

CHAPTER 4

ANIMAL KINGDOM

Animal Kingdom is characterized by multicellular, eukaryotic organisms. The cells lack cell walls. They ingest and digest food (holozoic), hence they are heterotrophic. Higher forms show elaborate sensory and neuromotor systems. Majority of them are motile. Reproduction is mostly sexual and embryological development is present in them. About 1.2 million species of animals are described till now. The classification helps to assign a systematic position to newly described species.

4.1 BASIS OF CLASSIFICATION

Though different animals differ in their form and structure, there are some fundamental similarities in them such as arrangement of cells, body symmetry, nature of coelom, diploblastic or triploblastic nature of the body wall, segmentation, presence or absence of notochord etc. These features form the basis for the classification of animals. Some of them are described here.

4.1.1 Levels of organization: The patterns of organization of cells vary in animals in spite of their multicellular nature. The patterns of cellular organization seen in animals are:-

a) **Cellular level of organization** – In these animals, the cells of the body form loose aggregates e.g.:- Sponges.

b) **Tissue level of organization-** In these animals, cells of the animal carrying out the same function are arranged in tissues e.g.:- Coelenterates.

c) **Organ system level of organization-** In these animals, tissue are grouped together to form organs, each specialized for a particular function e.g.:- members of Platyhelminthes and other higher phyla.

4.1.2. Body symmetry: The arrangement of body parts around a central point or line determines symmetry. Some animals are **asymmetrical** which cannot be divided into two equal halves along any plane passing through the centre e.g.:- sponges. Some exhibit **radial symmetry** where the animal can be divided into two equal halves along any plane passing through the central axis e.g.:- Coelenterates, Ctenophores and Echinoderms. Still other animals exhibit **bilateral symmetry** where the body can be divided into identical left and right halves along only one plane e.g.:- Annelids, Arthropods, Chordates etc.

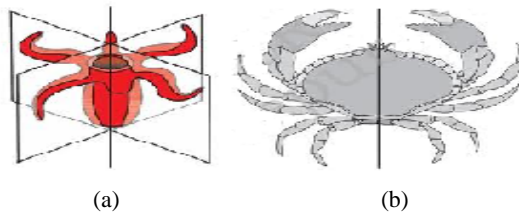


Fig. 4.1. (a) Radial symmetry (b) Bilateral symmetry.

4.1.3 Body wall: The body wall of the animal may be arranged in two or three embryonic layers. Accordingly the animals are called **diploblastic** (having outer ectoderm and inner endoderm and undifferentiated mesoglea in between them) animals. e.g.:- Coelenterates, and **triploblastic** (having outer ectoderm, middle mesoderm and inner endoderm) animals. e.g.:- Platyhelminthes to Chordates.

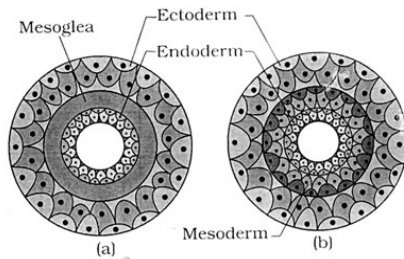


Fig. 4.2. Body layers (a) Diploblastic (b) Triploblastic.

4.1.4. **Coelom:** The presence or absence of a cavity called coelom in between body wall and gut is important for classification. The animals are of three types based on the presence or absence of coelom-

- a) **Acoelomates**- In these animals body cavity is absent. e.g. Platyhelminthes
- b) **Pseudocoelomates**- In these animals the body cavity is not lined by mesoderm e.g. Aschelminthes
- c) **Eucoelomates**- In these animals true coelom lined by mesoderm is present. e.g. Annelids to Chordates

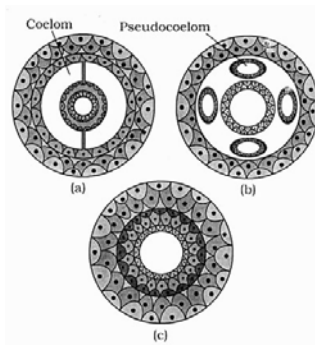


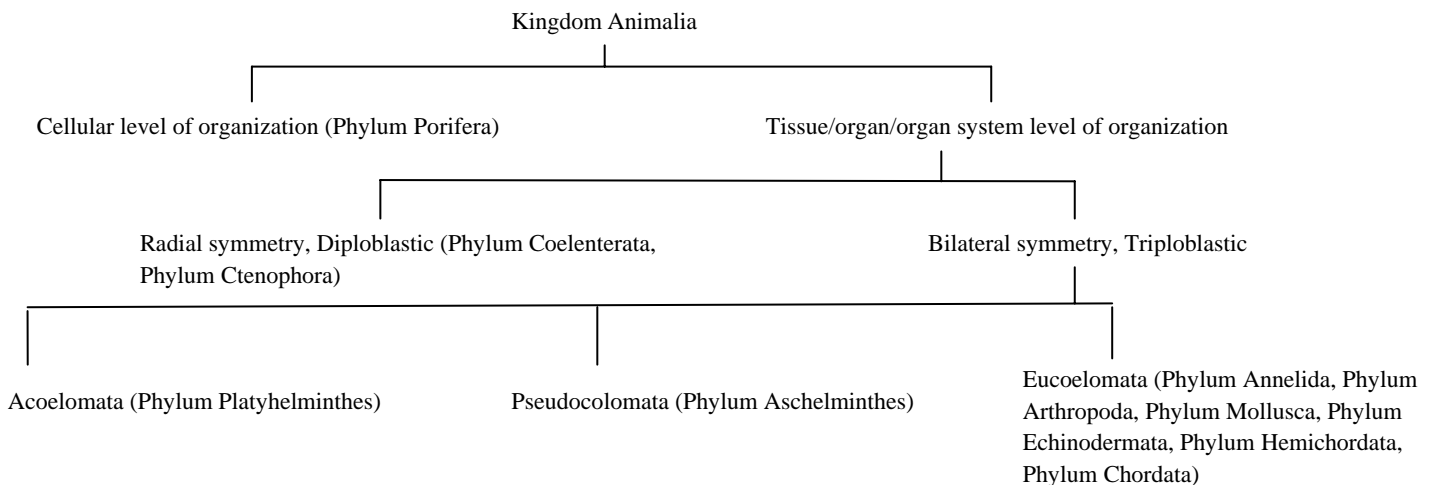
Fig. 4.3. Diagrammatic sectional view of (a) Eucoelomate (b) Pseudocoelomate (c) Acoelomate.

4.1.5. **Segmentation:** It is also called metamerism. The body is externally and internally divided into repeated, linear series of body units called metameres or somites, e.g.:- Earthworms.

4.1.6. **Notochord:** Notochord is a supporting rod-like structure derived from mesoderm. It may be present in embryonic or adult stages. The animals which possess notochord are called chordates. e.g. Chordata. The animals in which notochord is absent are called non chordates, e.g.:- Porifera to Hemichordata.

4.2 CLASSIFICATION OF ANIMALS

An outline of classification of animals is given below:



Different Phyla of Non-chordates and their examples

1. Phylum- **Porifera**:- **Dermal ostia** and **canal system** are present. E.g. *Sycon*(Scypha), *Euspongia* (Bath sponge), *Spongilla*(Fresh water sponge)

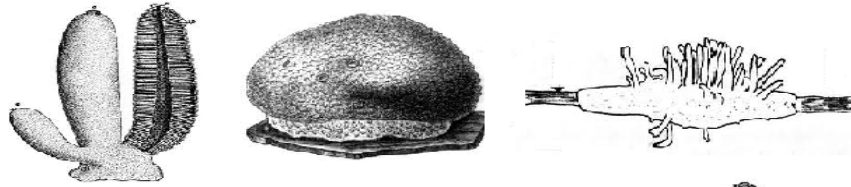


Fig. 4.4. Porifera: (a) *Sycon* (b) *Euspongia* (c) *Spongilla*

2. Phylum- **Coelenterata or Cnidaria**:- They possess cells called **cnidoblasts** for defence and food capture. E.g. *Hydra*, *Obelia*, *Physalia* (Portugese man of war), *Adamsia* (Sea anemone), *Meandrina* (Brain coral)



Fig. 4.5. Coelenterata: (a) *Aurelia*,

(b) *Adamsia*.

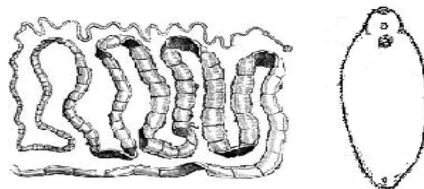
Fig. 4.6. Diagrammatic view of Cnidoblast

3. Phylum- **Ctenophora** :- They possess external rows of **comb plates** for locomotion. E.g. *Pleurobranchia*, *Ctenophora*



Fig. 4.7. Ctenophora: *Pleurobranchia*

4. Phylum- **Platyhelminthes** :- They have **flat body**. **Solenocytes(flame cells)** are present for excretion. E.g. *Planaria*, *Fasciola* (Liver fluke), *Taenia* (Tape worm)



4.8. Platyhelminthes: (a) Tape worm,

(b) Liver fluke

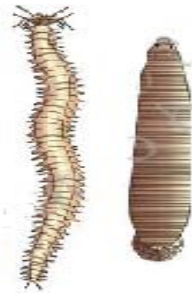
5. Phylum- **Aschelminthes** :- They are **cylindrical, elongated** and worm-shaped. E.g. *Ascaris* (Round worm), *Wuchereria* (Filarial worm), *Ancylostoma* (Hook worm)



Male Female

Fig. 4.9. Aschelminthes: Roundworm

6. Phylum- **Annelida** :- Their body exhibits **true segmentation(metamerism)** E.g. *Pheretima* (Earthworm), *Nereis* (Rag worm) ,*Hirudinaria* (Leech)



4.10. Annelida: (a) *Nereis*, (b) *Hirudinaria*.

7. Phylum- **Arthropoda** :- They have **paired, jointed appendages** and **chitinous exoskeleton**. E.g. *Penaeus* (Prawn), *Apis* (Honey bee), *Bombyx* (Silk moth), *Laccifer* (Lac insect), Mosquitoes (*Anopheles* , *Culex*, *Aedes*), *Palamnaeus* (Scorpion), *Arnea* (Spider), *Limulus* (King crab)



Fig. 4.11. Arthropoda: (a) Locust, (b) Prawn, (c) Spider.

8. Phylum- **Mollusca** :- They are **soft-bodied** animals which generally possess calcareous shell as exoskeleton. E.g. *Pila* (Apple snail), *Pinctada* (Pearl oyster), *Dentalium* (Tusk shell), *Chaetopleuara* (Chiton), *Lamellidens* (Fresh water mussel), *Aplysia* (Sea hare), *Octopus* (Devil fish), *Sepia* (Cuttle fish), *Loligo* (Squid).



Fig. 4.12. Mollusca: (a) *Pila*, (b) *Octopus*.

9. Phylum-**Echinodermata** :- They are **spiny-skinned** animals having radial symmetry in adult stage. They possess water vascular system. E.g. *Asterias* (Star fish), *Ophiura* (Brittle star), *Echinus* (Sea urchin), *Cucumaria* (Sea cucumber), *Antedon* (Sea lily).



Fig. 4.13. Echinodermata: (a) *Asterias*, (b) *Ophiura*.

10. Phylum- **Hemichordata** :- They are worm-like animals with **proboscis, collar** and **trunk**. Respiration by many paired gills. Excretion is through proboscis gland. E.g. *Balanoglossus*, *Saccoglossus*



Fig. 4.14. *Balanoglossus*.

4.2.1. Phylum: Chordata

Phylum Chordata includes animals characterized by the presence of a **notochord**, a **dorsal hollow nerve cord** and **paired pharyngeal gill slits**.

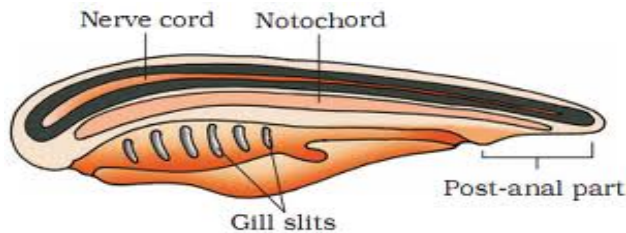
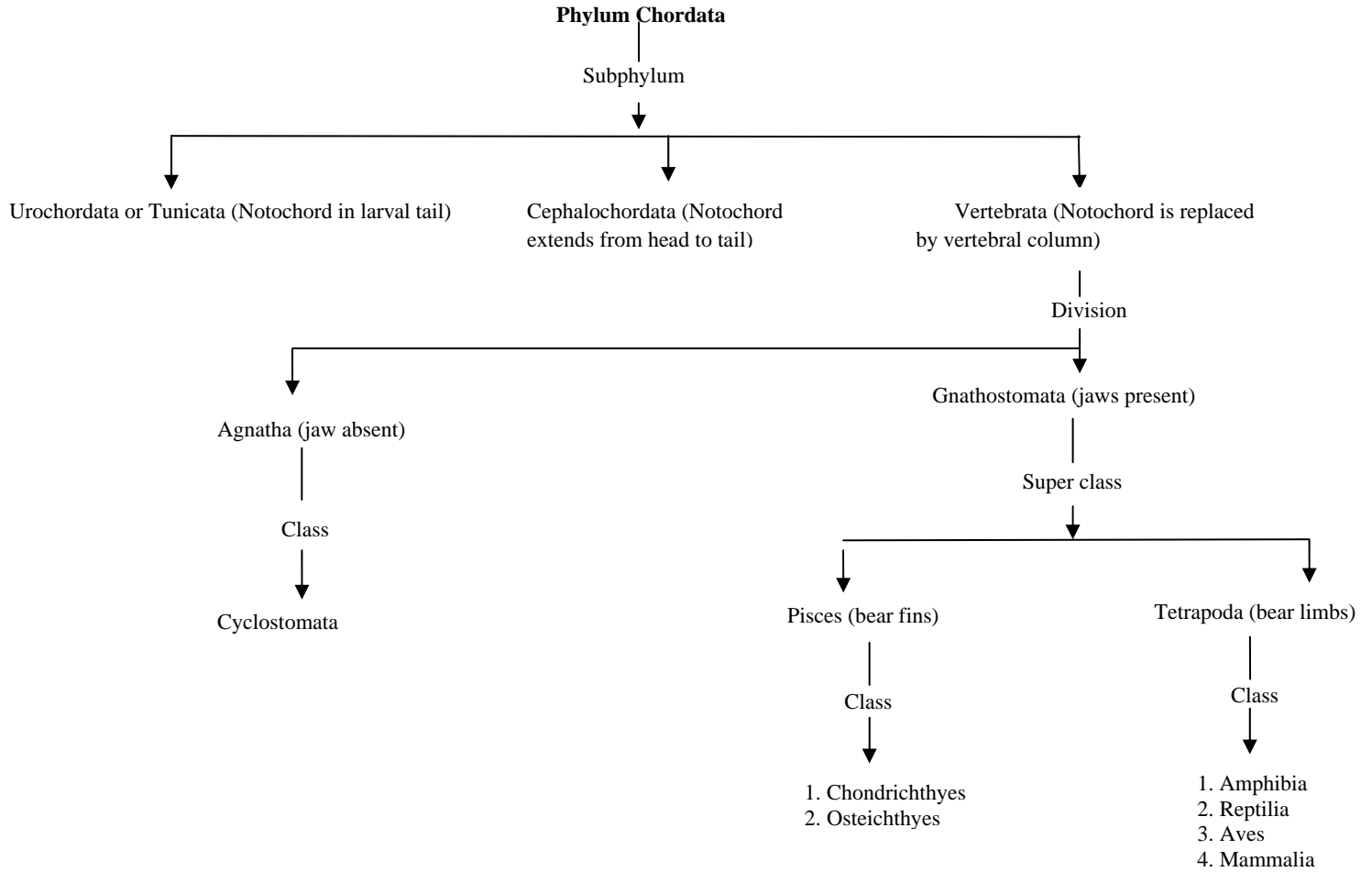


Fig. 4.15. Diagrammatic representation of Chordata characteristics.

Phylum Chordata is divided as follows:



Subphyla **Urochordata** and **Cephalochordata** are called **protochordates** and are all marine organisms.

1. Subphylum **Urochordata**: In the members of this subphylum, the adults are sedentary (attached) forms without notochord. Their larvae have notochord in the tail region. Eg:- *Ascidia*, *Doliolum*.

2. Subphylum **Cephalochordata**: In the members of this subphylum notochord extends from the head to tail region, eg:- *Branchiostoma* (Amphioxus or Lancelet).



Fig. 4.16. Urochordata: (a) *Asidia*, Cephalochordata: (b) *Branchiostoma*.

3. Subphylum **Vertebrata**: It is composed of members which possess notochord only in the embryonic stages. In adults it is replaced by **Vertebral column**. Along with basic chordate characters, they have ventral heart with 2, 3 or 4 chambers, kidneys for excretion and paired appendages which may be fins or limbs.

Different Classes of Subphylum Vertebrata

1. Class - **Cyclostomata** :-They have suctorial and circular mouth without jaws. Paired fins and scales are absent.

E.g. *Petromyzon*(Lamprey), *Myxine* (Hag fish).



Fig. 4.17.Cyclostomata: *Petromyzon*

2. Class - **Chondrichthyes** :- They are marine fishes with cartilaginous endoskeleton. The exoskeleton has placoid scales. E.g. *Scoliodon* (Shark), *Pristis* (Saw fish), *Trygon* (Sting ray), *Narcine* (Electric ray).



Fig.4.18. Chondrichthyes: (a) *Scoliodon*, (b) *Pristis*

3. Class - **Osteichthyes** :- They are marine or freshwater fishes with bony endoskeleton. The exoskeleton has cycloid or ctenoid scales. E.g. *Sardinella* (Sardine), *Scomber* (Mackerel), *Exocoetus* (Flying fish), *Hippocampus* (Sea horse), *Labeo* (Rohu), *Catla* (Catla), *Anabas* (Climbing perch).

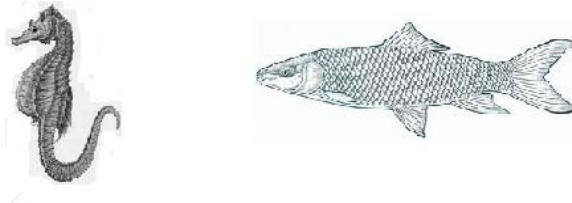


Fig. 4.19. Osteichthyes : (a) *Hippocampus* (b) *Labeo*

4. Class - **Amphibia** :- They are the vertebrates adapted to land and water. They do not possess exoskeleton. E.g. *Rana* (Frog), *Hyla* (Tree frog), *Bufo* (Toad), *Salamandra* (Salamander), *Ichthyophis* (Limbless amphibian).



Fig. 4.20. Amphibia: (a) *Rana*, (b) *Salamandra*.

5. Class - **Reptilia** :- They are the creeping or crawling vertebrates having dry, cornified skin without skin glands. The exoskeleton has horny scales or scutes. E.g. *Chameleon* (Tree lizard), *Calotes* (Garden lizard), *Hemidactylus* (Wall lizard), *Chelone* (Turtle), *Testudo* (Tortoise), *Naja* (Cobra), *Bangarus* (Krait), *Vipera* (Viper).



Fig. 4.21. Reptilia: (a) *Chameleon*,

(b) *Naja*

6. Class - **Aves** :- They are animals with wings and are adapted for flight. They have feathers as exoskeleton and their jaws are modified into beaks. E.g. *Corvus* (Crow), *Columba* (Pigeon), *Pavo* (Peacock), *Psittacula* (Parrot), *Neophron* (Vulture), *Struthio* (Ostrich), *Aptenodytes* (Penguin).

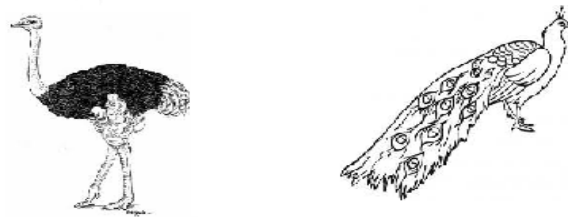


Fig. 4.22. Aves: (a) *Struthio*,

(b) *Pavo*.

7. Class - **Mammalia** :- They possess breast glands (mammary glands) and majority of them are viviparous. They have hair as exoskeleton. E.g. *Ornithorhynchus* (Platypus), *Macropus* (Kangaroo), *Pteropus* (Flying fox), *Camelus* (Camel), *Macaca* (Monkey), *Homo sapiens* (Human), *Rattus* (Rat), *Elephas* (Elephant), *Canis* (Dog), *Equus* (Horse), *Felis* (Cat).



Fig.4.23. Mammalia: (a) *Platypus*,

(b) *Macropus*,

(c) *Macaca*.

SUMMARY

Classification of animal Kingdom is based on some fundamental features like symmetry, levels of organization, coelom, segmentation, notochord etc. Besides these each phylum or class has many distinctive and specific features. Poriferans have cellular level of organization and have ostia. Coelenterates bear cnidoblasts. Ctenophores are marine and have comb plates. Platyhelminthes have flat body. Aschelminthes are pseudocoelomates with cylindrical body. Annelids are metamerically segmented with true coelom. Arthropods are the group of animals with jointed appendages and chitinous exoskeleton. Mollusca have soft body covered by calcareous shell. Echinoderms have spiny skin and water vascular system. Chordates possess a notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits. Some are protochordates and others are vertebrates. Some vertebrates do not possess jaws (Agnatha) while majority possess jaws (Gnathostomata). Agnatha is represented by class Cyclostomata which are primitive. Gnathostomata has two superclasses- Pisces and Tetrapoda. Superclass Pisces includes fishes bearing fins and includes Classes Chondrichthyes and Class Osteichthyes. Class Chondrichthyes are marine fishes with cartilagenous endoskeleton. Class Osteichthyes are fresh water or marine fishes with bony endoskeleton.

Super class Tetrapoda includes animal with 2 pairs of limbs. Tetrapoda includes Classes- Amphibia, Reptilia, Aves and mammalia. Amphibians are adapted to live both on land and in water. Reptiles are characterized by dry and cornified skin. Aves are flying animals with feathers, beaks and wings. Mammals have features like skin covered with hair, presence of mammary glands and viviparity.

EXERCISE

1. Name the fundamental features which are considered in the classification of animals?
2. What is the function of comb plates?
3. Mention the functions of the following:
 - a) Flame cells
 - b) cnidoblasts
4. Name the phylum in which the members possess pseudocoelom.
5. The members of which phylum show the following-
 - a) Water vascular system
 - b) chitinous exoskeleton
6. Which chordates do not possess vertebral column in adults?
7. Name a chordate which has a mouth without jaws.
8. Dry, cornified skin is the feature in the members of class ----.
9. In which group of animals beaks are present?
10. Members of ---- class are generally viviparous.

Exercises – Answers

1. Levels of organization, body symmetry, body wall, coelom, segmentation, Notochord etc.
2. Locomotion
3. (a) Excretion. (b) Defence and food capture
4. Aschelminthes
5. (a) Echinodermata (b) Arthropoda
6. Urochordata
7. *Petromyzon* or *Myxine*
8. Class : Reptilia
9. Class : Aves
10. Class : Mammalia