1 Introduction

Chordates are animals characterized by the presence of a ***notochord***. They are included in the phylum ***Chordata*** which is the last phylum among the 30 phyla of the animal kingdom. The animals which do not contain a notochord are called ***Non-chordates*** or ***Invertebrates.***

The phylum Chordata comprises about 70,000 species where as, the non-chordates constitute about 1,024,410. Thus the chordates make up only about 7% of the animal kingdom. Though it is a small phylum, it is remarkable that man, the master of the present age, belongs to this phylum. Again phylum Chordata includes the largest and heaviest animals like blue whale (35 metres long and 120 tons in weight). The familiar chordates are *fishes, frogs, toads, lizards, snakes, turtles, crocodiles, birds* and mammals including *man*.

General Characters of Chordata

The animals containing a notochord, a dorsal tubular nerve cord and gill slits are called ***chordates.***

Chordates have the following characteristics:

1. Notochord : A dorsal longitudinal skeletal rod is located beneath the nerve cord. It is made up of ***vacuolated notochordal cells***. In higher chordates, it is surrounded or replaced

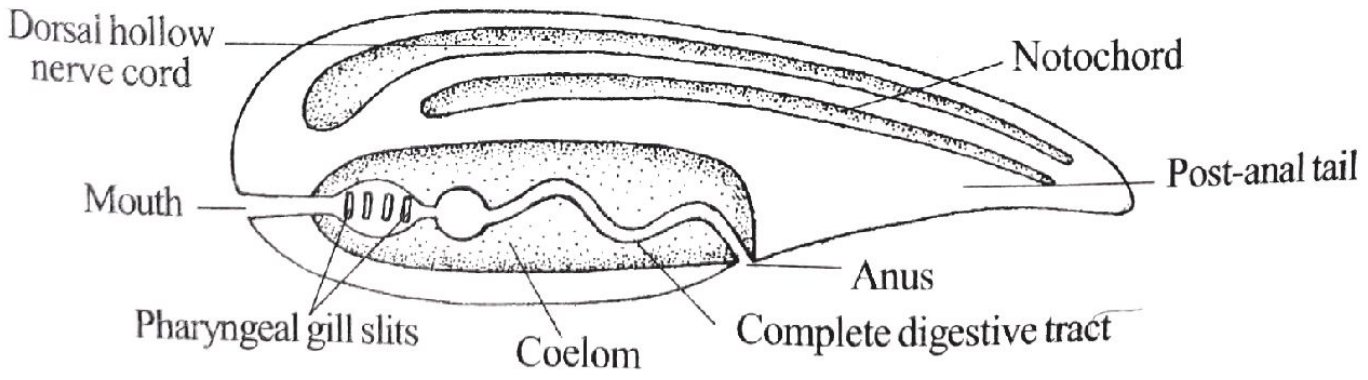

Fig. 1.1: Diagrammatic representation of chordate characteristics.

by a ***vertebral column.***

2. Nerve Cord: A single, tubular (***hollow***) nerve cord is located ***dorsal*** to the alimentary canal (Fig. 1.2). In the invertebrate phyla, the nerve cord is often paired, solid and ventral to the alimentary canal.

3. Pharyngeal Gill Slits: Paired openings are present on either side of the pharynx.

4. Post-anal Tail: It is present at some stage of the life cycle. May or may not persist in the adult.

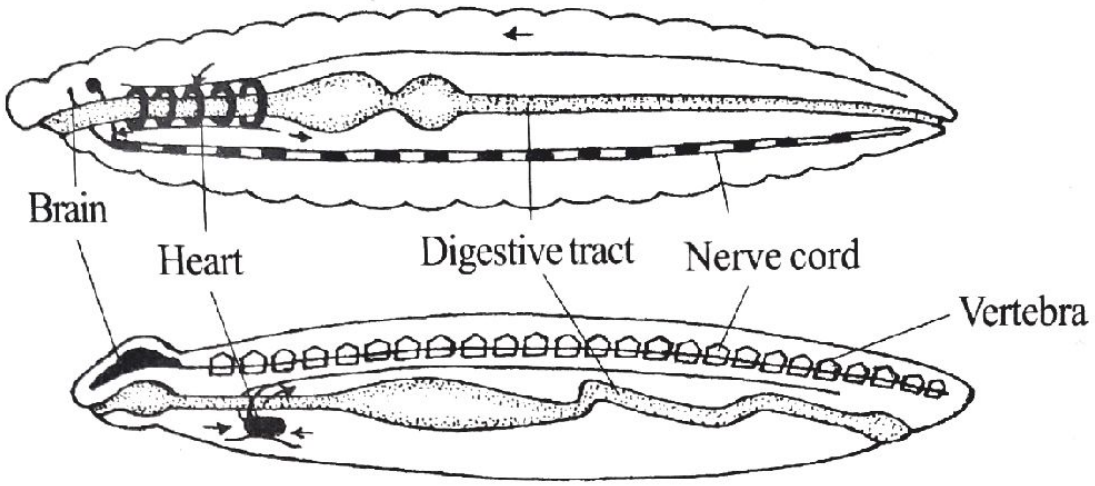

Fig.1.2: Fundamental differences in the body plan of (top) an invertebrate (annelid) and (bottom) a chordate. Note the location of heart and nerve cord. The arrows indicate the direction of blood flow.

5. Closed Vascular System: The blood never comes out of the blood vessels and it contains ***capillaries.***

6. Haemoglobin: Haemoglobin is present in the RBC.

7. Ventral Heart: The chordate heart is located on the ventral side of the body.

8. Direction of Blood Flow : In chordates, the blood is pumped anteriorly, then dorsally and posteriorly.

9. Hepatic Portal System : The food laden blood from the alimentary canal is carried to the liver through a ***hepatic portal vein.***

10. Bilateral Symmetry: All chordates are bilaterally symmetrical at least in the embryonic stage.

11. Cephalization: In bilaterally symmetrical animals, there is a concentration of nervous tissue and sense organs in or toward the head. This is known as ***cephalization.***

12. Metamerism : Certain structures that are repeated one after another are said to be metameric. Eg. *Some nerves, blood vessels, vertebrae, ribs, muscles*, etc.

13. Coelom: All chordates have a true body cavity (between the body wall and the gut wall) lined entirely with mesoderm. The coelom is ***entero coelous*** developing from the gut.

Classification of Chordata

Chordata is a phylum comprising of animals with a ***notochord***. Chordata is the last phylum in the ***Animal Kingdom***. The remaining phyla include non-chordates (Invertebrates).

Phylum Chordata is sub-divided into 3 subphyla, namely :

Subphylum 1. Urochordata

Subphylum 2. Cephalochordata

Subphylum 3. Vertebrata

Urochordata includes chordates containing notochord in the ***tail region.*** Eg. *Ascidian (Herdmania).*

Cephalochordata includes chordates containing a notochord extending upto the ***tip of head***. Eg. *Amphioxus.*

The subphylum Urochordata and Cephalochordata are together called ***Protochordata*** or ***Prochordata*** because they are the ***first*** chordates.

The ***protochordates*** do not possess a ***cranium*** (a part of skull enclosing brain) and a ***head***. So they are called ***Acrania.***

The ***Vertebrata*** possess a ***cranium*** and a ***head.*** So they are called ***Craniata.***

The vertebrata includes animals containing a ***vertebral column***. Vertebral column is the ***back bone*** formed of a series of ring-like vertebra arranged one behind the other. The vertebral column either develops around the notochord or replaces the notochord.

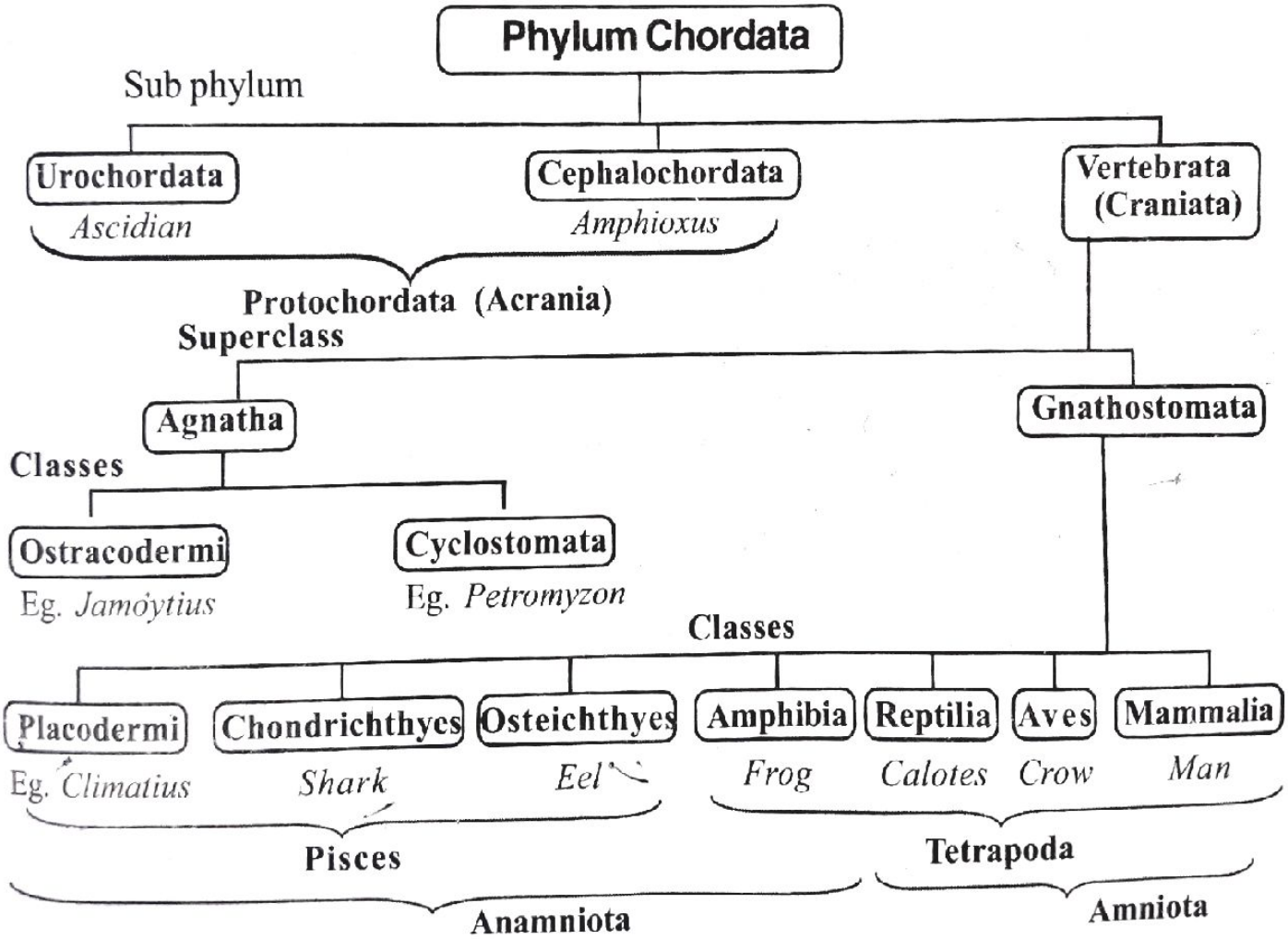

Fig.1.3 : Synoptic classification of Chordates.

Subphylum Vertebrata is divided into two superclasses based on the presence or absence of jaws, namely :

Superclass 1. Agnatha

Superclass 2. Gnathostomata

Agnatha are vertebrates without jaws.

Agnatha is divided into two classes, namely :

Class 1. Ostracodermi Eg. Jamoytius.

Class 2. Cyclostomata Eg. Petromyzon.

Gnathostomata are vertebrates containing jaws.

Gnathostomata is divided into 7 classes, namely :

Class 1. Placodermi
Class 2. Chondrichthyes } *Pisces*
Class 3. Osteichthyes

Class 4. Amphibia
Class 5. Reptilia
Class 6. Aves } *Tetrapoda*
Class 7. Mammalia

Placodermi, Chondrichthyes and Osteichthyes include ***fishes***. So they are together called class ***Pisces.***

Amphibia, Reptilia, Aves and Mammalia contain 4 limbs. So they are together called ***Tetrapoda.***

Pisces and Amphibia do not develop an embryonic membrane ***amnion***. So they are together called ***Anamniota.***

Reptilia, Aves and Mammalia develop an ***amnion***. So they are called ***Amniota.***

Placodermi includes ***plate-skinned*** fishes. Eg. *Climatius.*

Chondrichthyes includes ***cartilaginous*** fishes. Eg. *Scoliodon, Narcine,* etc.

Osteichthyes includes ***bony*** fishes. Eg. *Eel.*

Amphibia includes vertebrates living partly in water and partly on land. Eg. *Rana hexadactyla, Rhacophorus,* etc.

Reptilia includes ***creeping*** land vertebrates. Eg. *Lizards, turtles, snakes, crocodiles,* etc.

Aves includes flying vertebrates with beaks, wings and feathers. Eg. *Birds.*

Mammalia includes ***hairy*** vertebrates with ***mammary glands***. Eg. *Echidna, Kangaroo, Monkey, Man,* etc.

Vertebrata

Vertebrata is a group of chordates having ***vertebral column***. This group is also called ***craniata*** because the animals included in this group contains a ***cranium*** and a ***head***.

Vertebrata is the highest subphylum of the phylum ***Chordata***.

General Characters

1. A vertebral column is present.
2. A distinct ***head*** is present.
3. The ***brain*** is well developed.
4. The brain is enclosed in a ***cranium***.
5. Two pairs of ***appendages*** in the form of ***fins*** or ***limbs*** are present.
6. The integument is made up of ***epidermis*** and ***dermis***.
7. The ***endoskeleton*** is bony or cartilaginous in nature.

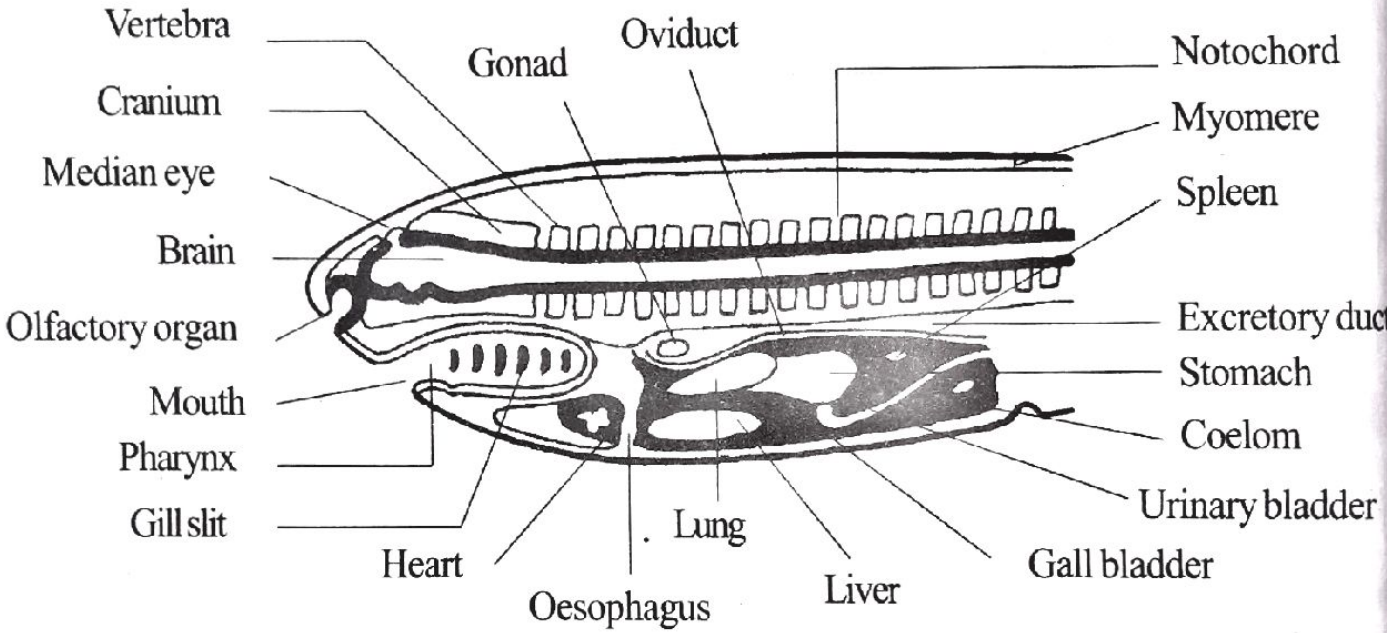

Fig.1.5: A longitudinal section of a generalized vertebrate showing the key characters.

8. The ***digestive system*** is well developed and it includes liver and pancreas.
9. The ***circulatory system*** is the ***closed type*** with capillaries.
10. The ***heart*** lies ventral to the digestive tract.
11. The ***blood*** flows backwards in the dorsal vessel and forwards in the ventral vessel. This is just reverse to that of invertebrates.
12. ***Portal systems*** are well developed .
13. The ***spinal nerves*** have two roots.
14. A ***tail*** is present.
15. ***Excretory system*** is made up of a pair of ***kidneys***. A ***bladder*** is present for storing urine.
16. The sexes are separate.
17. In many vertebrates, the genital duct and the rectum join together to form a ***cloaca***.
18. ***Endocrine glands*** are well developed.

Key Characters

1. Anterior end of the dorsal nerve cord is enlarged to form a ***brain*** and the remaining part is ***spinal cord.***

2. Brain is protected by a skeletal structure called ***neurocranium***, hence the name ***Craniata.***

3. Spinal cord is protected by a series of metamerically arranged ***vertebrae,*** associated with the notochord in their development.

4. Pharynx small; having relatively few gill slits.

5. Paired sense organs in head-***olfactory, optic*** and ***otic***- are typical.

6. Vertebrate blood contains ***haemo-globin*** held in ***erythrocytes.***

The subphylum Vertebrata is subdivided into two superclasses viz., ***Agnatha*** (jawless fish-like vertebrates) and ***Gnathostomata*** (Vertebrates with jaws).

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