sting ray) Raja (Skate)

## **Subclass II Holocephali or Bradyodontii**

- In adult holocephali scales, spiracles and cloaca are absent
- Gills are covered by operculum (holocephali) Eg; chimera, hydrolagus, callorhynchus.

## **III Class: Osteichthyes**

- a) These are true bony fishes, living in both fresh water and sea water.
- b) Scales are of three types, ganoid, cycloid and ctenoid.
- c) Caudal fin is homocercal or diphyrcal.
- d) Endoskeleton is chiefly of bone.
- e) Mouth is terminal.
- f) Respiration by 4 pairs of filamentous gills present. Gills are covered by an operculum on either side.
- g) Air bladder or swim bladder is present with a connection or no connection to the pharynx. In some it is lung like.
- h) The air bladder is a hydrostatic organ.
- i) Class Osteichthyes is divided into Acanthodii, sarcopterygii and actinopterygii

### **Subclass I: Acanthodii :**

- Oldest known gnathostomes
- Became extinct during Permian period
- Type of scales are Ganoid scales
- Caudal fin is heterocercal
- Eg; climatius and Diplocanthus

### **Subclass II: Sarcopterygii**

- These are called lobe finned fishes.
- The paired fins are fleshy lobed with jointed skeleton and muscles resembling tetrapod limb.
- sarcopterygians are also called choanichthyes, because of the presence of internal nostrils.
- Intestine has spiral valve
- It includes two orders: 1. Crossopterygii and 2. Dipnoi

### **Order 1: Crossopterygii**

- It includes Rhipidistians (eg Osteolepis, Eusthenopteron) and coelocanthes

- Internal nares are present in rhipidistians but absent in coelocanthes
- Scales are cosmoid
- Crossopterygian fishes which dominated the Devonian period have almost become extinct by the end of Cretaceous.
- Species of the family, Coelacanthidae are the only living examples of this group. They have been found near Comoros islands between Africa and Madagascar in the river Chalumna.
- Latimeria chalumnae a coelocanth fish is named after Mrs.C.Latimer who identified the fish. It is referred to as a living fossil by Smith (1938).
- The body of Latimeria is covered with cosmoid scales. Internal nostrils are absent.
- Latimeria persists since Jurassic time with very little change.
- Latimeria menadoensis is found in eastern Indian Ocean.

## **Order 2: Dipnoi**

- Median fins continue to form diphyccercal tail fin.
- Body covered by cycloid scales
- Internal nostrils are present. Lungs are single or paired.
- Spiracles are absent
- There are only three genera that are living today.
- The dipnoans inhabit the rivers and are capable of breathing 'air' by Lungs.
- Commonly called as lung fishes

### Neoceratodus:

- Restricted to Burnett and Mary rivers of Queens land, Australia.
- It is known as Burnett Salmon.
- There is a single lung.
- Paired fins are paddle like.
- It is inactive and sluggish in habit.

### Protopterus:

- It is present in the White Nile on North of Congo basin and Zambezi Rivers in South Africa.
- Dorsal and caudal fins are united.
- Lungs are double.
- Paired fins are filamentous.
- During unfavourable seasons it undergoes aestivation.

### Lepidosiren:

- This is a South American lung fish and occurs along the course of main Amazon River.
- Dorsal and caudal fins are united and form the principal organs of locomotion.
- Two lungs are present.
- Paired fins are short.
- It also undergoes aestivation.
- The living dipnoans have special relationship despite the oceanic barriers separating them. Such organisms constitute an example for discontinuous distribution.
- Romer called them uncles of Amphibia because they are closely related to the ancestors

of amphibians, the Rhipidistian stock.

### **Subclass III – Actinopterygii :**

- These fishes are called ray finned fishes; since the fins are supported by dermal fin rays.
- Nostrils are not connected to the mouth cavity.
- This is divided into 3 infra classes. Chondrostei, Holostei, Teleostei.

#### **Infra class I - Chondrostei**

- Endoskeleton cartilaginous.
- It includes primitive ray finned fishes
- Mouth opening is large.
- Skin is covered with ganoid scales or scutes.
- Caudal fin is heterocercal but diphyrcercal type present in Bichir.
- All of them are North American fishes.
- Intestine has spiral valve
- Air bladder is connected to pharynx and functions as lung
- E.g. Acipenser (Sturgeon),  
Polypterus. (Bichir)

#### **Infra class II -Holostei**

- This includes intermediate ray finned fishes
- Mouth opening is small.
- Ganoid or cycloid scales form the exoskeleton.
- Tail fin is heterocercal.
- Spiracles are absent
- Air bladder is mainly hydrostatic and connected to pharynx
- Vestigial spiral valve is present
- North American fishes.  
E.g. Amia (Bowfin), Lepidosteus (garpike).

#### **Infra class III – Teleostei**

- This includes advanced ray finned fishes
- World wide in distribution.
- Mouth is small and terminal
- Scales are ctenoid or cycloid.
- Tail fin is homocercal.
- Air bladder or swim bladder, a hydrostatic organ is usually present.
- Spiracle is absent
- Spiral valve is absent

Some examples:

Echeneis:

- The sucker fish or Remora is found in all seas.
- The head is depressed with a sucker made of two rows of transverse lamellae.
- The anterior dorsal fin is modified into a sucker.
- These fishes attach themselves to other fishes and lead an ectocommusal life.

Hippocampus:

- This marine fish is called 'Sea horse'.
- The skin is covered by bony plates.
- It can swim vertically.
- Tail is prehensile.
- The male has a brood pouch formed by the combined pelvic fins.
- The young ones develop in the brood pouch.

Exocoetus:

- It is a flying fish of tropical seas.
- The pectoral fins become greatly elongated and sustain the fish in its gliding leaps, like a parachute
- Fish takes a leap with the powerful tail and glides for a few meters.

•Eel: (Anguilla)

- It lives in marshy areas.
- Pectoral fins are present.
- Pelvic fins are absent.
- Dorsal and anal fins are continuous with caudal fin.
- Adults migrate to sea in autumn.
- It is an example for catadromous fish.(migration from fresh water to sea water)
- Spawn in deep water and die.