Chapter

4

# Animal Kingdom

Classification is a system of categorizing living things.

## BASIS OF CLASSIFICATION

### 1. Levels of Organisation

Organisation is the structural differentiation of animal body. *Based on organization of cells, it is divided into three levels:*

(a) **Cellular level of organization:** In this, the cells are arranged as loose cell aggregates.
Examples:Poriferans (Sponges).

(b) **Tissue level of organization:** In this, the cells performing the same functions are arranged into tissues.
Examples: Coelenterates and Ctenophores.

(c) **Organ level of organization:** In this type, the tissues are grouped together to form organs and the organs are associated to form organ systems. Each system performs a specific physiological function.
Examples: All higher animals (from Platyhelminthes to chordates).
Organ systems of different animals show complexities. Examples:

- **Digestive system** of cnidarians and Platyhelminthes is incomplete i.e. it has only a single opening which serves as both mouth and anus. Complete digestive system has 2 openings i.e. mouth and anus.
- **Circulatory system** is of 2 types: Open and closed.
  - In **open type**, blood is pumped out through heart. Cells and tissues are directly bathed in it.
  - In **closed type:** Blood is circulated through vessels.

### 2. Body Plan

Animals have three types of body plans.

(a) **Cell Aggregate Plan:** In this, the body consists of aggregation of cell. It is usually found in Sponges.

(b) **Blind sac Plan:** In this, the body has a single cavity with one opening to the outside. The single opening act as both mouth for intake of food and anus for egestion of undigested food. It is found in Coelentrates and flatworms.

(c) **Tube within a tube plan:** In this, the body has two tubes; one formed by the body wall and other formed within it by the digestive tract.

It is of two types: Protostomic plan and Deuterostomic plan.

(i) **Protostomic Plan:** In this type of plan, mouth develops first and anus later on in the embryo. The animals which possess this body plan are called protostomes. It occurs in Roundworms, annelids, mollusks and arthropods.

(ii) **Deuterostomic plan:** In this type of plan, anus develops first and mouth later on in the embryo. The animals which possess this plan are called deuterostomes. It is found in Echinodermates, hemichordates and chordates.

### 3. Body Symmetry

Based on symmetry, animals are two types: Asymmetrical and Symmetrical.
It is the arrangement of similar body parts on two sides of main axis of body.

(a) **Asymmetrical:** In this, body cannot be divided into equal halves through median plane. The simplest animals have no symmetry.
Examples: Sponges, Snails etc.

(b) **Symmetrical:** In this, body can be divided into two similar parts. It is of two types.

(i) **Radial symmetry:** Body can be divided into 2 similar parts by any plane along oral \aboral axis of body.
Examples: **S**ome Poriferans, Cnidarians, Ctenophores and Echinoderms.

(ii) **Bilateral symmetry:** Body can be divided into two identical right and left halves by a section passing through the longitudinal axis.
Examples**:** Annelids, arthropods and all vertebrates.
The body of bilaterally symmetrical animal has an upper or vertebral dorsal side, a lower ventral side, left and right lateral sides, anterior (cephalic) side and posterior (anal) side.

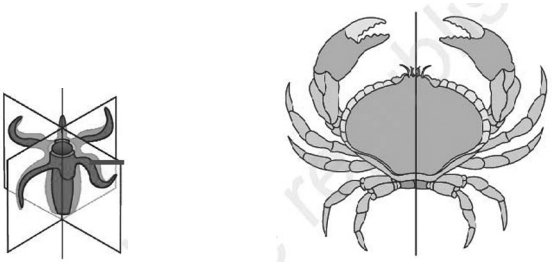


**Fig.** (a) Radial Symmetry (b) Bilateral symmetry

## 4. Germ layers

- These are layers of gastrula from which all the body organs are formed.
- All cells of the adult organism can be traced to one of the three **germ layers**. Some animals have only the inner and outer germ layers but more complex animals have mesoderm as well.

Three types of germ layers:

(a) **Ectoderm** - It is the inner layer which gives rise to the outer covering of the animal (skin, hair, nails, feathers, and scales) and the nervous system.

(b) **Mesoderm** - It gives rise to muscles, skeleton, circulatory system, kidney, reproductive system

(c) **Endoderm** - It gives rise to digestive tract and associated organs.

- Based on the number of germ layers, animals are two types- Diploblastic and Triploblastic.

**(i) Diploblastic animals:** Cells are arranged in two germ layers- outer ectoderm and inner endoderm. Mesoglea may be present in between ectoderm and endoderm
Examples:Sponges and Coelenterates.

**(ii) Triploblastic animals:** They have three germ layers- Outer ectoderm, middle mesoderm and inner endoderm.
Examples: Platyhelminthes (Flat worms) to Chordates (mammals).

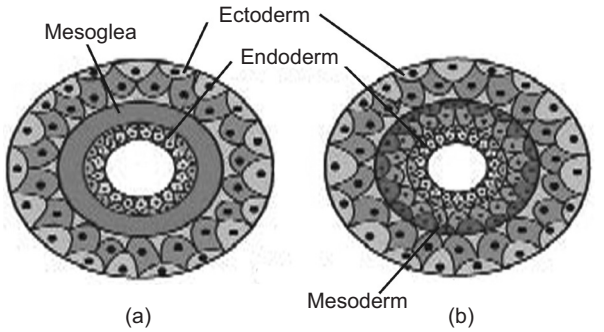



**Fig.** Germinal layers: (a) Diploblastic (b) Triploblastic

## 5. Coelom (Body cavity)

- It is the space between body wall and gut wall. Coelom separates the muscles of gut and body wall.
- On the basis of nature of coelom, animals are of 3 types: Acoelomate, Pseudocoelomate, and Eucoelomate.

**(a) Acoelomate:** They have no coelom. The space between body wall and digestive cavity is filled with matrix (parenchyma).
Examples: Poriferans to Platyhelminthes.

**(b) Pseudocoelomate:** They have no true coelom. They have a body cavity partially surrounded by mesoderm. Mesoderm is present in scattered pouches between ectoderm and endoderm.
Example: Aschelminthes.

**(c) Coelomate (True coelomate or Eucoelomate):** They have body cavity completely surrounded by mesoderm. Coelom is lined by peritoneal layer and is filled with coelomic fluid.
Examples: Annelids to chordates.

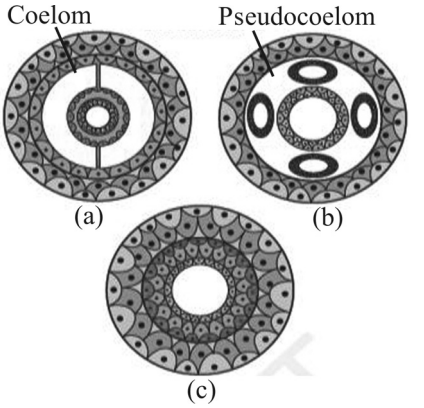



**Fig. 4.3** Diagrammatic sectional view of: (a) coelomate (b) Pscduocoelomate (c) Acoelomate

- **Haemocoelomates:** Here, the true coelom is reduced and is filled with blood. Examples: In Arthropods and molluscs
- **Functions of coelom:**
  - ➢ It accommodates visceral organs
  - ➢ Coelomic fluid gives moist environment to visceral organs, thereby reducing the friction.
  - ➢ It acts as shock absorber.
- True coelom is of two types: Schizocoelom and Enterocoelom.

(i) **Schizocoelom:** It develops as a split in the mesoderm sheet. It occurs in Annelids, Arthropods, and Molluscs.

(ii) **Enterocoelom:** In this, the mesoderm arises from the wall of the embryonic gut as hollow outgrowths. It occurs in Echinoderms, Chordates.

## 6. Segmentation (Also known as Metamerism)

- Segmentation is the division or differentiation of the body into distinct proportions called segments.
- Examples: Annelids, Arthropods.In vertebrates: only internal metamerism is seen.
- It is of two types:

(a) **Metameric segmentation (True metamerism):** In this, the body is often divided both externally and internally into number of segments (metameres). E.g. Annelids, arthropods and chordates.

(b) **Pseudometamerism (False metamerism):** In this, the body is not internally divided. For e.g. the proglottids (segments of tapeworms) are budded off from the neck and are not of embryonic origin.

## 7. Notochord

- Notochord is a rod-like structure formed during embryonic development on the dorsal side.
- It is mesodermally derived.
- Animals with notochord are called **chordates** while those without notochord are called **non-chordates.**

## 8. Digestive tract

- It is the passage where food is taken for digestion, absorption and elimination. It is of two types:

(a) **Incomplete digestive tract:** It has a single opening called mouth that takes food as well as eliminates the undigested food. It is found in Cnidarians and Platyhelminthes.

(b) **Complete digestive tract:** It has two openings; mouth for intake of food and anus for elimination of undigested food. It is found in Nemathelminthes to chordates.

## 9. Digestion

- Digestion is the breaking down of complex food molecules into simple organic form.

It is of two types:

(a) **Intracellular digestion** that occurs within the cells. In this, the digestive enzymes are poured into the food vacuoles, where digestion of food takes place. It occurs in protozoans and sponges.

(b) **Extracellular digestion** that occurs outside the cell in a cavity. In this the digestive enzymes are poured into the cavity for digestion to take place. It occurs in higher invertebrates and all vertebrates.

## 10. Excretion

- It is the removal of metabolic wastes from the body.
- Animals are classified into three types on the basis of removal of nitrogenous wastes.

(a) **Ammonotelic animals:** They excrete ammonia. E.g. Amoeba, Hydra, Sycon, Earthworm, Crocodiles etc.

(b) **Urotelic animals:** They excrete urea. E.g. Cartilaginous fishes, semi-aquatic amphibians, turtles, alligators, mammals including man.

(c) **Uricotelic animals:** They excrete uric acid. E.g. Most insects, some land crustaceans, land snails, lizards, snakes and birds.

(d) **Aminotelic animals:** They excrete excess amino acids. E.g. some mollusks like Limnaea, Unio, some echinoderms (Asterias).

(e) **Guanotelic animals:** They excrete guanine. E.g. Spider

## 11. Fertilization

- Fertilization is the union of male and female gametes. It is of two types:

(a) **External fertilization:** When fertilization occurs outside the female body, it is called external fertilization. For e.g. Starfish, frog etc.

(b) **Internal fertilization:** When fertilization occurs inside the female body, it is called external fertilization. E.g. Reptiles, birds, mammals.

## 12. Development

- It is the changes that an organism undergoes from its beginning to maturity. It is of two types:

(a) **Direct development**: In this, the young ones resemble the adults in all respects except colour, size. There is no intermediate stage in direct development. E.g. Hydra, Earthworm and silver fish.

(b) **Indirect development:** In this, the young ones do not resemble the adults. The young ones usually pass through one or more intermediate stages before obtaining the shape of the adults. E.g. Silk moth, housefly, frog.

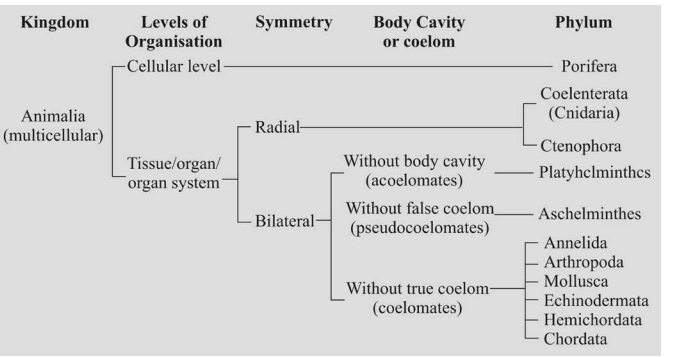
**Metamorphosis:** It is the phenomenon of passing through different juvenile stages before attaining the adult form. E.g. Silk moth, housefly, Frog, Butterfly

# CLASSIFICATION OF ANIMALS

**Characteristic features of kingdom Animalia:**

- All animals belonging to kingdom Animalia are multicellular eukaryotes.
- They have heterotrophic mode of nutrition.
- Almost all animals are mobile and they move about in search of food or for other needs, except for sponges and corals. They are sedentary.
- It is most diverse group than the plant kingdom.

**Broad classification of kingdom Animalia based on common fundamental features**

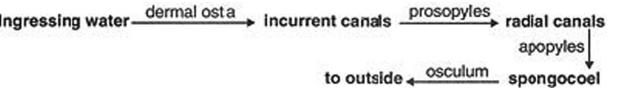


## PHYLUM PORIFERA (Animals Bearing Pores- The Sponges)

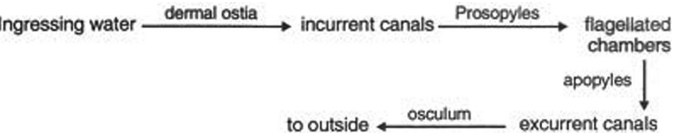
- Members of this phylum are also called **sponges**.
- **Habit and Habitat:** They are mainly marine, aquatic animals. They are sedentary.
- **Body form:** Sponges have a porous body wall. The pores or holes allow water to pass through this animal. Floating food particles are caught once they are inside the sponge. The pores are of two types: Inhalent pores are called ostia while exhalent pores are called oscula.
- **Levels of organization:** They show cellular level of organization. The body is little more than a mass of specialized cells, not organized into tissues.
- **Germ layers:** The sponges are diploblastic, which means they have two germ layers. No mesoderm is present.
- **Symmetry:** They are asymmetrical, which mean no definite shape.
- **Coelom:** Poriferans are acoelomate.
- **Body wall:** *The body of sponges consists of three layers:*
  - ➢ **Pinacoderm:** It is an outer layer of flattened contractile epithelial cells called pinacocytes.
  - ➢ **Choanoderm:** It is an inner layer of flagellated collar cells (choanocytes) that circulate sea water within and through the sponge to bring in food and reproductive products and help discharge waste products.
  - ➢ **Mesohyl layer:** It is a non-cellular layer found in between Pinacoderm and choanoderm. It has fine dispersed spongin fibres and number spicules. It also contains Amoebocytes. They carry nutrients to other cells, aid in reproduction, and produce chemicals that help make up the spicules of sponges.
  - ➢ **Canal system:**In water canal system, water enters through minute pores **(ostia)** in the body wall into a central cavity **(spongocoel),** from where it goes out through **osculum. Three types of canal systems are found in sponges.**

(a) **Asconoid type**: It is the simplest type of canal system which is found in Leucosolenia and a few other sponges.

(b) **Syconoid type:** It is more complex than the ascon type. It is found in sycon and some other sponges.




(c) **Leuconoid type:** It is most complex canal system which is found in *Spongilla* and some other sponges.In class Demospongia the leuconoid condition is derived from a larval stage called **rhagon.**



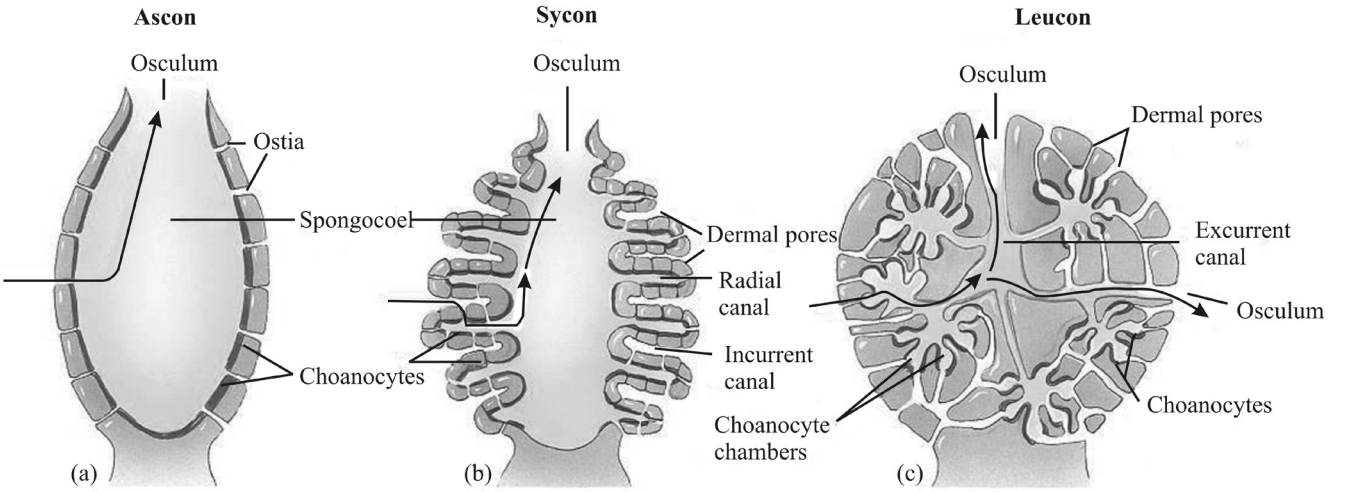




**Fig.:** Types of canals system found in sponges

- **Skeleton:** Almost all sponges possess an internal skeleton. It may consist of calcareous or siliceous **spicules** or fine **sponging fibres** or of both, location in the mesohyl layer.
- **Digestion and Digestive system:** Digestive system is absent. Digestion is intracellular. They have water canal system to gather food.
- **Circulatory system:** Circulatory system is absent. Distribution of food from the ingesting cells to others is brought about by wandering amoebocytes of mesohyl layer.
- **Respiratory system:** Respiratory system is absent. Exchange of gases occurs by diffusion through the plasma membranes of the cells as in protozoans.

- **Excretory system:** Excretory system is absent. Removal of metabolic wastes also occurs by diffusion through the plasma membranes of the cells as in protozoans. Ammonia is chief excretory waste.
- **Nervous system:** It is absent.
- **Reproductive system:**
  - ➢ **Asexual reproduction** is quite common, and occurs in one of two ways:
    - ♦ **Fragmentation:** Fragments that break off from the parent animal may become new sponges OR
    - ♦ **Gemmules:** Collections of amoebocytes within a hard, protective outer layer.
  - ➢ Sponges are **hermaphrodites.** This means male and female sex organs are seen in same individual. But produce eggs and sperm at different times to avoid self-fertilization. This is called **sequential hermaphroditism**.
  - ➢ Fertilization is internal.
  - ➢ The development is indirect and includes a free swimming larva, the **amphiblastula** (in sycon) or **parenchymula** (in Leucosolenia) for dispersal of the species.
- **Other features:**
  - ➢ Millions of minute pores (ostia) are present.
  - ➢ **Spongocoel** (body cavity) and canals are lined with **choanocytes(collar cells).**
  - ➢ Body wall is supported by a skeleton made of spicules and spongin fibres.
- **Examples:**
  *Leucosolenia* (Simplest colonial sponge)
  *Sycon* (Scypha),
  *Spongilla* (freshwater sponge)
  *Euspongia* (Bathsponge)
  *Euplectella* (The Venus'Flower basket)
  *Hyalonema* (The glass rope sponge)
  *Cliona* (The Boring sponge)
  *Chalina* (The deadman's Fingers or The Mermaid's gloves)

## PHYLUM COELENTERATA (Cnidaria)

- Members of this phylum are also called **Cnidarians**.
- **Habit and Habitat:** They are mostly marine, aquatic animals. They are usually marine, sessile or free-swimming.
- **Body forms:** It varies considerably. Most of them are polymorphic. Occurrence of more than one type of individuals in their colonies performing different functions is called polymorphism. E.g. *Obelia. Obelia* is trimorphic, having three kinds of zooids- polyps, blastostyles and medusa.
- **Levels of organization:**Cnidarians have tissue level of organization.
- **Germ layers:** They are diploblastic. Their body wall is made of 2 cell layers called the ectoderm and endoderm. The ectoderm is the outside layer while the endoderm is found on the inside layer. A jellylike material is found between these 2 layers.
- **Symmetry:** They have radial symmetry. This means that they can be divided along any plane, through a central axis, into roughly equal halves.
- **Coelom:** They are acoelomate.
- **Body wall:** The body wall consists of two layers of cells-outer epidermis and inner gastrodermis. Epidermis consists of Cnidoblasts or stinging cells**.**A cnidoblast has nematocysts, a stinging organ which is used for defence and offence.
- **Digestive system:**
  - ➢ The digestive system is incomplete which means that coelenterates have just one opening to the digestive cavity. This single opening serves as both its mouth and anus. Digestion is both intracellular and extracellular.
  - ➢ Food is digested in a gut (gastrovascular cavity) and the resulting particles are absorbed by cells. This allows the animal to digest something larger than its own cells. The extracellular digestion of food is an evolutionary development.
  - ➢ The single opening (mouth/anus) is a two-way digestive system.
- **Mode of nutrition:**
  - ➢ They are carnivores which capture food with tentacles surrounding the mouth. They capture their prey using nematocysts.
  - ➢ A **nematocyst** is a capsule that contains a coiled, threadlike tube. The tube can be sticky or barbed. It also may contain toxic substances. Nematocysts are located in cells on the tentacles.
  - ➢ **Cnidocytes** (stinging cells) on the tentacles paralyze prey which is then brought into the mouth.Cnidoblasts are certain ectodermal defensive cells with a capsule called ***nematocyst*** containing poisonous fluid. They are present on the tentacles and the body and is used for anchorage, defense and to capture prey.
- **Respiratory system:** It is absent.
- **Circulatory system:** It is absent.
- **Excretory system:** Waste products are removed through the body surface.
- **Nervous system:** A cnidarian has a simple nervous system. It does not have a control center or brain such as other animals. The nervous system consists of a **nerve net** that conducts impulses to and from all parts of the body. Statocyst is a sense organ for balance which is first time developed in cnidarian.
- **Skeleton:** In coelenterates, body is supported by calcareous exoskeleton or endoskeleton.
- **Reproductive system:**
  - ➢ Reproduction is both by asexual (budding) and sexual methods. The cnidarian life cycle begins with the larval form, known as the planula, which is a

small, free-swimming ciliated organism. Following this stage, some cnidarians go through a polyp and a medusa stage. During the polyp stage they produce asexually, whereas during the medusa stage they produce sexually. These various stages allow the cnidarians to have rapid asexual reproduction (by the polyp), dispersal and genetic recombination (by the medusa), and habitat selection (by the planula larva).

- ➢ Polyp reproduces asexually (budding) and medusa sexually.
- ➢ Sexes are separate as in jellyfish but lower cnidarians like the hydra show asexual (budding) as well. Hydra has a great power of regeneration.
- ➢ Fertilization is external.
- ➢ Development is indirect.

- **Other features:**
  - ➢ Corals have a skeleton made up of calcium carbonate.
  - ➢ They have a central gastrovascular cavity (coelenteron) with a single opening (mouth) on hypostome.
  - ➢ Coelenterates exhibit two body forms: polyp and medusa *e.g., Hydra, Aurelia.*
    - ♦ Polyp is tubular attached form, with upwardly directed mouth and tentacles. It represents the asexual stage. (*e.g.*, sea anemone).
    - ♦ Medusa is umbrella shaped body called a bell. It is free-swimming form, with downwardly directed mouth and tentacles. It represents the sexual stage. *e.g.*, jellyfish.
  - ➢ They exhibit polymorphism and alternation of generation between body forms. This phenomenon is called as Metagenesis. It occurs in ***Obelia*** where polyp produces medusae asexually and medusae form the polyps sexually.
- **Specialized Cells:**
  - ➢ Most coelenterates have tentacles that contain stinging cells (Cnidoblasts)that are used for protection and capturing food.
  - ➢ Their bodies contain a nerve network that allows movement of the tentacles and body.
- **Examples:** *Hydra, Obelia (*Sea fur*), Physalia* (Portugese man of war)*, Aurelia (*The jellyfish)*, Adamsia* (Seaanemone), *Pennatula* (Sea pen)), *Gorgonia* (Sea fan), *Astraea* (The star coral), *Meandrina sinuosa* (The brain coral), *Pennatula* (The sea pen or sea feather) etc.

## PHYLUM CTENOPHORA

- They are also called as **sea walnuts** or **comb jellies**.
- **Habit and Habitat:** They are exclusively marine. They are solitary and pelagic.
- **Body form**: Body form is variable.
- **Levels of organization:** They show tissue level of organization.
- **Germ layers:** They are diploblastic, having ectoderm and endoderm.
- **Symmetry:** They show biradial (Radial + bilateral) symmetry. The arrangement of comb plates gives the appearance of radial symmetry while the tentacles and branching of gastrovascular canals are of bilateral type.
- **Coelom:** They are acoelomate.
- **Digestive system:** Digestive system is incomplete. Digestion is both intracellular and extracellular.
- **Respiratory system:** Respiratory system is absent.
- **Circulatory system**: It is absent.
- **Excretory system:** Removal of waste products occurs through body surface.
- **Locomotion:** comb like eight ciliary plates called comb plates are present on the body. The cilia of these plates help in swimming. Hence, ctenophores are called comb jellies.
- **Nervous system:** They have only a network of neurons.
- **Reproductive system:**
  - ➢ They are hermaphrodite (monoecious).
  - ➢ They show only sexual reproduction.
  - ➢ Fertilization is external.
  - ➢ Development is indirect with a ciliated spherical cydippid larva.
- **Other features:**
  - ➢ Body has eight vertical external rows of ciliated comb plates for locomotion.
  - ➢ They have tentacles present.
  - ➢ They show bioluminescence. Bioluminescence is the property of living organism to emit light from body.
- **Example:** *Ctenoplana, Pleurobrachia* (The sea gooseberry), Hormiphora (The sea walnut).

## PHYLUM PLATYHELMINTHES (Flat Worms)

- Members of this phylum are also called as 'flat worms'. These animals are given their name because of their flattened bodies.
- **Habit and Habitat:** They are mostly endoparasites. Some are free living. Flatworms (*e.g.*, *planaria*) can be found in marine or aquatic environments, as well as damp terrestrial habitats. They are mostly endoparasites in animals including human beings.
- **Body forms:** the body is dorso-ventrally flattened and is without true segments.
- **Levels of organization:** This phylum shows the first appearance of **organs** - a group of tissues that function as one unit. Thus, they show organ system level of organization.
- **Germ layers:** They are triploblastic. Flatworms have 3 distinct tissue layers called the ectoderm, endoderm, and mesoderm or middle layer. Each layer gives rise to the various organs and systems of this animal.
- **Symmetry:** Flatworms have bilateral symmetry and they have a definite head and tail region. Bilateral symmetry allows both the specialization of different body parts and

**cephalization**. Cephalization allows animals to move through and experience their environment head first.

- **Coelom:** They are acoelomate (without coelom).
- These acoelomates have a thin body to allow diffusion of gases and nutrients.
- **Digestive system:** In free-living species of flatworms the digestive system is incomplete which means that the digestive cavity has only a single opening. The parasitic tapeworm has no need for a digestive system because it absorbs nutrients that are already digested by the host in which it lives.
- **Respiratory system:** It is absent.
- **Circulatory system:** It is absent.
- **Excretory system:** Excess water is removed from the planarian's body by a system of flame cells. The water from flame cells collects in tubules and leaves the body through pores on the body surface. Thus, flame cells helps inexcretion and Osmoregulation
- **Nervous system:** Nervous system is ladder like. It consists of the brain and two main longitudinal nerve cords connected at intervals by transverse commissures.
- **Sensory organ:**
  - ➢ At the head, eyespots can detect the presence or absence of light. Primitive eye spots allow planarians to distinguish light and dark.
  - ➢ Sensory cells detect chemicals and movement in water. On each nerve cord, near the head, is a small swelling called a ganglion (plural, ganglia). The ganglion receives messages from the eyespots and sensory cells. The ganglion then communicates with the rest of the body along the nerve cords. Messages from the nerve cords trigger responses in a planarian's muscle cells.
- **Reproductive system:**
  - ➢ Planarians can reproduce asexually. If a planarian is damaged, it has the ability to regenerate, or regrow, new body parts.
  - ➢ **Regeneration** is the replacement or regrowth of missing body parts. Missing body parts are replaced through cell division.
  - ➢ Planarians are sexual hermaphrodites with the reproductive system only appearing during mating season.
  - ➢ Fertilization is internal.
  - ➢ Development is indirect with many larval stages. In liver fluke miracidium, sporocyst, redia, cercaria, and metacercaria larvae are present. In tapeworm, onchosphere, hexacanth and cysticercus larvae are found.
- **Other features**
  - ➢ Some members like *Planaria* have high regeneration capacity.
  - ➢ Members have unsegmented, dorso-ventrally flattened body (except in tape worms).
  - ➢ Hooks and suckers are present in parasitic forms.
  - ➢ Some of them absorb nutrients from the host through their body surface.
  - ➢ The knob-shaped head of a tapeworm is called a scolex. The tapeworm's body is made of detachable, individual sections called proglottids. A proglottid contains muscles, nerves, flame cells, and male and femalereproductive organs.
- **Specialized Structures**
  - ➢ The *planaria* has a pair of eyespots at its anterior or front end. These eyespots detect light which the *planaria* avoids so they are less visible to their predators.
  - ➢ The tapeworm like other parasitic worms has a thick protective cuticle on the outside of its body. The cuticle protects the worm from being digested by the strong digestive enzymes of its host.
- **Examples:***Taenia solium* (Tape worm), *Fasciola* (Liver fluke), *Planaria.*

## PHYLUM ASCHELMINTHES (Roundworms)

- They are also called **'round worms'**.
- **Habit and Habitat:** They are free living, aquatic and terrestrial or parasitic in plants and animals.
- **Body form:** They appear circular in cross section. Hence, known as round worms. They are unsegmented. Their cylindrical bodies are tapered at both ends and are covered by a protective cuticle.
- **Levels of organization:** They show organ system level of organization
- **Germ layers:** They are tripoloblastic as they have three tissue layers; ecto, endo and mesoderm.
- **Symmetry:**They show bilateral symmetry with an anterior end and a posterior end.
- **Coelom:** Roundworms have a pseudocoelom, a fluid-filled bodycavity partly lined with mesoderm.
- **Digestive system:** Roundworms have a complete digestive system with well-developed muscular pharynx. Their digestive tract has 2 openings; a mouth to ingest food and an anus to egest waste.Having a separate mouth and anus creates a one-way digestive system.
- **Respiratory system:** It is absent.
- **Circulatory system:** It is absent.
- **Excretory system:** Wastes are removed through excretory pore. In *Ascaris,* renette cell is present.
- **Nervous system**: It is present.
- **Reproductive system:**
  - ➢ Sexual reproduction with separate sexes (Dioecious).
  - ➢ Fertilization is internal.
  - ➢ Development may be direct (where young ones resemble the adult) or indirect. Filariform larva is present in *Ancylostoma* (hook worm), microfilaria larva is found in *Wuchereria* (filarial worm) and Rhabditiform larva is present in *Ascaris and Enterobius* (pin worm).

- **Other features**
  - ➢ They have syncytialepidermis.
  - ➢ They have thick cuticle.
  - ➢ Members belonging to this phylum show sexual dimorphism, where male and female show morphological difference. Often females are longer than males.

**Examples**

- *Ascaris lumbricoides* (Roundworm), *Ancylostoma duodenale* (Hookworm), *Wuchereria bancrofti* (Filarial worm), *Enterobius vermicularis (*pin worm).
- *Trichinella (*The Trichina worm): It is found in the small intestine of human beings. The disease caused by them is called trichinosis.

## PHYLUM ANNELIDA (The segmented animals)

- They are also called as **"segmented worms"**. Body is metamerically segmented, hence the phylum name Annelida (Latin, *annulus:* little ring).
- **Habit and Habitat:** They may be aquatic or terrestrial, free-living or parasitic.
- **Body Plan:** They have metameric segmentation. Annelids have similar shape as the roundworm but the body is segmented both internally and externally which allows for a quicker response for movement. Each segment has its own muscles and are called **metameres**. By using these separated muscles, a worm can shorten and lengthen its body to move.
- Segmentation also allows for specialization of body tissues. Groups of segments work together for a particular purpose or function. Certain segments have adaptations or modifications for sensing surroundings and for reproduction.
- The evolutionary advantage is that by changing one segment, it can create a new body part without affecting other parts.
- Although segmentation is continued through all other phyla (including humans) it is not always obvious. Examples of segmentation in humans are seen in muscles and in the spine.
- **Levels of organization:** They show organ system level of organization.
- **Germ layers:** They are triploblastic.
- **Symmetry:** They have Bilateral symmetry: anterior and posterior ends; dorsal and ventral surfaces.
- **Coelom:** They are coelomate. They are the first animal to have a true schizocoelomic coelom.
- **Digestive system:** Segmented worms have a complete digestive system and this set-up is often referred to as a tube-within-a-tube body plan.
- **Respiratory system:** They have cutaneous respiration (skin). Some have branchial (gill) respiration.
- **Circulatory system:** Circulatory system is closed. There is no real heart but the muscular sections of some blood vessels are the beginnings of a more advanced system.
- **Excretory system:** Nephridia are excretory structures that eliminate metabolic wastes from nearly every segment.
- **Nervous system:** Neural system consists of paired ganglia (sing. ganglion) connected by lateral nerves to a double ventral nerve cord. Nerve cords connect the brain to nerve centers that are found in each segment of the worm. These nerve centers are called ganglia.
- Locomotory organs are **setae** (in earthworm) or **parapodia** (in Neries).
- **Reproductive system:**
  - ➢ Annelids show sexual reproduction.
  - ➢ ***Nereis*** is dioecious and aquatic annelid while earthworm and leeches are monoecious.
  - ➢ Development is indirect. It includes trochophore larva.
  - ➢ Some annelids show separate sexes while some are hermaphrodites.
- **Other features**
  - ➢ Annelids show true segmentation.
  - ➢ Animals have longitudinal and circular muscles in both body wall and the wall of the alimentary canal for locomotion.
  - ➢ They have haemoglobin in the plasma.
- **Examples**
  - ➢ *Neanthes (Nereis), Pheretima* (Earthworm), *Hirudinaria granulosa*. *(*Blood sucking cattle Leech).

## PHYLUM ARTHROPODA (Animals with jointed legs)

- **Numbers:** Arthropods are the most successful of any animal group. This is mainly due to the success of insects, which has more than a million different species.
- **Adaptations for success:**
  - ➢ Segments have specialized functions.
  - ➢ Well defined head with excellent sensory apparatus.
  - ➢ Jointed appendages. Some are sensory while some are for feeding, manipulating, and moving.
  - ➢ Exoskeleton.
  - ➢ Waste from the blood is excreted as solid crystals.
- **Habit and Habitat:** They are cosmopolitan. Arthropods are found in all habitats and are the most numerous and diverse of invertebrates.
- **Body form:** Arthropods have a segmented body with paired jointed appendages. The body consists of head, thorax and abdomen.
- **Levels of organization:** They have organ system level of organisation.
- **Germ layers:** They are triploblastic.
- **Symmetry:** They show bilateral symmetry.
- **Coelom:** The true coelom is greatly reduced and is filled with blood. They are haemocoelomates.
- **Exoskeleton:**The exoskeleton is rigid and made of chitin. It provides protection and limits water loss. The exoskeleton is strong but its weight limits the size of arthropods. To become

larger, animals require a strong, flexible endoskeleton. A disadvantage is that the exoskeleton does not grow.An exoskeleton must be shed periodically. Shedding the old exoskeleton is called **moulting.**

- **Digestive system:** Digestive system is complete and well developed. Arthropods show a wide variety of feeding strategies that are dependent on their feeding appendages.
- **Mouth parts:** The mouth parts of most arthropods include one pair of jaws called. The mandibles are adapted for holding, chewing, sucking, or biting the different foods eaten by arthropods.
- **Respiratory system:** Respiration takes place either by gills, book gills, lungs or tracheal system.
  - ➢ Aquatic arthropods (crustaceans) use gills to get oxygen from the water and release carbon dioxide into the water.
  - ➢ Land arthropods either have a system of tracheal tubes or book lungs. Most insects have **tracheal tubes,** a network of hollow air passages that carry air throughout the body. Muscle activity helps pump the air through the tracheal tubes. Air enters and leaves the tracheal tubes through openings on the thorax and abdomen called **spiracles**.
  - ➢ Arachnids (like spider) exchange gases through a simple lung.
- **Circulatory system:** Circulation is open type.
- **Excretory system:** Excretion occurs either by Antennary glands or Malpighian tubules or coxal glands.
- **Nervous system:**Well-developed overall.A nerve ring followed by a double ventral ganglionated nerve cord
  - ➢ Crustaceans are able to detect tiny vibrations in the water and have compound eyes able to form crude images.
  - ➢ Insects have highly developed sensory gear and most can detect stimuli outside the human range of detection. Most have a few simple eyes and a pair of compound eyes which enable them to form images. They cannot focus well but are excellent for detecting movement. Some insects have tiny hairs which detect air vibrations.
- **Endocrine system:** Endocrine glands are present which secrete hormones. Some arthropods particularly insects excretes pheromones. **Pheromones** are chemicals released by one individual to affect the behaviour of another individual. Sex pheromones are used to attract a mate.
- **Reproductive system:**
  - ➢ Sexes are separate.
  - ➢ External fertilization in aquatic forms. Internal fertilization in land forms. Mostly **oviparous.** Development is director indirect. In indirect development, there is metamorphosis.
- **Parthenogenesis:** It is the process of development of an egg into a complete individual without fertilization by a sperm. E.g. Male honey bees (Drones) are produced by parthenogenesis.
- **Other features**
  - ➢ This is the largest phylum of kingdom Animalia.
  - ➢ Jointed appendages are a major advancement because they can be specialized for different functions.
  - ➢ Body is covered by chitinous cuticle (exoskeleton).
  - ➢ Sensory organs (antennae, compound &simple eyes, statocysts or balance organs) are present.
- **Examples:** *Palamneus (*Scorpion), *Aranea (*Spider), *Palaemon (*Prawn), *Peripatus (*The walking worm): It is a connecting link between annelida and arthropoda.

**Economically important insects:** *Apis (*honey bee)*, Bombyx (*silk worm)*,Laccifer (*lac insect).

**Vectors:** Mosquitoes (*Anopheles, Culex and Aedes*), Housefly etc.

**Gregarious pest***: Locusta (*Locust).

**Living fossil:** *Limulus* (King crab). Horseshoe crabs *(Limulus*) are considered to be living fossils.

**Trilobites** are fossil arthropods, about 600 million years old.

## PHYLUM MOLLUSCA (Soft Bodied Animals)

- The members of this phylum are also known as soft-bodied animals.
- **Common features found in all molluscs:** Bilateral symmetry, a coelom, a digestive tract with two openings, a muscular foot, and a mantle.
- **Habit and Habitat:** They are **g**enerally aquatic. Few are terrestrial.
- **Body Plan:** Molluscs have a soft, unsegmented body and often move with a strong muscular foot on its ventral surface. All molluscs, except for the bivalves, show clear cephalization. The heavy shell makes these animals largely sessile so cephalization is not required. *Neopiliana* is a segmented mollusc.
- **Levels of organization:** They show organ system level of organisation.
- **Germ layers:** They are triploblastic.
- **Symmetry:** They show bilateral symmetry. In some mollusks like *Pila* due to torsion (twisting) during growth, the adults become asymmetrical.
- **Coelom:** Coelom is greatly reduced. They are Haemocoleomates.
- **Nutrition:** Snails and many other mollusks use a **radula** to obtain food. A radula is a structure located in the mouth of mollusks. Similar to a rough file, the radula is a tongue like organ with rows of teeth. Molluscs use their radulas to drill, scrape, grate, and even to cut food. Octopuses and squids capture food with their tentacles. They use their radulas to tear up the food they have caught. Some mollusks are grazers. Others, including bivalves, are filter feeders. They do not have radulas. Instead, they filter their food from the water.
- **Digestive system:** Digestive system is complete and well developed.

- ➢ The longer digestive tract with specialized organs allows better digestion and more diverse food.
- ➢ Gastropods scrape food from surfaces. Bivalves use the gills to filter food particles from the water. Cephalopods are predators with a hard beak for tearing and biting.

- **Respiratory system:** They have gills (ctenidia) in aquatic forms and pulmonary sac in terrestrial forms.Gills are specialized parts of the mantle. They are a system of tiny strands that contain a rich supply of blood for transporting gases. Gills increase the surface area where carbon dioxide and oxygen are exchanged. In snails and slugs that live on land, the mantle cavity appears to have become a primitive lung.
- **Circulatory system:** Circulatory system is open type.
  - ➢ A large body cavity requires the development of a circulatory system. A fluid (often blood) is circulated by the contraction of a muscular heart (or hearts). Blood carries nutrients and oxygen to cells and carries wastes and carbon dioxide away.
  - ➢ Only cephalopods (cuttle fish) have a closed circulatory system with a heart and blood vessels. The other molluscs have an open circulatory system.
  - ➢ Blood is usually blue due to the presence of copper containing blue respiratory pigment called haemo-cyanin.
- **Excretory system:** excretory organs are one or two pairs of sac like kidneys. Gills are also excretory in function. Ammonia is chief excretory matter.
- **Nervous system:** Molluscs have simple nervous systems.
  - ➢ The nervous system is highly developed in cephalopods because they are predators. They have a highly developed brain which allows them to learn and solve problems. Their image-forming eyes give them quite good vision.
  - ➢ Octopuses have complex eyes that are similar to the eyes of humans. In some mollusks, eyes are present over stalks called ommatophores.
  - ➢ Osphradium is present in some molluscs for testing chemical and physical nature of water.
- **Reproductive system:**
  - ➢ Most molluscs show sexual reproduction with separate sexes.
  - ➢ Development is indirect. It includes a characteristic larva, veliger, trochophore or glochidium.
  - ➢ They are oviparous.
  - ➢ Young care is highly developed in the octopus.
- **Other Features**
  - ➢ Molluscs are second largest phylum of animals and second most successful land animals, next to insects. There are more terrestrial molluscs than terrestrial vertebrates.
  - ➢ They have **univalve** or **bivalve** calcareous shell.
  - ➢ The radula: Molluscs are well known for their tongue-like organ called the radula which has many rows of teeth and is used to scrape food from the surface of plants and rocks. It is absent in bivalves.
  - ➢ The mantle: The mantle is a fold of skin that surrounds the body organs. The mantle acts like a gland because it is capable of secretion. These secretions harden to help form the shells of mollusks.
  - ➢ Body is covered by calcareous shell. It is unsegmented over visceral hump.
  - ➢ Shell is secreted by mantle. Mantle is the soft and spongy layer of skin, which covers visceral hump. The mantle encloses a cavity called mantle cavity.
- **Examples:** *Pila* (Apple Snail), *Achatina* (Land snail), *Pinctada* (Pearl Oyster), *Sepia* (Cuttlefish), *Loligo* (Squid), *Octopus* (Devil fish), *Aplysia* (Sea Hare), *Dentalium* (Elephant's Tusk shell),*Chaetopleura* (Chiton), *Unio (*Fresh water Mussel),

  *Neopilina* is a connecting link between annelida and mollusca

## PHYLUM ECHINODERMATA (The Spiny Skinned Animals)

- They are also known as spiny bodied organisms.
- **Habit and Habitat:** All are exclusively marine living mainly on the ocean floor.
- Echinoderms are deuterostomes. Echinoderms have a close relationship to chordates because chordates are also deuterostomes.
- **Body:**The body is star shaped, spherical or cylindrical. It lacks head. Echinoderms have an internal, limy skeleton and a spiny outside surface or skin. These structures give both support and protection.
- **Levels of organization:** They show organ system level of organisation.
- **Germ layers:** They are triploblastic.
- **Symmetry:** The adults are radially symmetrical but larvae are bilaterally symmetrical.
- **Coelom:** They are coelomate animals.They have true enterocoelic coelom.
- **Pedicellariae and Spines:** Echinoderms bear spines and pedicellariae. Spines are protective in function while pedicellariae keep the body surface clear of debris and minute organisms.
- **Digestive system:** Digestive system is complete. Mouth is present on the lower (ventral) side and anus on upper (dorsal) side.
- **Respiratory system:** Respiratory organs are dermal branchiae (gills) or papulae and tube feet.
- **Circulatory system:** Circulatory system is reduced and open type.
- **Excretory system:** Excretory system is absent. Diffusion through **gills.** Ammonia is the chief excretory matter.
- **Nervous system:** An echinoderm has a simple nervous system. It consists of a nerve ring that surrounds the mouth.

Echinoderms do not have heads or brains. Nerves extend from the nerve ring down into each ray. Nerves in the rays are called radial nerves. The radial nerves branch out into a network of nerves. This nerve network provides sensory information to the animal.

- **Reproductive system:**
  - ➢ Sexes are separate.
  - ➢ Fertilization is external.
  - ➢ Development is indirect with free swimming larva.
- **Other Features**
  - ➢ Calcareous Endoskeleton **(ossicles)** present.
  - ➢ The skeleton of all echinoderms is mostly calcium carbonate, the compound that makes up limestone.
  - ➢ A thin epidermis, or outer layer of skin, covers the endoskeleton.
  - ➢ All echinoderms have water vascular system for locomotion, respiration, food capture and transport.
  - ➢ **Water-vascular System (Ambulacral system):** Echinoderms like sea stars and sea urchins are well known for their water-vascular system which consists of water-filled tubes that run through their body. By moving water in and out of these tubes echinoderms can move on "jets" of water or use their tubed feet as suction cups. In water vascular system, sea water enters through a porous plate called ***madreporite.*** It consists of radiating canals and ***tube feet (podia)*** filled with water.
  - ➢ Echinoderms have great power of **autotomy** and **regeneration.**
- **Examples:** *Asterias* (Starfish), *Echinus (*Sea Urchin), *Echinocardium, Antedon* (Sea Lily), *Cucumaria* (Sea Cucumber)*, Ophiura* (Brittle Star).

## PHYLUM HEMICHORDATA

- It consists of small worm-like organisms.
- Hemichordates were earlier placed as a sub-phylum under Phylum Chordata.
- **Habit and Habitat:** The members belonging to this group are exclusively marine.
- **Body form:** Body is cylindrical, and composed of an anterior **proboscis, acollar** and a long **trunk.**
- **Levels of organization:** They have organ system level of organization.
- **Germ layers:** They are triploblastic.
- **Symmetry:** They have bilateral symmetry.
- **Coelom:** Hemichordates are enterocoelous.
- **Digestive system:** Digestive system isComplete.
- **Respiratory system:** Respiration takes place through gills.
- **Circulatory system:** Circulatory system is open type.
- **Excretory system:** Excretory organ is proboscis gland.
- **Nervous system:** Nervous system is simple.
- **Reproductive system:**
  - ➢ It is mostly sexual.
  - ➢ Sexes are separate.
  - ➢ Fertilization external.
  - ➢ Development is indirect through a free swimming tornaria larva.
- **Examples:** *Balanoglossus* (Tongue worm), *Saccoglossus, Rhabdopleura.*

## PHYLUM CHORDATA

**Characteristic Features**

- **Habit and Habitat:** They are marine, freshwater, or terrestrial.
- **Symmetry:** Chordates have bilateral symmetry.
- **Characteristic features of chordates:**
  - ➢ Chordates have a flexible, supporting rod or notochord on their dorsal side. In the invertebrates the notochord remains stiff and flexible. In the vertebrates, cartilage or bone replaces the notochord to form a supporting backbone.Notochord is a flexible rod located in the mid dorsal line between the alimentary canal and the nerve cord in the embryo.
  - ➢ They have dorsal hollow nerve cord.
  - ➢ They have paired pharyngeal gill slits.
  - ➢ Heart is ventral.
  - ➢ They have post anal tail.

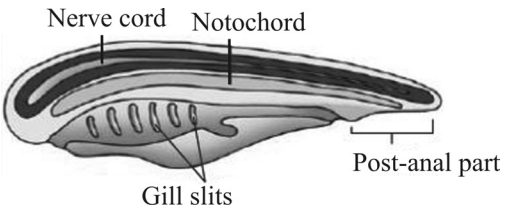



**Fig.** Chordata characteristics

**Differences between Chordata and Non-Chordata**

| Chordata | Non chordata |
|---|---|
| Notochord is found in embryonic stage | Notochord is absent. |
| Central nervous system is dorsal, hollow and single. | Central nervous system is ventral, solid and double. |
| Pharyngeal gill slits are present. | Pharyngeal gill slits are absent. |
| Chordates have ventral heart. | They have dorsal heart. (If present). |
| Post anal tail is present. | Post anal tail is absent. |

Phylum Chordate is Divided into Three Sub Phyla: Urochordata, Cephalochordata, and Vertebrata.

## 1. Sub Phylum: Urochordata (Also known as Tunicata; uro:tail)

**Characteristic Features**

- **Habit and Habitat:**They are exclusively marine.
- Notochord is present only in larval tail.
- Body is covered by ***test*** made up of ***tunicin***
- They show retrogressive metamorphosis.
  ***Note:*** Transformation of a larva into an adult is known as metamorphosis. If the adult loses some advanced characters of the larva, it is called **retrogressive metamorphosis.**
- Reproduction: They are hermaphrodite (Male and female sex organs are seen in same individual).
- **Examples:** *Ascidia, Salpa, Doliolum, Herdmania (*Sea squirt), *Ciona, Botryllus* (colonial Urochordata), *Pyrosoma* etc.
- *Pyrosoma* is bioluminescent colonial Urochordata.

## 2. Sub Phylum: Celphalochordata (Cephalo: head)

**Characteristic Features**

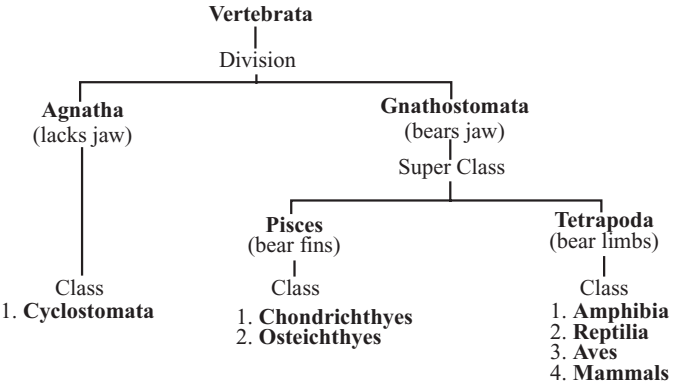
- Notochord extends from head to tail region and is persistent throughout the life.
- **Habit and Habitat:** They are exclusively marine.
- They are fish-like.
- **Coelom:** They have no definite coelom.
- Sexes are separate.
- **Examples:** *Branchiostoma* (Amphioxus or Lancelet)

## 3. Sub Phylum: Vertebrata

**Characteristic Features**

- All vertebrates are chordates but all chordates are not vertebrates.
- **Notochord:** They possess notochord only during the embryonic period. Notochord gets replaced by a cartilaginous or bony vertebral columnin the adult.
- **Coelom:**Coelom is well developed.
- **Cephalization:** There is high degree of cephalization.
- **Digestive system:** Digestive tract is complete
- **Circulatory system:** It is closed type. It consists of blood vascular and lymphatic systems. They have ventral muscular heart.
- **Respiratory system:** Respiratory organs may be gills, skin, buccopharyngeal cavity or lungs.
- **Excretory organ:** They have kidneys for excretion and osmoregulation.
- **Skeletal system:** They all have paired appendages which may be fins or limbs.

**Classification of sub phylum Vertebrata**




Sub phylum Vertebrata has 2 divisions- Agnatha and Gnathostomata

**A. Sub Division: Agnatha (Jawless Vertebrates)**

*Includes 1 class: Cyclostomata*

**Class : Cyclostomata (Circular mouthed fishes)**

**Characteristic Features**

- **Habit and Habitat:** All members of the class live *as ectoparasites on* some fishes.
- They have elongated body.
- They have sucking and circular mouth without jaws.
- Body is devoid of scales and paired fins.
- Their cranium and vertebral column are cartilaginous.
- **Respiratory system:** Cyclostomes have 6-15 pairs of gill slits for respiration.
- **Circulatory system:** Circulation is of closed type.
- **Endoskeleton:** Endoskeleton is cartilaginous.
- **Reproduction:** They are usually marine, but migrate for spawning to fresh water. After spawning, they die. Their larvae, after metamorphosis,return to ocean.
- **Examples:** *Petromyzon* (Lamprey) and *Myxine* (Hagfish).

**B. Sub Division: Gnathostomata (The Jawed Vertebrates)**

Includes 2 super classes: Pisces and Tetrapoda

i. **Super Class: Pisces (Fishes- Bear Fins):**
Super class Pisces has 2 classes: Chondrichthyes and Osteichthyes.

**(a) Class Chondrichthyes (The cartilaginous fishes)**

- **Habit and Habitat:**They are usually marine animals.
- **General Characters:**
  - ➢ They have a superior, streamlined design for swimming.
  - ➢ They have cartilaginous endoskeleton.
  - ➢ They have heterocercal caudal fin.
  - ➢ They have gill slits and without operculum, except *Chimaeras.*
  - ➢ Skin is tough with placoid scaled that are dermal in origin.
  - ➢ Jaws are well developed. Mouth is located ventrally.

Development of the moveable jaw allowed these animals to eat larger prey and become top predators.

- ➢ Teeth are modified placoid scales which are backwardly directed.
- ➢ They lack air bladder.Thus, they have to swim constantly to avoid sinking.
- ➢ They are cold blooded animals (Poikilotherms). Cold blooded animals lack the capacity to regulate the body temperature.
- ➢ Heart is 2-chambered. (1 Auricle + 1 Ventricle). Blood that no longer has oxygen flows into one chamber of the heart from the body tissues. The second heart chamber pumps blood directly to the capillaries located in the fish's gills. Oxygen is picked up from the water passing over the gills.
- ➢ They have very keen sense of smell. They can detect a drop of blood in 100 L of sea water.
- ➢ The lateral line - a series of small pits along the animal's body allow the animals to detect vibrations in the water. The sound receptors of terrestrial vertebrates may have evolved from these organs.
- ➢ Sexes are separate. In males, pelvic fins bear ***claspers,*** which are used for copulation.
- ➢ Fertilization is internal which is advanced for a fish.
- ➢ Many of them are viviparous. Eggs generally develop inside the female's body, and young are born alive.
- ➢ Some of them have electric organs (e.g. *Torpedo),* and some possess poison sting (e.g. *Trygon).*
- ➢ **Examples:** *Scoliodon* (Dogfish), *Pristis* (Saw fish), *Trygon* (Sting ray), *Torpedo* (Electric ray), *Rhinobatus (*Guitar fish), *Chimaera, etc.*

**(b) Class Osteichthyes (The Bony fishes)**

- **Habit and Habitat:**They include both marine and fresh water fishes.
- **Characteristic features:**
  - ➢ Bony fishes developed a heavy skeleton made completely of bone. A backbone surrounds the spinal cord and the brain is fully encased in a protective skull.
  - ➢ They have homocercal caudal fin.
  - ➢ Mouth is terminal.
  - ➢ They have four pairs of gills covered by an operculum on each side.
  - ➢ Skin is covered with cycloid, ctenoid and ganoid scales.
  - ➢ They have air bladder which regulates buoyancy.
  - ➢ Their swim bladder is a gas-filled sac that allows the animal to float at any depth in the water (sharks must move through the water to avoid sinking).
  - ➢ The body is covered with a layer of mucous to facilitate gliding through the water and to protect from parasites.
  - ➢ Gills extract dissolved oxygen from the water around them. Water is brought in through the mouth and passes over filaments rich in blood vessels which provide a huge surface area. Water is then forced out slits in the side of the throat.
  - ➢ Heart is 2 chambered (1 auricle + 1 ventricle).
  - ➢ Kidneys are mesonephric. Ammonia is the chief nitrogenous waste.
  - ➢ The lateral line system is well-developed.
  - ➢ The nervous system is quite developed to allow for some complex behaviours and movement.
  - ➢ Although their vision is not great, they have quite a good sense of smell.
  - ➢ Sexes are separate. Fertilisation is external.
  - ➢ They are mostly oviparous and development is direct.
  - ➢ **Examples:**
    - ♦ **Marine fishes:** *Exocoetus*(flying fish), *Hippocampus* (sea horse), *Sardine,Mackeral, Tuna,Echeneis*(suckerfish)*, Pomfret,Cybium, Lophius (*Angler fish).
    - ♦ **Fresh water fishes:** *Labeo* (Rohu),*Catla* (Katla), *Clarias* (Magur), *Anguilla, Mystus, Heteropneustes, Tilapia, Anabas* (Climbing perch)
  - ➢ Lung fishes have three chambered heart. (2 auricles + 1 ventricle).

## Super class: Tetrapoda (Bear Limbs)

It has 4 classes: Amphibia, Reptilia, Aves, and Mammalia

**(a) Class Amphibia (amphi: dual, bios: life)**

- **Characteristic features:**
- Amphibians are the first tetrapods to invade the land. The juvenile phase of the life cycle is dependent on water, where gas exchange occurs through gills. The adult phase is less dependent on water and gas exchange occurs through lungs.
- Amphibians have aquatic larval life and terrestrial adult life.
- They require a watery environment for breeding.
- Body is divisible into head and trunk.
- Skin is moist without scales.
- Eyes have eyelids.
- A tympanum represents ear.
- Two pairs of limbs are used for locomotion except for caecilians.
- Alimentary canal, urinary and reproductive tracts opens into a Cloaca which opens to exterior.
- They are Poikilotherms (cold blooded animals).
- Respiration is by gills (in larva), lungs and skin (in adults).
- Amphibians have a **three-chambered heart** (2 auricles + 1 ventricle). Blood from the lungs (**pulmonary circuit**) goes to one atrium while blood from the body (**systemic circuit**) goes to the other atrium. Both atria empty into the ventricle where the blood is mixed.
- The advantage of this system is that there is higher pressure in vessels that lead to both the lungs and body.
- Kidneys are mesonephric. Larvae and tailed amphibians

(e.g. salamanders) are ammonotelic. Frogs and toads are ureotelic.

- Fertilisation is external. However in *Salamander and Ichthyophsis* fertilization is internal.
- They are mostly oviparous, except for *Salamandra salamandra,* which is viviparous.
- Development is indirect.
- External fertilization requires that sperm swim through water to the egg so the animals must stay in or near water for reproduction.
- The eggs do not have an outer covering or shell and therefore are not protected against drying out.
- **Adaptations to live on land**
  - ➢ Legs for movement and to support body weight.
  - ➢ Lungs replaced gills because the thin filaments of the gills would clump together out of water.
  - ➢ Improved heart to deliver more oxygen to walking muscles.
  - ➢ Eggs are laid in water to prevent them drying out.
  - ➢ Most species live close to water to prevent the skin from drying out.
- **Examples:** *Bufo* (Toad), *Rana*(Frog), *Hyla* (Treefrog), *Salamandra*(Salamander),*Ichthyophis*(Limblessamphibia),*Ambystoma* (Tigersalamander), *Rhacophorus* (Flying frog), *Necturus (*Mud puppy), *Amphiuma* (Congo eel), *Salamandra, Siren (*Mud eel), *Ambystoma, Triturus (*newt),*Uraeotyphlus, Ichythyopis* (Blind worm) etc.

**(b) Class Reptilia (Latin. Repre: to crawl-Creeping vertebrates)**

- **Habit and habitat:** They are mostly terrestrial.
- **Characteristic features:**
  - ➢ Reptilians first evolved during the Carboniferous time
  - ➢ Mesozoic Era is called the **Age of Reptiles**
  - ➢ They have creeping and crawling mode of locomotion.
  - ➢ Body is covered by dry and cornified skin, and epidermal scales or scutes.
  - ➢ Tympanum represents ear
  - ➢ Limbs are 2 pairs (if present).
  - ➢ They are poikilotherms (cold blooded animals).
  - ➢ Snakes and lizards shed their scales as skin cast.
  - ➢ Reptiles have more efficient lungs than amphibians. Reptiles do not need to use their skin for gas exchange because the lungs are sufficient.
  - ➢ They have a thick, scaly skin with keratin that makes skin impermeable to water and gases.
  - ➢ Most reptiles, like amphibians, have three-chambered hearts.
  - ➢ Some reptiles, including crocodiles and alligators, have four chambered hearts. A four-chambered heart completely separates the supply of blood with oxygen from the blood that does not have oxygen. This separation allows more oxygen to reach body tissues. Land animals require more energy than aquatic animals.
  - ➢ Crocodiles are ammonotelic. Turtles and alligators areureotelic. Lizards and snakes are uricotelic.
  - ➢ Most have a good sense of smell but poor eyesight.
  - ➢ Snakes and lizards also have a keen sense of smell. The **Jacobson's organ** is a pit like structure located in the roof of the mouth in both snakes and lizards. Special cells in the Jacobson's organ help the animal identify and differentiate the smells found in the air molecules.
  - ➢ Snake do not possess ears. Most do not have hearing as we think of it. They have membranes on the sides of the head to detect vibrations.
  - ➢ Most reptiles reproduce by laying eggs on dry land. Some snakes give live birth to well-developed young.
  - ➢ All reptiles have internal fertilization.
  - ➢ They are oviparous.The amniotic egg is encased in a water-tight, leathery shell covering.
  - ➢ Development is direct.
  - ➢ Most reptiles do not care for their young.

**Examples:** *Chelone* (Turtle), *Testudo* (Tortoise), *Chameleon* (Treelizard), *Calotes* (Garden lizard), *Crocodilus* (Crocodile), *Alligator*, *Gavialis* (gharial), *Hemidactylus* (Walllizard), *Sphenodon* (Tautara), *Draco* (flying dragon or flying lizard), *Phrynosoma* (hornedlizard), *Varanus* (monitor).

**Poisonous snakes:** *Naja* (Cobra), *Bangarus* (Krait), *Vipera* (Viper), *Crotalus* (rattle snake), *Enhydrina* (sea snake) etc.

**Non-poisonous snakes:** *Python,Typhlos* (blind snake), *Dryophis* (tree snake).

**(c) Class Aves (Latin. Avis:bird)**

- Habit and Habitat: They are mostly terrestrial.
- **Characteristic features:**
  - ➢ They have spindle shaped body to offer minimum resistance to the wind.
  - ➢ Members of this class have feathers. Most of them can fly except for few birds. Birds that cannot fly are known as flightless birds. Example: Ostrich, Emu, Kiwi and Penguin.
  - ➢ Their success is derived from the development of the feather which allows them to fly. **Feathers** are lightweight, modified protein scales. Feathers provide insulation and enable a bird to fly. Birds frequently run their bills or beaks through their feathers. This process, called **preening**, keeps the feathers in good condition for flight. When it preens, a bird also rubs oil from a gland located near the tail onto the feathers. Water birds must do this in order to waterproof their feathers.
  - ➢ Scales on their legs and feet and claws on their toes are reptilian characteristics. These are made of keratin.
  - ➢ The beak and feet are adapted to suit the bird's lifestyle.
  - ➢ Forelimbs are modified into wings.

- ➢ Hind limbs have scales and are modified for walking, swimming, or clasping tree branches.
- ➢ Skin is dry without glands except the oil gland at the base of the tail.
- ➢ Birds have no teeth.Birds eat small amounts of food often and digestion is very fast to minimize the weight during flight. Birds must consume enough food to provide the energy needed for endothermy and flight.
- ➢ Digestive tract has additional chambers- the crop and gizzard.
- ➢ Respiration is by lungs. Air sacs are connected to lungs to supplement respiration.
- ➢ They have bony endoskeleton.
- ➢ Bones are long, hollow and pneumatic, which assist in flying.
- ➢ They are homoiotherms (warm-blooded animals). Homoiotherms can maintain a constant body temperature.
- ➢ Birds have a double circulatory system with 2 atria and 2 ventricles.
- ➢ They don't have urinary bladder, except for *Rhea.*
- ➢ Nervous system is highly developed with excellent vision. This is required for flight.
- ➢ Smell and taste are not as good although hearing is excellent.
- ➢ The well-developed cerebrum allows for complex behaviour and learning. The cerebellum is also well-developed to allow the complex muscle movements required for flight.
- ➢ Birds have internal fertilization and produce hard-shelled, amniotic eggs.
- ➢ Development is direct.
- ➢ Birds exhibit complex behaviour including parental care.
- ➢ T.H. Huxley said "birds are glorified reptiles".
- ➢ The bird Albatross can fly throughout the day without flapping its wings even once.

- **Anatomical features related to flight**
  - ➢ Forelimbs have developed into wings and feathers provide lift. Flight muscles are called **pectorals** and are attached to wing and **keeled sternum.**
  - ➢ The breast bone is called the **sternum.** The sternum supports the thrust and power that the muscles produce when the wings move to get the bird off the ground. Feathers and wings are adaptations that allow birds to fly.
  - ➢ **Furculum** or wish bone is a fused collarbone that stabilizes bird in flight.
  - ➢ The bony or cartilaginous tail has been replaced by feathers.
  - ➢ The skeleton is made of hollow bones to reduce weight.
  - ➢ The breastbone is enlarged for attachment of strong flight muscles.
  - ➢ Females have only one ovary.
- **Fossil Record:** *Archaeopteryx* is the earliest known bird in the fossil record. It is considered the possible link between birds and reptiles.

**Examples:** *Corvus* (Crow),*Columba* (Pigeon),*Psittacula* (Parrot), *Struthio* (Ostrich), *Pavo* (Peacock), *Gullus* (Fowl), *Bubo,* (Owl)*, Aptenodytes* (Penguin), *Neophron* (Vulture), *Apteryx* (Kiwi), Rhea, *Dromaius* (Emu) etc.

**(d) Class Mammalia (Latin. Mamma:breast)**

**Characteristic Features**

- These animals have mammary glands (milk producing glands) to nourish young ones.Young are born relatively helpless but are fed milk and cared for by one or both parents. Most young are born live.
- Milk is 95% water but is rich in fat, sugar, protein.
- They are homoiotherms (warm blooded animals).
- They have 2 pairs of limbs adapted for walking, running, climbing, burrowing, swimming or flying.
- All mammals have hair. Mammal hair is made of the protein keratin. Hair may have evolved from scales.
- ***Functions of hair:***
- Hair provides insulation and waterproofing, which conserve body heat. If body heat becomes too high, mammals have internal mechanisms that signal the body to cool off.
- Note that marine mammals have blubber in addition to or instead of hair. The lack of hair minimizes drag in the water.
- It provides camouflage.
- Whiskers function as sensory structures.
- It may serve as defensive weapons as in porcupines.
- Mammals cool by panting and through the actions of sweat glands. Panting releases water from the nose and mouth, this result in a loss of body heat. Sweat glands secrete moisture onto the surface of the skin. As the moisture evaporates, it transfersheat from the body to the surrounding air.
- Mammals have a diversity of teeth for different kinds of foods.
- They have different types of teeth in jaw- Heterodont, thecodont, diphyodont. Fish, amphibians, and reptiles have teeth that are all similar
- Mammals walk more efficiently than reptiles because their legs are positioned further under their body.
- Respiration is by lungs.More efficient breathing results from the **diaphragm** muscle.
- Mammals have a four chambered heart. Renal portal system is absent.
- Mammals have well-developed sense organs and a large brain with a large cerebrum.

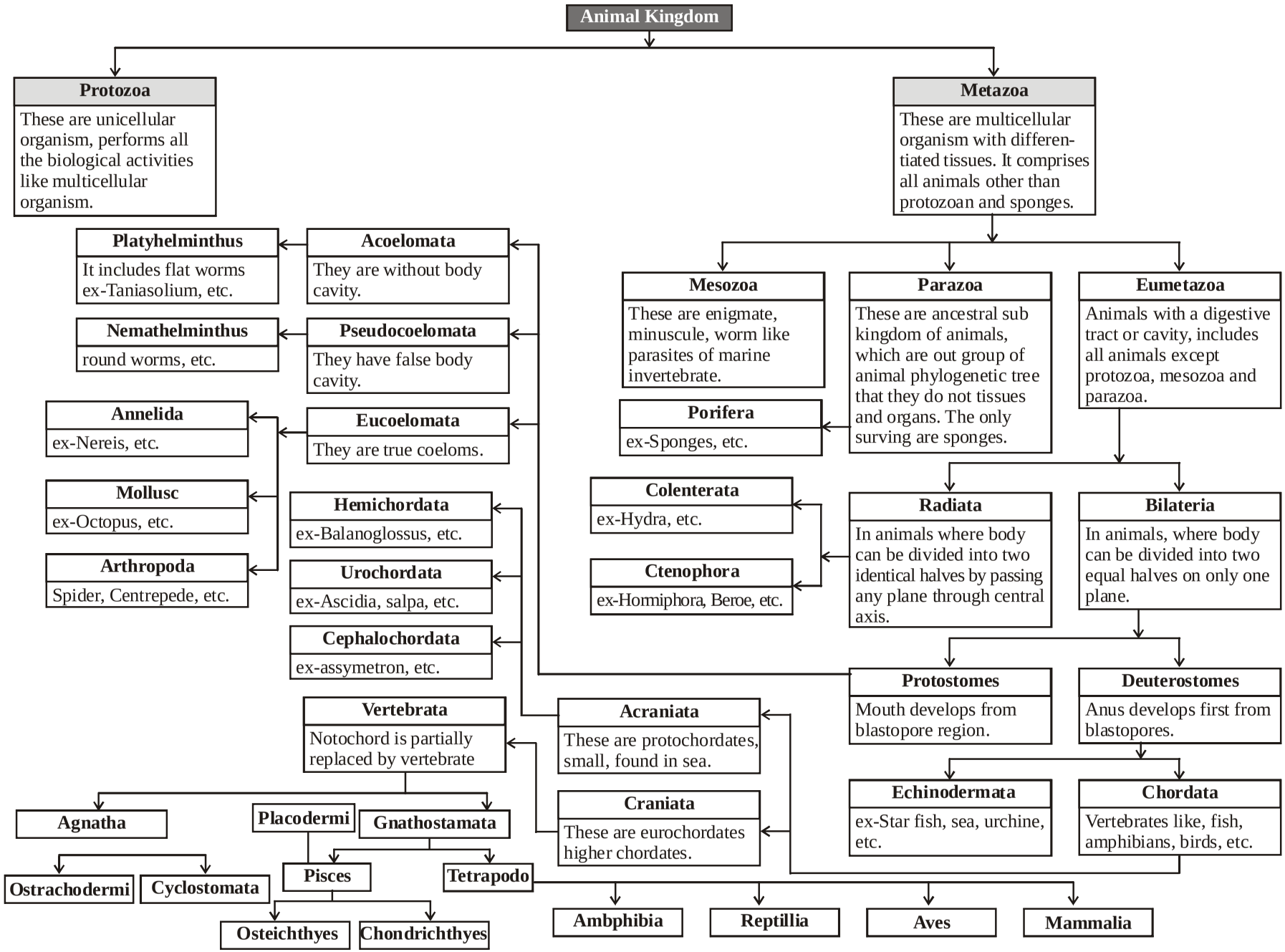
- They have external ear (Pinnae)
- Sexes are separate.
- Fertilisation is internal.
- They are viviparous (except for *Echidna* and *Platypus)*. *Echidna* and *Platypus* are egg laying mammals.
- Development is direct.
- Types of mammals:

(i) **Monotremes** (one hole) are **egg-laying mammals** which include the duck-billed *Platypus* and spiny anteater.

(ii) **Marsupials** (marsupium, L - pouch) are **pouched-mammals** which includes opossums, kangaroos, and koalas in addition to some mouse and wolf relatives in Australia. Marsupial young begin development in the female's body.

(iii) **Placental mammals** give birth to **well-developed young.** Nutrients, water, and oxygen pass from mother to foetus while wastes pass from foetus to mother.

**Examples:** *Ornithorhynchus* (*Platypus*), *Macropus* (Kangaroo), *Pteropus* (flyingfox), *Camelus* (Camel), *Macaca* (Monkey), *Rattus* (Rat), *Canis* (dog), *Felis* (Cat), *Elephas* (Elephant), *Equus* (Horse), *Delphinus* (Common Dolphin), *Pantheratigris* (Tiger), *Panthera leo* (lion).


Animal Kingdom
Protozoa
These are unicellular organism, performs all the biological activities like multicellular organism.
Metazoa
These are multicellular organism with differentiated tissues. It comprises all animals other than protozoan and sponges.
Platyhelminthus
It includes flat worms ex-Taniasolium, etc.
Acoelomata
They are without body cavity.
Nemathelminthus
round worms, etc.
Pseudocoelomata
They have false body cavity.
Annelida
ex-Nereis, etc.
Eucoelomata
They are true coeloms.
Mollusc
ex-Octopus, etc.
Arthropoda
Spider, Centrepede, etc.
Hemichordata
ex-Balanoglossus, etc.
Urochordata
ex-Ascidia, salpa, etc.
Cephalochordata
ex-assymetron, etc.
Vertebrata
Notochord is partially replaced by vertebrate
Acraniata
These are protochordates, small, found in sea.
Craniata
These are eurochordates higher chordates.
Agnatha
Placodermi
Gnathostamata
Ostrachodermi
Cyclostomata
Pisces
Tetrapodo
Osteichthyes
Chondrichthyes
Ambphibia
Reptillia
Aves
Mammalia
Mesozoa
These are enigmate, minuscule, worm like parasites of marine invertebrate.
Parazoa
These are ancestral sub kingdom of animals, which are out group of animal phylogenetic tree that they do not tissues and organs. The only surving are sponges.
Eumetazoa
Animals with a digestive tract or cavity, includes all animals except protozoa, mesozoa and parazoa.
Porifera
ex-Sponges, etc.
Colenterata
ex-Hydra, etc.
Ctenophora
ex-Hormiphora, Beroe, etc.
Radiata
In animals where body can be divided into two identical halves by passing any plane through central axis.
Bilateria
In animals, where body can be divided into two equal halves on only one plane.
Protostomes
Mouth develops from blastopore region.
Deuterostomes
Anus develops first from blastopores.
Echinodermata
ex-Star fish, sea, urchine, etc.
Chordata
Vertebrates like, fish, amphibians, birds, etc.

# EXERCISE - 1
## Conceptual Questions

**1.** Which of the protozoan is considered as connecting link between plants and animals ?
(a) *Entamoeba* (b) *Paramoecium*
(c) *Euglena* (d) *Monocystis*

**2.** In Platyhelminthes
(a) The embryonic layers, ectoderm and endoderm, are separated by mesoglea
(b) The body is asymmentrical
(c) There is tissue level of organization
(d) The body cavity is absent

**3.** Which one of the following organisms as diploblastic ?
(a) *Pennatula* (b) *Paramoecium*
(c) *Polystomella* (d) *Entamoeba*

**4.** Radial symmetry occurs in
(a) fishes (b) molluscs
(c) star fishes (d) sponges

**5.** In coelomates, the problem of diffusion of food from gut to tissues is solved by
(a) the presence of coelomic fluid
(b) churning the food within the body cavity
(c) developing a circulatory system
(d) developing gut associated glands

**6.** Which of the following is a fresh water sponge?
(a) *Sycon* (b) *Euspongia*
(c) *Spongilla* (d) *Pleurobrachia*

**7.** Comb jellies belong to
(a) Porifera (b) Cnidaria
(c) Ctenophora (d) Corals

**8.** Which one of the sponge part corresponds to the mouth of other animals ?
(a) Osculum (b) Incurrent canal
(c) Ostia (d) Excurrent canal

**9.** Bath sponge is common name of –
(a) *Spongilla* (b) *Euspongia*
(c) *Euplectella* (d) *Leucosolenia*

**10.** Classification of porifera is based upon –
(a) spicules (b) canal system
(c) amoebocytes cells (d) nutrition

**11.** Cellular grade organisation is found in –
(a) helminthes (b) coelenerata
(c) porifera (d) all of these

**12.** The members of the following phylum are mostly marine and asymmetrical
(a) Ctenophora (b) Coelenterata
(c) Porifera (d) Echinodermata

**13.** Spicules and amoebocytes in a sponge occur in its
(a) Pinacoderm (b) Choanoderm
(c) Mesenchyme (d) Spongocoel

**14.** *Hydra* is a coelenterate because it has –
(a) tentacles
(b) mesogloea
(c) coelenteron and cnidoblast
(d) hypostome

**15.** "Portuguese man of war" is –
(a) soldier of world war I
(b) portuguese soldier
(c) a sponge
(d) a polymorphic, colonial, colenterata

**16.** Which one of the following is Coelentrate ?
(a) Sea cow (b) Sea cucumber
(c) Sea fan (d) Sea horse

**17.** Given are the four matches of phyla with their characteristic cells
A. Coelenterata - Nematocytes
B. Porifera - Choanocytes
C. Ctenophora - Solenocytes
D. Platyhelminthes - Nephrocytes
Mark the option that has both correct matches
(a) A, B (b) B, C
(c) C, D (d) B, D

**18.** Filaria worm is –
(a) *Trichuris* (b) *Wauchereria bancrofti*
(c) *Ascaris lumbricoides* (d) *Ancylostoma*

**19.** Which of the following is commonly called 'Pearl oyster'
(a) *Limulus* (b) *Pinctada*
(c) *Dentalium* (d) *Chaetoplenura*

**20.** Following organism is triploblastic, bilaterally symmetrical and marine, and respires through gills
(a) *Echinus* (b) *Hirudinaria*
(c) *Balanoglossus* (d) *Physalia*

**21.** Which of the following does not belong to phylum Coelenterata ?
(a) Sea pen (b) Sea feather
(c) Sea cucumber (d) Sea fan

**22.** The members of following phylum are exclusively marine, radially symmetrical and diploblastic
(a) Porifera (b) Echinodermata
(c) Ctenophora (d) Hemichordata

**23.** *Planaria*, Liver fluke and *Taenia solium* are
(a) All segmented (b) All found in the gut
(c) All have coelom (d) All are flatworms

**24.** Diploblastic acoelomate condition is found in
(a) *Planaria* (b) *ascaris*
(c) Rotifer (d) sea anemone

**25.** Annelids are –
(a) Radially symmetrical (b) Externally segmented
(c) Triploblastic (d) Pseudocoelomate

**26.** Which statement regarding *Nereis* is wrong ?
(a) It has nephridium for excretion
(b) It is metamerically segmented
(c) It is monoecious
(d) It has parapodia for swimming

**27.** Example of living fossil in Arthropoda is :
(a) *Cimex* (b) *Triarthus*
(c) *Peripatus* (d) *Eupagurus*

**28.** Following is an oviparous mammal
(a) *Delphinus* (b) *Ornithorhynchus*
(c) *Macropus* (d) *Elephas*

**29.** Which of the following feature of bony fish is missing in cartilaginous fishes
(a) Operculum (b) Placoid scales
(c) Poekilothermic (d) Paired fins

**30.** What distinguishes an insect from a crustacean ?
(a) Number of eye
(b) Arrangement of nerve cord
(c) Number of appendages
(d) Presence of wings

**31.** Which of the following characteristic is shared by all Arthropods ?
(a) Complete metamorphosis (b) Wings
(c) Jointed appendages (d) Asexual reproduction

**32.** Mark the correct match of the animal and its common name
(a) Trygon – dog fish
(b) Ascidia – lancelet
(c) Pterophyllum – flying fish
(d) Myxine – hagfish

**33.** Which of the following is a limbless amphibian
(a) *Salamander* (b) *Ichthyophis*
(c) *Pristis* (d) *Cucumaria*

**34.** *Chelone* is commonly known as
(a) Garden lizard (b) Tortoise
(c) Flying lizard (d) Turtle

**35.** Sharks do not have
(a) Teeth (b) Claspers
(c) Air bladder (d) Ventral mouth

**36.** Which of the following animal is cold blooded and has 4 - chambered heart
(a) Salamander (b) *Ornithorhynchus*
(c) Crocodile (d) *Calotes*

**37.** The following group is not a subphylum of Chordata
(a) Urochordata (b) Tetrapoda
(c) Cephalochordata (d) Vertebrata

**38.** Member of Echinodermata has a specific system, which is not found in other phylum, it is –
(a) canal system (b) water vascular system
(c) respiratory system (d) reproductive system

**39.** Which of the following is found in both coelenterates and echinoderms in adult stage ?
(a) Coelenteron (b) Radial symmetry
(c) Tube-feet (d) Bilateral symmetry

**40.** The animal with tube-feet is –
(a) star-fish (b) jelly-fish
(c) silver-fish (d) cray-fish

**41.** Water vascular system is found in –
(a) *Hydra* (b) Leech
(c) Fish (d) Star-fish

**42.** *Salpa* and *Doliolum* belong to
(a) Cephalochordata (b) Hemichordata
(c) Tunicata (d) Cyclostomata

**43.** Antedon is commonly called :-
(a) Sea lily (b) Brittle star
(c) Sea-star (d) Sea-cucumber

**44.** One character is given wrongly for phylum chordata mark it –
(a) Presence of notochord
(b) Presence of vertebral column
(c) Paired gill slits
(d) A central nervous system dorsal to digestive canal

**45.** Which of the following is a chordate feature, not shared by the non-chordates ?
(a) Metamerism (b) Axial organization
(c) Bilateral symmetry (d) Pharyngeal gill slits

**46.** In which of the following class of Annelida, one pair ovaries and several pair testes are found ?
(a) Archiannelida (b) Hirudinea
(c) Oligochaeta (d) Polychaeta

**47.** Annelida and mollusca resemble in many embryonic features because both have
(a) spiral cleavage and mesoderm formation
(b) identical conspicuous segmentation in body, muscles and nervous system
(c) meroblastic cleavage and ectoderm formation
(d) special types of mouth parts

**48.** The scientific name of Ostrich is
(a) *Neophron* (b) *Aptenodytes*
(c) *Pavo* (d) *Struthio*

**49.** The members of which group do not exhibit metamerism
(a) Pisces (b) Aves
(c) Arthropoda (d) Mollusca

**50.** *Gambusia* is a –
(a) parasitic fish
(b) pest of fish
(c) fish predator of mosquitos larva
(d) mosquito spreading yellow fever

**51.** Sea Hare is
(a) *Sepia* (b) *Teredo*
(c) *Aplysia* (d) *Pila*

**52.** Jaws are absent in –
(a) protochordata
(b) protochordata and cyclostomata
(c) *Amphioxus* and *Balanoglossus*
(d) *Herdmania* and *Myxine*

**53.** Scales in chondrichthyes are –
(a) placoid (b) ganoid
(c) cycloid (d) sesamoid

**54.** Which one of the following is a cartilaginous fish?
(a) Silver fish (b) Dog fish
(c) Cray fish (d) Star fish

**55.** Heart of fishes is
(a) one chambered (b) two chambered
(c) three chambered (d) four chambered

**56.** *Hippocampus* (Sea Horse) belongs to the class
(a) Agnatha (b) Chondrichtyes
(c) Osteichthyes (d) Mammalia

**57.** Fishes are
(a) homoiothermic (b) poikilothermic
(c) Both (a) and (b) (d) None of these

**58.** Which of the following is characteristic feature of fishes ?
(a) Tail and venous heart
(b) Venous heart and gills
(c) Epidermal scales and tail
(d) Epidermal scales and gills

**59.** Which one of the following has an open circulatory system ?
(a) Periplaneta (b) Hirudinaria
(c) Octopus (d) Pheretima

**60.** Similarity between fish and tadpole is
(a) legs (b) fins
(c) lateral line (d) scales

**61.** What is the true for mammalia ?
(a) *Platypus* is oviparous
(b) Bats have feather
(c) Elephant is an ovo-viviparous
(d) Diaphragm is absent in them

**62.** Which of the following character is not found in all the chordates ?
(a) Diaphragm (b) Coelom
(c) Pharyngeal gill slits (d) Dorsal nerve cord

**63.** In which of the following animal post anal tail is found ?
(a) Earthworm (b) Lower invertebrate
(c) Scorpion (d) Snake

**64.** In which of the following notochord is present in embryonic stage ?
(a) All chordates (b) Some chordates
(c) Vertebrates (d) Non-chordates

**65.** In which animal nerve cell is present but brain is absent ?
(a) Sponge (b) Earthworm
(c) Cockroach (d) *Hydra*

**66.** One of the following is a very unique feature of the mammalian body –
(a) Presence of diaphragm
(b) Four chambered heart
(c) Rib cage
(d) Homeothermy

**67.** An egg laying mammal is –
(a) Kangaroo (b) *Platypus*
(c) Koala (d) Whale

**68.** The early stage human embryo distinctly possesses
(a) Gills (b) Gill slits
(c) External ear (pinna) (d) Eye brows

**69.** In *Hydra*, egestion of undigested food and excretion of nitrogeneous wastes occur through –
(a) mouth and tentacles
(b) mouth and body wall
(c) mouth and mouth
(d) body wall and body wall\

**70.** Which one of the animal of amphibia has no tongue?
(a) *Amphiuma* (b) *Ichthyophis*
(c) *Necturus* (d) *Salamander*

**71.** Which of the following is not found in birds ?
(a) Hind limb (b) Fore limb
(c) Pelvic girdle (d) Pectoral girdle

**72.** Which type of respiratory organs are present in spiders and scropions ?
(a) Book lungs (b) Gills
(c) Gill books (d) Lungs

**73.** Flight muscles of bird are attached to
(a) clavicle (b) coracoid
(c) keel of sternum (d) scapula

**74.** Flippers of seal are modified
(a) Fins (b) Hind limb
(c) Forelimb (d) Gills

**75.** Which character is not same in aves and mammals ?
(a) Single systemic arch
(b) Metanephric kidney
(c) Seven cervical vertebrae
(d) Homoiotherms

# EXERCISE - 2
## Applied Questions

**1.** Which one of the following characters is not typical of the class Mammalia?
(a) Thecodont dentition
(b) Alveolar lungs
(c) Ten pairs of cranial nerves
(d) Seven cervical vertebrae

**2.** From the following statements select the wrong one.
(a) Prawn has two pairs of antennae
(b) Nematocysts are characteristic of the Phylum Cnidaria
(c) Millipedes have two pairs of appendages in each segment of the body
(d) Animals belonging to Phylum Porifera are exclusively marine

**3.** Few cnidarians like corals have a skeleton composed of _____.
(a) calcium hydroxide (b) calcium sulphate
(c) calcium carbonate (d) sodium bicarbonate

**4.** In contrast to Annelids the Platyhelminths show:
(a) Absence of body cavity (b) Bilateral symmetry
(c) Radial symmetry (d) Presence of pseudocoel

**5.** Two common characters found in centipede, cockroach and crab are
(a) Jointed legs and chitinous exoskeleton
(b) Green gland and tracheae
(c) Book lungs and antennae
(d) Compound eyes and anal cerci

**6.** When any plane passing through the central axis of the body divides the organism into two identical halves, the organism is called
(a) Radially symmetrical
(b) Bilaterally symmetrical
(c) Asymmetrical
(d) Metamerically segmented

**7.** Which of the following organism is correctly matched with its common name ?
(a) *Aurelia* -comb jelly (b) *Adamsia* -sea anemone
(c) *Ancylostoma* - pin worm (d) *Aplysia* - sea mouse

**8.** Choanocytes perform
(a) nutrition (b) excretion
(c) reproduction (d) secretion of spicules

**9.** In chordates the notochord is
(a) Mesodermal and dorsal to nerve cord
(b) Endodermal and dorsal to nerve cord
(c) Mesodermal and ventral to nerve cord
(d) Endodermal and ventral to nerve cord

**10.** A student has identified a triploblastic coelomate segmented animal as an arthropod. Which additional character the student should have verified before identifying that animal as an arthropod ?
(a) Presence of wings (b) Presence of antenna
(c) Type of coelom (d) Type of symmetry

**11.** Lamprey is not a fish since it does not have
(a) Closed blood vascular system
(b) Fins
(c) Body scales
(d) Cranium and vertebral column

**12.** The presence of compound eyes is characteristics of the phylum
(a) nematoda (b) molluska
(c) echinodermata (d) arthropoda

**13.** Absence of head, unsegmented body and endoskeleton of dermal calcareous plate are the characters of
(a) mollusca (b) arthropoda
(c) echinodermata (d) none of these

**14.** Polyp phase is absent in
(a) *Hydra* (b) *Aurelia*
(c) *Physalia* (d) *Obelia*

**15.** Bioluminescence is exhibited by
(1) *Chlorella* (2) *Hirudinaria*
(3) *Chlamydomonas* (4) *Ceratium*

**16.** Which one of the following groups of structures/organs have similar function ?
(a) Typholosle in earthworm, intestinal villi in rat and contractile vacuole in *Amoeba*
(b) Nephridia in earthworm, malpighian tubules in cockroach and urinary tubules in rat
(c) Antennae of cockroach, tympanum of frog and clitellum of earthworm
(d) Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish

**17.** Which one of the following sets of animals belongs to the same class of a phylum ?
(a) Hydra, jelly fish, cray fish
(b) Bat, pigeon, whale
(c) Spider, scorpion, centipede
(d) Whale, otter, kangaroo

**18.** *Ornithorynchus* is a
(a) fossil bird
(b) flightless bird
(c) connecting link between reptiles and birds
(d) mammal

**19.** Poisonous fangs of a snake are modified
(a) Mandible (b) Maxillary teeth
(c) Canines (d) Nasals

**20.** *Meandrina* (Brain coral) belongs to phylum -
(a) Porifera (b) Coelenterata
(c) Ctenophora (d) Platyhelminthes

**21.** In which one of the following sets of animals do all the four give birth to young ones?
(a) Platypus, Penguin, Bat, Hippopotamus
(b) Shrew, Bat, Cat, Kiwi
(c) Kangaroo, Hedgehog, Dolphin, Loris
(d) Lion, Bat, Whale, Ostrich

**22.** Biradial symmetry and lack of cnidoblasts are the characteristics of
(a) *Ctenoplana* and *Beroe* (b) *Aurelia* and *Paramecium*
(c) Hydra and starfish (d) Starfish and sea anemone

**23.** In ctenophora, the body bears _____ external rows of ciliated comb plates, which help in locomotion.
(a) five (b) six
(c) seven (d) eight

**24.** Flame cells present in platyhelminthes, are specialised in -
(a) respiration aond absorption
(b) osmoregulation and circulation
(c) respiration and excretion
(d) osmoregulation and excretion

**25.** Metameric segmentation is the characteristic of
(a) Echinodermata and Annelida
(b) Annelida and Arthropoda
(c) Mollusca and Chordata
(d) Platyhelminthes and Arthropoda

**26.** Which one of the following is a matching set of a phylum and its three examples ?
(a) Platyhelminthes - *Planaria, Schistosoma, Enterobius*
(b) Mollusca - *Loligo, Teredo, Octopus*
(c) Porifera - *Spongilla, Euplectella, Pennatula*
(d) Cnidaria - *Bonellia, Physalia, Aurelia*

**27.** What is common about Trypanosoma, Noctiluca, Monocystis and Giardia ?
(a) They have flagella
(b) They produce spores
(c) These are all parasites
(d) These are all unicellular protists

**28.** Annual migration does not occur in the case of
(a) Siberian crane (b) Salamander
(c) Arctic tern (d) Salmon

**29.** Which one of the following is NOT a characteristic of phylum Annelida?
(a) Closed circulatory system (b) Segmentation
(c) Pseudocoelom (d) Ventral nerve cord

**30.** Which one of the following is the true description about an animal concerned?
(a) Earthworm - The alimentary canal consists of a sequence of pharynx, oesophagus, stomach, gizzard and intestine
(b) Frog - Body divisible into three regions - head, neck and trunk
(c) Rat - Left kidney is slightly higher in position than the right one
(d) Cockroach - 10 pairs of spiracles (2 pairs on thorax and 8 pairs on abdomen)

**31.** Which one of the following phyla is correctly matched with its two general characteristics?
(a) Arthropoda - Body divided into head, thorax and abdomen and respiration by tracheae
(b) Chordata - Notochord at some stage and separate anal and urinary openings to the outside
(c) Echinodermata - Pentamerous radial symmetry and mostly internal fertilization
(d) Mollusca - Normally oviparous and development through a trochophore or veliger larva

**32.** Which of the following are economically important insects?
(a) *Bombyx* and *Apis* (b) Laccifer and Anopheles
(c) Locusta and Limulus (d) All of these

**33.** *Ascaris* is characterized by
(a) absence of true coelom but presence of metamerism
(b) presence of neither true coelom nor metamerism
(c) presence of true coelom but absence of metamerism
(d) presence of true coelom and metamerism (metamerisation)

**34.** Which one of the following groups of three animals each is correctly matched with their one characteristic morphological feature?

| | **Animals** | | **Morphological feature** |
|---|---|---|---|
| (a) | Liver fluke, Sea anemone, Sea cucumber | - | Bilateral symmetry |
| (b) | Centipede, Prawn, Sea urchin | - | Jointed appendages |
| (c) | Scorpion, Spider, Cockroach | - | Ventral solid central nervous system |
| (d) | Cockroach, Locust, *Taenia* | - | Metameric segmentation |

**35.** A file like rasping organ for feeding, called radula present in phylum-
(a) Arthropoda (b) Mollusca
(c) Echinodermata (d) Chordata

**36.** Which one of the following groups of animals is bilaterally symmetrical and triploblastic?
(a) Aschelminthes (round worms)
(b) Ctenophores
(c) Sponges
(d) Coelenterates (Cnidarians)

**37.** Which one of the following pairs of animals comprises 'jawless fishes'?
(a) Mackerals and Rohu (b) Lampreys and hag fishes
(c) Guppies and hag fishes (d) Lampreys and eels

**38.** One example of animals having a single opening to the outside that serves both as mouth as well as anus is:
(a) *Octopus* (b) *Asterias*
(c) *Ascidia* (d) *Fasciola*

**39.** In which of the phylum, excretory organs like proboscis gland is present?
(a) Hemichordata (b) Chordata
(c) Echinodermata (d) Annelida

**40.** Which one of the following statements about all the four of *Spongilla*, Leech, Dolphin and Penguin is correct?
(a) Penguin is homeothermic while the remaining three are poikilothermic
(b) Leech is a fresh water form while all others are marine
(c) *Spongilla* has *special* collared cells called choanocytes, not found in the remaining three
(d) All are bilaterally symmetrical

**41.** Which one of the following kinds of animals are triploblastic?
(a) Flat worms (b) Sponges
(c) Ctenophores (d) Corals

**42.** Which one of the following statements about certain given animals is correct?
(a) Round worms (Aschelminthes) are pseudocoelomates
(b) Molluscs are acoelomates
(c) Insects are pseudocoelomates
(d) Flat worms (Platyhelminthes) are coelomates

**43.** What will you look for to identify the sex of the following?
(a) Female *Ascaris*- Sharply curved posterior end
(b) Male frog- A copulatory pad on the first digit of the hind limb
(c) Female cockroach-Anal cerci
(d) Male shark-Claspers borne on pelvic fins

**44.** Which of the followings possesses electric organs belong to class chondrichthyes?
(a) *Torpedo* (b) *Petromyzon*
(c) *Trygon* (d) *Exocoetus*

**45.** Which one of the following have the highest number of species in nature?
(a) Fungi (b) Insects
(c) Birds (d) Angiosperms

**46.** Which one of the following groups of animals is correctly matched with its one characteristic feature without even a single exception ?
(a) Reptilia : possess 3 - chambered heart with one incompletely divided ventricle
(b) Chordata : possess a mouth provided with an upper and lower jaw
(c) Chondrichthyes : possess cartilagious endoskeleton
(d) Mammalia : give birth to young one.

**47.** In which one of the folllowing, the genus name, its two characters and its class/phylum are correctly matched?

| | **Genus name** | **Two characters** | **Class/ phylum** |
|---|---|---|---|
| (a) | *Ascaris* | (i) Body segmented<br>(ii) Males and females distinct | Annelida |
| (b) | Salamander | (i) A tympanum represents ear<br>(ii) Fertilization is external | Amphibia |
| (c) | *Pteropus* | (i) Skin possesses hair<br>(ii) Oviparous | Mammalia |
| (d) | *Aurelia* | (i) Cnidoblasts<br>(ii) Organ level of organization | Coelenterata |

**48.** In which of the following possesses poison sting belong to class chondrichthyes?
(a) *Labeo* (b) *Myxine*
(c) *Clarias* (d) *Trygon*

**49.** Which one of the following statements is totally wrong about the occurrence of notochord, while the other three are correct?
(a) It is present only in larval tail in Ascidians
(b) It is replaced by a vertebral column in adult frog
(c) It is absent throughout life in humans from the very beginning
(d) It is present throughout life in *Amphioxus*

**50.** Frogs differ from humans in possessing:
(a) paired cerebral hemispheres
(b) hepatic portal system
(c) nucleated red blood cells
(d) thyroid as well as parathyroid

**51.** In which one of the following the genus name, its two charcters and its phylum are not correctly matched, whereas the remaining three are correct ?

| | **Genus name** | **Two characters** | **Phylum** |
|---|---|---|---|
| (a) | *Pila* | (a) Body Segmented<br>Mouth with radula | Mollusca |
| (b) | *Asterias* | (b) Spiny Skinned<br>Water vascular system | Echinodermata |
| (c) | *Sycon* | (c) Pore bearing<br>Canal system | Porifera |
| (d) | *Periplaneta* | (d) Jointed appendages<br>Chitinous exoskeleton | Arthropoda |

**52.** In class of Amphibia, respiration occurs through-
(a) gills (b) lungs
(c) skin (d) All of these

**53.** Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them?
(a) *Pteropus* and *Ornithorhyncus* - Viviparity
(b) Garden lizard and Crocodile - Three chambered heart
(c) *Ascaris* and *Ancylostoma* - Metameric segmentation
(d) Sea horse and Flying fish - Cold blooded (poikilothermal)

**54.** Which one of the following categories of animals, is correctly described with no single exception in it?
(a) All sponges are marine and have collared cells.
(b) All mammals are viviparous and possess diaphragm for breathing.
(c) All bony fishes have four pairs of gills and an operculum on each side.
(d) All reptiles possess scales, have a three chambered heart and are cold blooded (poikilothermal).

**55.** In amphibians, heart is _____ chambered.
(a) two (b) three
(c) four (d) none of these

**56.** Heart is three - chambered in reptiles, exception is -
(a) Turtle (b) *Chameleon*
(c) *Naja* (cobra) (d) Crocodile

**57.** Which group of animals belong to the same phylum?
(a) Earthworm , Pinworm, Tapeworm
(b) Prawn, Scorpion, Locusta
(c) Sponge, Sea anemone, Starfish
(d) Malarial parasite, *Amoeba*, Mosquito

**58.** Match the name of the animal (column I), with one characteristics (column II), and the phylum/class (column III) to which it belongs :

| | **Column I** | **Column II** | **Column III** |
|---|---|---|---|
| (a) | *Ichthyophis* | terrestrial | Reptilia |
| (b) | *Limulus* | body covered by chitinous exoskeleton | Pisces |
| (c) | *Adamsia* | radially symmetrical | Porifera |
| (d) | *Petromyzon* | ectoparasite | Cyclostomata |

**59.** Which of the following are correctly matched with respect to their taxonomic classification?
(a) Centipede, millipede, spider, scorpion-Insecta
(b) House fly, butterfly, tse tse fly, silverfish-Insecta
(c) Spiny anteater, sea urchin, sea cucumber-Echinodermata
(d) Flying fish, cuttlefish, silverfish-Pisces

**60.** One of the representatives of phylum Arthropoda is :
(a) Silverfish (b) Pufferfish
(c) Flying fish (d) Cuttlefish

**61.** The characteristics of class Reptilia are :
(a) Body covered with dry and cornified skin, scales over the body are epidermal, they do not have external ears
(b) Body covered with moist skin which is devoid of scales, the ear is represented by a tympanum, alimentary canal, urinary and reproductive tracts open into a common cloaca
(c) Fresh water animals with bony endoskeleton, air-bladder to regulate buoyancy
(d) Marine animals with cartilaginous endoskeleton, body covered with placoid scales

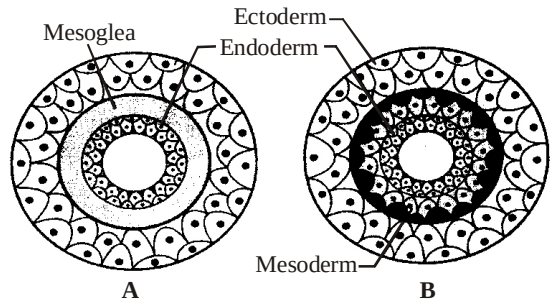
**62.** Which one of the following animals is correctly matched with its one characteristics and the taxon?

| | **Animal** | **Characteristic** | **Taxon** |
|---|---|---|---|
| (a) | Duckbilled platypus | Oviparous | Mammalian |
| (b) | Millipede | Ventral nerve cord | Arachnida |
| (c) | Sea Anemone | Triploblastic | Cnidaria |
| (d) | Silverfish | Pectoral and Pelvic fins | Chordata |

**63.** Which one of the following groups of animals reproduces only by sexual means?
(a) Ctenophora (b) Cnidaria
(c) Porifera (d) Protozoa

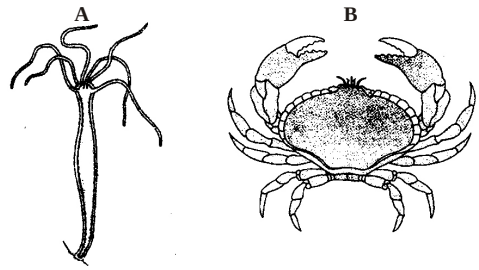
**64.** Sharks and dogfishes differ from skates and rays by
(a) Their pectoral fins distinctly marked off from cyclindrical bodies
(b) Gill slits are ventrally placed
(c) Head and trunk are widened considerably
(d) Distinct demarcation between body and tail

**65.**




The above diagram shows the germs layer. The animals having structures shown in the figures A and B are respectively called–
(a) Diploblastic, Triploblastic
(b) Triploblastic, Diploblastic
(c) Diploblastic, Diploblastic
(d) Triploblastic, Triploblastic

**66.** Animal A and B show symmetry –




(a) Bilateral, Asymetrical respectively
(b) Radial, Bilateral respectively
(c) Bilateral, Bilateral respectively
(d) Radial, Radial respectively

**67.** Match Column I with Column II

| | **Column I** | **Column II** |
|---|---|---|
| A. | Limbless reptiles | 1. Elephant |
| B. | Jawless vertebrates | 2. Lamprey |
| C. | Flightless bird | 3. Ichthiophis |
| D. | Largest terrestrial animal | 4. Ostrich |
| E. | Blind worm | 5. Cobra |
| | | 6. Penguin |

(a) A $\rightarrow$ 2; B $\rightarrow$ 5; C $\rightarrow$ 4; D $\rightarrow$ 1; E $\rightarrow$ 3
(b) A $\rightarrow$ 5; B $\rightarrow$ 2; C $\rightarrow$ 4; D $\rightarrow$ 1; E $\rightarrow$ 3
(c) A $\rightarrow$ 5; B $\rightarrow$ 2; C $\rightarrow$ 1; D $\rightarrow$ 4; E $\rightarrow$ 3
(d) A $\rightarrow$ 5; B $\rightarrow$ 4; C $\rightarrow$ 2; D $\rightarrow$ 4; E $\rightarrow$ 3

**68.** Match Column I with Column II

| Column I (Organism) | Column II (Excretory structure) |
|---|---|
| A. Cockroach | 1. Nephridia |
| B. Cat fish | 2. Malpighian tubules |
| C. Earthworm | 3. Kidneys |
| D. *Balanoglossus* | 4. Flame cells |
| E. Flatworm | 5. Proboscis gland |

(a) A → 1; B → 3; C → 2; D → 4; E → 5
(b) A → 3; B → 1; C → 2; D → 5; E → 4
(c) A → 2; B → 1; C → 3; D → 5; E → 4
(d) A → 2; B → 3; C → 1; D → 5; E → 4

**69.** Match Column I with Column II

| Column I (Scientific name) | Column II (Common name) |
|---|---|
| (A) *Psittacula* | 1. Crow |
| (B) *Paro* | 2. Vulture |
| (C) *Aptenodytes* | 3. Peacock |
| (D) *Meophron* | 4. Penguin |
| (E) Corvus | 5. Parrot |

(a) A → 3; B → 5; C → 4; D → 2; E → 1
(b) A → 5; B → 3; C → 4; D → 2; E → 1
(c) A → 5; B → 3; C → 2; D → 4; E → 1
(d) A → 5; B → 4; C → 3; D → 2; E → 1

**70.** Which of the following statements is/are not true ?
(1) In Urochordata, notochord is present only in larval tail.
(2) In cephalochordata, notochord extends from head to tail region.
(3) Branchiostoma belongs to Hemichordata.
(4) Only one class of living members, class cyclostomata represents the super class agnatha
(a) (1), (2) and (4) only (b) (3), (4) and (1) only
(c) (3) only (d) (1) and (4) only

**71.** Which of the following statements are true/false?
(1) In Torpedo the electric organs are capable of generating strong electric shock to paralyze the prey.
(2) Bony fishes use pectoral, pelvic, dorsal anal and caudal fins in swimming.
(3) Amphibian skin is moist and has thick scales.
(4) Birds are poikilothermous animals.
(5) The most unique mammalian characteristic is the presence of milk producing mammary glands by which the young ones are nourished.
(a) (1), (2) and (3) are true; (4), E are false
(b) (1), (2) and (5) are true; (3) and (4) are false
(c) (1), (4) and (5) are true; (2) and (3) are false
(d) (1), (2) and (4) are false; (3) and (5) are true

**DIRECTIONS for Qs. 72 to 75 : Each questions contain STATEMENT-1 (Assertion) and STATEMENT-2 (Reason). Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.**

(a) Statement- 1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement -1
(b) Statement -1 is True, Statement -2 is True ; Statement-2 is NOT a correct explanation for Statement - 1
(c) Statement - 1 is True, Statement- 2 is False
(d) Both the Statements are False.

**72.** **Statement 1 :** Blood is colourless in the insects.
**Statement 2 :** Insect blood has no role in $O_2$ transport.

**73.** **Statement 1 :** Sponges belong to Porifera.
**Statement 2 :** Sponges have canal system.

**74.** **Statement 1 :** Birds have one ovary.
**Statement 2 :** This reduces the body weight for flight.

**75.** **Statement 1 :** Bats and whales are classified as mammals.
**Statement 2 :** Bats and whales have four-chambered heart.

# EXERCISE - 3
## Exemplar & Past Years NEET/AIPMT Questions

### Exemplar Questions

**1.** In some animal groups, the body is found divided into compartments with at least some organs. This characteristic feature is called
(a) Segmentation (b) Metamerism
(c) Metagenesis (d) Metamorphosis

**2.** Given below are types of cells present in some animals. Which of the following cells can differentiate to perform different functions?
(a) choanocytes (b) interstitial cells
(c) gastrodermal cells (d) nematocytes

**3.** Which one of the following sets of animals share a four chambered heart?
(a) Amphibian, Reptiles, Birds
(b) Crocodiles, Birds, Mammals
(c) Crocodiles, Lizards, Turtles
(d) Lizards, Mammals, Birds

**4.** Which of the following pairs of animals has non-glandular skin?
(a) Snake and frog (b) Chameleon and turtle
(c) Frog and pigeon (d) Crocodile and tiger

**5.** Birds and mammals share one of the following characteristics as a common feature.
(a) Pigmented skin (b) Pneumatic bones
(c) Viviparity (d) Warm blooded body

**6.** Which one of the following sets of animals belong to a single taxonomic group?
(a) Cuttlefish, jellyfish, silverfish, dogfish, starfish
(b) bat, pigeon, butterfly
(c) Monkey, chimpanzee, man
(d) Silkworm, tapeworm, earthworm

**7.** Which one of the following statements is incorrect?
(a) Mesoglea is present in between ectoderm and endoderm in *Obelia*
(b) *Asterias* exhibits radial symmetry
(c) *Fasciola* is a pseudocoelomate animal
(d) *Taenia* is a triploblastic animal

**8.** Which one of the following statements is incorrect?
(a) In cockroaches and prawns excretion of waste material occurs through malpighian tubules.
(b) In ctenophores, locomotion is mediated by comb plates.
(c) In *Fasciola* flame cells take part in excretion
(d) Earthworms are hermaphrodites and yet cross fertilisation take place among them.

**9.** Which one of the following is oviparous?
(a) Platypus (b) Flying fox (bat)
(c) Elephant (d) Whale

**10.** Which one of the following is not a poisonous snake?
(a) Cobra (b) Viper
(c) Python (d) Krait

**11.** Match the following list of animals with their level of organisation.

| **Division of Labour** | **Animal** |
|---|---|
| (i) Organ level | A. *Pheretima* |
| (ii) Cellular aggregate level | B. *Fasciola* |
| (iii) Tissue level | C. *Spongilla* |
| (iv) Organ system level | D. *Obelia* |

Choose the correct match showing division of labour with animal example.
(a) (i)-B, (ii)-C, (iii)-D and (iv)-A
(b) (i)-B, (ii)-D, (iii)-C and (iv)-A
(c) (i)-D, (ii)-A, (iii)-B and (iv)-C
(d) (i)-A, (ii)-D, (iii)-C and (iv)-B

**12.** Body cavity is the cavity present between body wall and gut wall. In some animals the body cavity is not lined by mesoderm. Such animals are called
(a) Acoelomate (b) Pseudocoelomate
(c) Coelomate (d) Haemocoelomate

**13.** Match the column I with column II and choose the correct option.

| **Column I** | **Column II** |
|---|---|
| A. Porifera | 1. Canal system |
| B. Aschelminthes | 2. Water vascular system |
| C. Annelida | 3. Muscular Pharynx |
| D. Arthropoda | 4. Jointed appendages |
| E. Echinodermata | 5. Metameres |

**Codes**

| | A | B | C | D | E |
|---|---|---|---|---|---|
| (a) | 2 | 3 | 5 | 4 | 1 |
| (b) | 2 | 5 | 3 | 4 | 1 |
| (c) | 1 | 3 | 5 | 4 | 2 |
| (d) | 1 | 5 | 3 | 4 | 2 |

## NEET/AIPMT (2013-2017) Questions

**14.** Which group of animals belong to the same phylum? ***[2013]***
(a) Earthworm , Pinworm, Tapeworm
(b) Prawn, Scorpion, Locusta
(c) Sponge, Sea anemone, Starfish
(d) Malarial parasite, *Amoeba*, Mosquito

**15.** Match the name of the animal (column I), with one characteristics (column II), and the phylum/class (column III) to which it belongs: ***[2013]***

| | **Column I** | **Column II** | **Column III** |
|---|---|---|---|
| (a) | *Ichthyophis* | terrestrial | Reptilia |
| (b) | *Limulus* | body covered by chitinous exoskeleton | Pisces |
| (c) | *Adamsia* | radially symmetrical | Porifera |
| (d) | *Petromyzon* | ectoparasite | Cyclostomata |

**16.** Which of the following are correctly matched with respect to their taxonomic classification? ***[2013]***
(a) Centipede, millipede, spider, scorpion-Insecta
(b) House fly, butterfly, tse tse fly, silverfish-Insecta
(c) Spiny anteater, sea urchin, sea cucumber-Echinodermata
(d) Flying fish, cuttlefish, silverfish-Pisces

**17.** One of the representatives of phylum Arthropoda is : ***[2013]***
(a) Silverfish (b) Pufferfish
(c) Flying fish (d) Cuttlefish

**18.** The characteristics of class Reptilia are : ***[NEET Kar. 2013]***
(a) Body covered with dry and cornified skin, scales over the body are epidermal, they do not have external ears
(b) Body covered with moist skin which is devoid of scales, the ear is represented by a tympanum, alimentary canal, urinary and reproductive tracts open into a common cloaca
(c) Fresh water animals with bony endoskeleton, air-bladder to regulate buoyancy
(d) Marine animals with cartilaginous endoskeleton, body covered with placoid scales

**19.** Which one of the following animals is correctly matched with its one characteristics and the taxon? ***[NEET Kar. 2013]***

| **Animal** | **Characteristic** | **Taxon** |
|---|---|---|
| (a) Duckbilled platypus | Oviparous | Mammalian |
| (b) Millipede | Ventral nerve cord | Arachnida |
| (c) Sea Anemone | Triploblastic | Cnidaria |
| (d) Silverfish | Pectoral and Pelvic fins | Chordata |

**20.** Which one of the following groups of animals reproduces only by sexual means? ***[NEET Kar. 2013]***
(a) Ctenophora (b) Cnidaria
(c) Porifera (d) Protozoa

**21.** Sharks and dogfishes differ from skates and rays by *[NEET Kar. 2013]*
(a) Their pectoral fins distinctly marked off from cyclindrical bodies
(b) Gill slits are ventrally placed
(c) Head and trunk are widened considerably
(d) Distinct demarcation between body and tail

**22.** Select the taxon mentioned that represents both marine and fresh water species: *[2014]*
(a) Echinoderms (b) Ctenophora
(c) Cephalochordata (d) Cnidaria

**23.** Which one of the following living organisms completely lacks a cell wall? *[2014]*
(a) Cyanobacteria (b) Sea – fan(*Gorgonia*)
(c) *Saccharomyces* (d) Blue–green algae

**24.** *Planaria* possesses high capacity of: *[2014]*
(a) Metamorphosis
(b) Regeneration
(c) Alternation of generation
(d) Bioluminescence

**25.** A marine cartilaginous fish that can produce electric current is: *[2014]*
(a) *Pristis* (b) *Torpedo*
(c) *Trygon* (d) *Scoliodon*

**26.** Which of the following animals is not viviparous?
(a) Elephant (b) Platypus *[2015 RS]*
(c) Whale (d) Flying fox (Bat)

**27.** Which of the following represents the correct combination without any exception? *[2015 RS]*

| | **Characteristics** | **Class** |
|---|---|---|
| (a) | Mouth ventral, gills without operculum; skin with placoid scales; persistent notochord | Chondrichthyes |
| (b) | Sucking and circular mouth; jaws absent, integument without scales; paired appendages | Cyclostomata |
| (c) | Body covered with feathers; skin moist and glandular; fore-limbs form wings; lungs with air sacs | Aves |
| (d) | Mammary gland; hair on body; pinnae; two pairs of Limbs | Mammalia |

**28.** A jawless fish, which lays eggs in fresh water and whose ammocoetes larvae after metamorphosis return to the ocean is: *[2015 RS]*
(a) *Myxine* (b) *Neomyxine*
(c) *Petromyzon* (d) *Eptatretus*

**29.** Body having meshwork of cell, internal cavities lined with food filtering flagellated cells and indirect development are the characteristics of phylum. *[2015 RS]*
(a) Porifera (b) Mollusca
(c) Protozoa (d) Coelenterate

**30.** The terga, sterna and pleura of cockroach body are joined by : *[2015 RS]*
(a) Muscular tissue (b) Arthrodial membrane
(c) Cartilage (d) Cementing glue

**31.** Which of the following characteristics is mainly responsible for diversification of insects on land? *[2015 RS]*
(a) Bilateral symmetry (b) Exoskeleton
(c) Eyes (d) Segmentation

**32.** Metagenesis refers to: *[2015 RS]*
(a) Alteration of generation between asexual and sexual phases of an organisms
(b) Occurrence of a drastic change in form during post-embroyonic development
(c) Presence of a segmented body and parthenogenetic mode of reproduction
(d) Presence of different morphic forms

**33.** Which of the following featrues is not present in the Phylum - Arthropoda ? *[2016]*
(a) Chitinous exoskeleton (b) Metameric segmentation
(c) Parapodia (d) Jointed appendages

**34.** Which of the following characteristic features always holds true for the corresponding group of animals? *[2016]*
(a) Cartilaginous endoskeleton — Chondrichthyes
(b) Viviparous — Mammalia
(c) Possess a mouth with an upper and a lower jaw — Chordata
(d) 3 - chambered heart with one incompletely divided ventricle — Reptilia

**35.** Which one of the following characteristics is not shared by birds and mammals ? *[2016]*
(a) Ossified endoskeleton (b) Breathing using lungs
(c) Viviparity (d) Warm blooded nature

**36.** An important characteristic that hemichordates share with chordates is : *[2017]*
(a) Ventral tubular nerve cord
(b) Pharynx with gill slits
(c) Pharynx without gill slits
(d) Absence of notochord

**37.** Which among these is the correct combination of aquatic mammals? *[2017]*
(a) Dolphins, Seals, Trygon (b) Whales, Dolphins, Seals
(c) Trygon, Whales, Seals (d) Seals, Dolphins, Sharks

**38.** In case of poriferans, the spongocoel is lined with flagellated cells called: *[2017]*
(a) oscula (b) choanocytes
(c) mesenchymal cells (d) ostia

**39.** Frog's heart when taken out of the body continues to beat for sometime. *[2017]*
Select the best option from the following statements.
(A) Frog is a poikilotherm.
(B) Frog does not have any coronary circulation.
(C) Heart is "myogenic" in nature.
(D) Heart is autoexcitable
Options:
(a) Only (D) (b) (A) and (B)
(c) (C) and (D) (d) Only (C)

# Hints & Solutions

## EXERCISE - 1

1. (c) *Euglena* is considered as the connecting link between plants and animals.
2. (d) 3. (a) 4. (c) 5. (c)
6. (c) 7. (b) 8. (c)
9. (b) Bath sponge is common name of Euspongia.
10. (a) 11. (c) 12. (c) 13. (c)
14. (c) 15. (d) 16. (c) 17. (a)
18. (b) 19. (c) 20. (c)
21. (c) Sea cucumber is the common name of *Cucumaria*. It is belong to phylum Echinodermata.
22. (c) 23. (d) 24. (d) 25. (c)
26. (c) 27. (c) 28. (b) 29. (a)
30. (c) 31. (c) 32. (d) 33. (b)
34. (d) 35. (c) 36. (c) 37. (b)
38. (b) 39. (b) 40. (a)
41. (d) Water vascular system is found in Star-fish.
42. (c) 43. (a)
44. (b) Vertebral column is present in the vertebrates only. It is not present in all the chordates.
45. (d) Chordates show the presence of nerve cord, notochord and pharyngeal gill slits.
46. (b) One pair of ovary and 11 pairs of testis are found in Leech or *Hirudinea*.
47. (b) 48. (d) 49. (d)
50. (c) 51. (c)
52. (b) Cyclostomata is a class of group Agnatha, where paired appendages girdles and jaw are absent. Some workers include even the protochordates in Agnatha.
53. (a) Placoid scale has a disc like basal plate. It resembles a tooth. These scales are found in cartilaginous fishes (chondricthyes) –
54. (b) *Elasmobranchii* (dog fish) is an alernative name for cartilaginous fish or chondrichthyes. The name refers to the fact that the gill-slits are exposed and not covered by an operculum.
55. (b) One auricle and one ventricle.
56. (c) Sea horse (*Hippocampus*) belongs to the class osteichthyes (due to bony skeleton) of super class pisces.
57. (b) Pisces, amphibia and reptiles are unable to maintain constant body temperature hence, are called as poikilothermic or cold blooded animal.
58. (b) Fishes have two chambered heart one auricle and one ventricle, which receives only venous blood and pump it to gills for purification.
59. (a)
60. (c) Lateral line system in a fish and some aquatic larvae (Tadpole) is made up of neuromast organs. It detects vibrations and pressure changes in water.
61. (a)
62. (a) Diaphragm is not found in all the chordates.
63. (d) 64. (a)
65. (d) *Hydra* nerve cell is present but brain is absent.
66. (a) 67. (b) 68. (b)
69. (b) In *Hydra*, undigested residues are egested from colenteron through mouth and body wall.
70. (b) *Icthyophis* is a limbless amphibian showing parental care. It has no tongue.
71. (b) In birds, forelimbs are modified as wings for flying. Therefore, the forelimb is not found in birds.
72. (a) In scorpion and spiders the respiratory organs are book lungs. They are named so because their folds resemble the leaves in a book. In this the exchange of gases takes place between the air of interlamellar spaces and the venous blood through the thin membranous walls of the lamellae.
73. (c) 74. (c)
75. (c) Except a few, only mammals possess seven cervical (neck) vertebrae.

## EXERCISE - 2

1. (c) Mammals have 12 pairs of cranial nerves.
2. (d) Animals belonging to Phylum Porifera are mostly marine except a few which are found in fresh water- *e.g. Spongilla, Euspongia*.
3. (c)
4. (a) Platyhelminthes includes flat warms. There is no body cavity. The animals are therefore acoelomates. Annelids also have bilateral symmetry. They are coelomate having a perivisceral cavity divided into compartments.
5. (a) Jointed legs & chitinous exoskeleton are the common characters found in centipede, cockroach & crab.
6. (a) 7. (b)
8. (a) Digestion in sponges is intracellular like protozoans. It takes place in choanocytes.
9. (c) 10. (b) 11. (c) 12. (d)
13. (c) 14. (b) 15. (d) 16. (b)
17. (d) Because they are belong to the class mammalia.
18. (d) *Ornithorynchus* or duck bill is an egg laying mammal.
19. (b) 20. (b)
21. (c) Penguin, Kiwi & Ostrich all belong to class Aves of chordata (*i.e.* birds) and they do not give birth to their young ones, they are oviparous while Kangaroo, Hedgehog, Dolphin, Loris all belong to class mammalia and are viviparous.
22. (a) 23. (d) 24. (d)
25. (b) Metameric segmentation means body is divided externally as well as internally. This characteristic is present in annelida (*e.g.* earthworm) and arthropoda (*e.g.* cockroach). Their body is divided externally and internally as well.
26. (b)

27. (d) *Trypanosoma*, *Noctiluca*, *Monocystis* & *Giardia* are unicellular protists i.e. unicellular eukaryotes.
28. (b) Salamander does not undergo any annual migration as it occurs in Siberian crane, Arctic tern and Salmon mainly for the search of food or for breeding.
29. (d) Cockroach belongs to phylum-Arthropoda. It has 10 pairs of Spiracles (2 pairs on thorax and 8 pairs on abdomen).
30. (d) Mollusca mostly oviparous and a few viviparous. The development may be direct or indirect with trochophore, velliger and glochidium.
31. (c) Pseudocoelomate is any invertebrate animal whose body cavity is a pseudocoel, a cavity between the gut and the outer body wall derived from a persistent blastocoel, rather than a true coelom. Pseudocoelomate animal include the Rotifera and Nematoda.
32. (d)
33. (b) *Ascaris* is a common parasite found in the large intestine of man. It is world wide in distribution. The number of worms may be 500 or more in a single host. *Ascaris* is characterised by presence of neither true coelom nor metamerism.
34. (c) Scorpion, spider and cockroach have ventral solid central nervous system. All three belongs phylum-Arthopoda.
    - Spider belongs to class-Archnida
    - Scorpion belongs to class-Archnida
    - Cockroach belongs to class-Insecta
35. (b)
36. (a) Aschelminthes is bilaterally symmetrical and triploblastic. These are mostly aquatic, free living or parasitic. Their body is three layered which is ectoderm, mesoderm and endoderm.
37. (b) Lampreys and hag fishes are unusual, jawless fish that comprise the order Cyclostomata, so named because of the circular shape of the mouth. The brains of lampreys and hagfishes differ a lot, but they also show a large number of similarities, as do all craniate brains.
38. (d) *Fasciola*, a flatworm has a single body cavity to the outside that serves both as mouth for ingestion and anus for egestion of undigested food. This is known as blind sac plan.
39. (a)
40. (c) *Spongilla* is a fresh water sponge that belongs to phylum porifera. It has special collared cells called choanocytes. Choanocytes are not found in leech, dolphin and penguin.
41. (a) Triploblastic condition can be seen in flat worms. Ctenophores, sponges and corals are diploblastic.
42. (a) Acoelomates are animals that have no body cavity or coelom. The examples are poriferans, coelenterates, ctenophore, platyhelminthes. Pseudo-coelomates are animals that has false or pseudo coelom. Examples are aschelminthes. Coelomates are animals that have true coelom enclosed by mesoderm on both sides. Examples: from annelida to arthropoda are coelomates. Hence, roundworms are pseudocoelomates, molluscs and insects are coelomates while flatworms are acoelomates.
43. (d) A male shark possesses a pair of claspers which are inserted into a female shark's cloaca (an opening on the underside of the body) at the time of mating. Claspers are located on the inner edge of the pelvic fins near the male's cloaca. The function of claspers is to introduce sperm into a female shark's body for the purpose of fertilizing her eggs. Female sharks do not have claspers.
44. (a)
45. (b) In nature insects have the highest number of species (30 million). Fungi have 100,000, angiosperms have 260,000 and birds have 10,000 species.
46. (c) Chondrichthyes are the cartilaginous fish with a flexible skeleton made of cartilage rather than bone.
47. (c) The characteristics and phylum of *Pteropus* is correct.
48. (d)
49. (c) Notochord is a flexible rod like structure that forms the main support of the body in the lowest chordates. It is not absent in humans through out their life. Notochord is present in embryonic stage and get changed or replaced by vertebral column in the adult.
50. (c) Human possesses enucleated RBC in mature state. But frog blood has both white and red blood cells which are nucleated. Frog cells do not lack platelets.
51. (a) Molluscans are soft bodied animals. Their body is unsegmented with a distinct head, muscular foot and visceral hump. In *Pila* the buccal cavity contains a resping organ, the radula with transverse rows of teeth.
52. (d)
53. (d) Sea horse and flying fish are cold blooded animals. *Ornithorhyncus* is oviparous. Crocodile has four chambered heart. *Ascaris* and *Ancylostoma* are segmented roundworms.
54. (a) All sponges are marine and have collared cells without any exception. Sponges are animals of the phylum Porifera. They are multicellular organisms which have bodies full of pores and channels allowing water to circulate through them.
55. (b) 56. (d)
57. (b) Prawn , Scorpion and Locusta belong to phylum Arthropoda. This is the largest phylum of Animalia, over two-thirds of all named species on earth are Arthropoda. Phylum is named so due to presence of jointed appendages (arthros = jointed, poda = appendages) in body of members of this phylum.
58. (d)
    - *Ichthyophis* – Amphibian
    - *Limulus* – Arthropoda
    - *Adamsia* – Cnidaria
    - *Petramyzon* – Jawless vertebrate & ectoparasite, cyclostomate
59. (b) House fly, butterfly, tse tse fly, silverfish all belongs to insecta.
60. (a) Representive of Phylum Arthropoda is silverfish. Arthropoda is the largest phylum of Animalia, which covers two-thirds of all named species.

61. (a) In option (a) all the characteristics belong to class Reptilia. In options (b), (c) and (d) the characteristics belong to the classes Amphibia, Osteichthyes and Chondrichthyes respectively.

62. (a) Duckbilled platypus is oviparous and comes under phylum mammalia. Millipede belongs to the phylum arthropoda. Sea-anemone is diploblastic belongs to phylum cnidaria. Silver-fish is an insect belongs to phylum arthropoda, having long antennae, no wings and move in a wiggling motion that resembles the movement of a fish.

63. (a) In **Ctenophora,** sexes are not separate. Reproduction takes place only by sexual means. In **Cnidaria**, which exist in both forms, polyps produce medusae asexually and medusae form the polyps sexually. **Porifera (sponge)** reproduce asexually by fragmentation and sexually by formation of gametes. **Protozoans** come under protista which reproduce asexually and sexually by cell fusion and zygote formation.

64. (a) Sharks and dogfishes have cylindrical body while skates and rays have flattened body with winglike pectoral fins which are not distinct from body.

65. (a) 66. (b) 67. (b) 68. (d)
69. (b) 70. (d) 71. (c)

72. (b) Insect blood is colourless and does not play any role in transport of oxygen. Insects have tracheal respiration.

73. (b) Sponges belong to Porifera and they have characteristic canal system.

74. (a) Birds have many adaptations for flight. They have pneumatic bones and only one ovary which reduces the body weight.

75. (b) Bats and whales are the members of class Mammalia. The bats are the only mammals which have wings and can really fly while whales are the largest animals in existence. Both bats and whales have four chambered heart but birds and crocodiles also have four chambered heart.

## EXERCISE - 3

### Exemplar Questions

1. (b) **Metamerism** is the external and internal division of animal body into segments with a serial repetition of at least some organs. e.g., annelids (earthworm).

**Segmentation** refers to the division of animal's body into a series of repetitive segments. It is external in arthropods, and internal in vertebrates.

**Metagenesis** is the phenomenon in which one generation of certain animals and plants reproduce asexually, followed by a sexually reproducing generation, *i.e.*, alternation of generation (*e.g. Obelia*).

**Metamorphosis** is the developmental process in an organism through which it changes from one life form to another.

2. (b) **Interstitial cells** are the totipotent cells in the body of cnidarians that are capable of giving rise to any kind of specialised cells in order to perform different functions.

**Choanocytes** or collar cells are associated with filtering of nutrients in sponges.

**Gastrodermal cells** or the cnidocyst are used for attachment and defence in cnidarians.

**Nematocyst** are capsules that are the specialised cells in cnidarians, that act as a paralysing sting and are used for defence purpose.

3. (b) Crocodiles, birds, and mammals have four-chambered heart.

**Heart** is usually three chambered in reptiles with an exception in crocodiles, which possess four chambered heart. The division in their heart is due to the incomplete interventricular septum.

Heart in **birds** and **mammals** is four chambered and there is a complete division of interventricular septum. **Amphibians** possess a three chambered heart in which the ventricles are not divided thus 2 atria and one ventricle is present.

4. (b) Chameleon and turtle belong to class–Reptillia and possess dry and non-glandular skin with scales.

Frog, pigeon and tiger possess modifications in their skin according to the adaptations in their respective habitats.

5. (d) Warm blooded animals are capable of maintaining constant body temperature, irrespective of the surrounding environment, *i.e.*, their body temperature is fixed. Warm blooded body is the characteristic feature in birds and mammals. This characteristic was first evolved in higher reptiles. Birds and mammals have acquired this feature from higher reptiles during evolution.

Pigmented skin is the adaptive feature seen in mammals and not present in birds. Pneumatic bones are found only in birds as their flight adaptation. These reduce body weight for flight. Viviparity is shown by mammals and not by birds as they are oviparous (lay eggs).

6. (c) Monkey, chimpanzee and man belong to a single taxonomic group, *i.e.* mammals because all of them possess the following characters.

(i) Two pairs of limbs.
(ii) Presence of external ears.
(iii) Viviparity
(iv) Skin possessing hair.
(v) Milk producing mammary glands.

| Animal Group | Taxonomic Group |
|---|---|
| Cuttle fish | Phylum-Mollusca, Class-Cephalopoda |
| Jelly fish | Phylum-Cnidaria |
| Silver fish | Class-Insecta, Order-Thysanura, Phylum-Arthropoda |
| Dog fish | Phylum-Chordata, Class-Chondrithyes |

| | |
|---|---|
| Starfish | Phylum-Echinodermata, Class-Asteroidea |

| **Animal Group** | **Taxonomic Group** |
|---|---|
| Bat | Phylum-Chordata, Class-Mammalia |
| Pigeon | Phylum-Chordata, Class-Aves |
| Butterfly | Phylum-Arthropoda, Class-Insects, Order-Lepidoptera |

| **Animal Group** | **Taxonomic Group** |
|---|---|
| Silkworm | Phylum-Arthropoda, Class-Insecta Order-Lepidoptera |
| Tapeworm | Phylum-Platyhelminthes, Class-Cestoda |
| Earthworm | Phylum-Annelida, Class-Oligochaeta |

7. (c) *Fasciola* does not possess body cavity hence, it is an acoelomate.

**Mesoglea** is an undifferentiated layer and is a characteristic of diploblastic and triploblastic animals present along with ectoderm and endoderm.

Symmetry in which the body can be divided into two equal identical halves from any plane passing through the central axis, is called radial symmetry as shown by *Asterias*.

*Taenia* is a triploblastic animal. It possesses three germinal layers, *i.e.*, ectoderm, endoderm and mesoderm.

8. (a) The statement (a) is incorrect because malpighian tubules are excretory structures in most of the insects, including cockroach, but green glands perform excretory functions in crustaceans like prawns, whereas all the other statements are true.

9. (a) Platypus is a primitive mammal which displays many characters of their reptilian descent, such as ovaparity. (they lay eggs.)

10. (c) **Except Python,** all other snakes are highly poisonous in nature. Python due to its large size, kills its prey by constriction of their body.

11. (c) *Pheretima* possesses organ system level of organisation. *Fasciola* possesses organ level organisation. *Spongilla* possesses cellular aggregate level of organisation.

*Obelia* possesses tissue level of organisation

12. (b) Body cavity not completely lined by the mesoderm, instead present in the form of scattered pouches, in between ectoderm and endoderm, is called pseudocoelomate, *e.g.*, roundworm.

The animals in which coelom is completely absent, *e.g.*, flatworms are **acoelomates.**

**Coelomates** have their body cavity lined by mesoderm and hence have true coelom, *e.g.*, annelids, molluscs, arthropods, *etc*.

**Haemocoelomates** are the animals in which body cavity is filled with haemolymph, *e.g.*, arthropods, molluscs.

13. (c) The body of porifera (sponges) is organised in a manner so that they form a complex system of pores and canals called canal system. This system helps in regulating the flow of water within them *e.g.*, *Sycon*.

Aschelminthes possess jointed appendages *e.g.*, *Ascaris*. Annelidans possess metameric segmentation in body *e.g.*, earthworm.

Arthropodans possess jointed appendages in each segment of their body *e.g.*, cockroach. Echinoderms possess water vascular system or ambulacral system *e.g.*, *Asterias* or starfish.

## NEET/AIPMT (2013-2017) Questions

14. (b) Prawn, Scorpion and Locusta belong to phylum Arthropoda. This is the largest phylum of Animalia, over two-thirds of all named species on earth are Arthropoda. Phylum is named so due to presence of jointed appendages (arthros = jointed, poda = appendages) in body of members of this phylum.

15. (d)

| | | |
|---|---|---|
| *Ichthyophis* | – | Amphibian |
| *Limulus* | – | Arthropoda |
| *Adamsia* | – | Cnidaria |
| *Petramyzon* | – | Jawless vertebrate & ectoparasite, cyclostomate |

16. (b) House fly, butterfly, tse tse fly, silverfish all belongs to insecta.

17. (a) Representive of Phylum Arthropoda is silverfish. Arthropoda is the largest phylum of Animalia, which covers two-thirds of all named species.

18. (a) In option (a), all the characteristics belong to class Reptilia. In options (b), (c) and (d) the characteristics belong to the classes Amphibia, Osteichthyes and Chondrichthyes respectively.

19. (a) Duckbilled platypus is oviparous and comes under phylum mammalia. Millipede belongs to the phylum arthropoda. Sea-anemone is diploblastic and belongs to phylum cnidaria. Silver-fish is an insect belonging to phylum arthropoda, having long antennae, no wings and move in a wiggling motion that resembles the movement of a fish.

20. (a) In **Ctenophora,** sexes are not separate. Reproduction takes place only by sexual means. In **Cnidaria**, which exist in both forms, polyps produce medusae asexually and medusae form the polyps sexually. **Porifera (sponge)** reproduce asexually by fragmentation and sexually by formation of gametes. **Protozoans** come under protista which reproduce asexually and sexually by cell fusion and zygote formation.

21. (a) Sharks and dogfishes have cylindrical body while skates and rays have flattened body with winglike pectoral fins which are not distinct from body.

22. (d) Members of Ctenophora, Cephalochordata and Echinodermata are exclusively marine.
23. (b) *Gorgonia* ( sea-fan) is an animal. All animals lack cell wall.
24. (b) *Planaria* is a flatworm which possesses a high capacity of regeneration.
25. (b) *Torpedo* is a sluggish fish. It is carnivorous. The prey is killed due to electric shock. The shock can also be harmful for human beings.
26. (b) *Platypus* is an oviparous (egg laying animal). It belongs to class-mammalia.
27. (a) (i) Aves possess dry skin, without glands except oil gland near the base of tail.
(ii) Pinnae are not found in aquatic animals and egg laying mammals.
(iii) In cyclostomes, unpaired appendages (joints) are found.
28. (c) *Petrormyzon marinus*, commonly known as sea lamprey lays eggs in fresh water and its larvae, after metamorphosis, return to the ocean (saline water).
29. (a) The given characteristic features define the phylum porifera.
30. (b) Between the various sclerite, a flexible membrane exists which is known as arthrodial membrane.
31. (b) The exoskeleton of insects consists of chitinous cuticle. It gets hardened due to deposition of calcium. It prevents dessication and gives protection.
32. (a) Metagenesis is defined as alternation of generation found in phylum cnidaria (eg. *Obelia*). In this phenomenon one generation of an organism reproduces asexually, followed by a sexually reproducing generation.
33. (c) All arthropods possess a stiff exoskeleton (external skeleton) composed primarily of chitin. Arthropod bodies are divided into segments. Parapodia are paired, lateral appendages extending from the body segments. Arthropod appendages may be either biramous (branched) or uniramous (unbranched). They do not possess jointed appendages.
34. (a) Chondrichthyes always have cartilaginous endoskeleton. Most mammals are viviparous, giving birth to young. However, the five species of monotreme, the platypuses and the echidnas, lay eggs. Chordates have jawless animals (Agnatha) as well. Most reptiles have 3 chambered heart. Crocodilians have 4 chambered hearts. Turtles have 3 chambered heart but with an incomplete wall in the single ventricle, so their hearts are functionally 4 chambered.
35. (c) Giving birth to young that develop within the mother's body rather than hatching from eggs. All mammals except the monotremes are viviparous.
36. (b) Pharyngeal gill slits are present in hemichordates and in chordates. Notochord is present in chordates only. Ventral tubular nerve cord is present in non-chordates.
37. (b) Sharks and Trygon (sting ray) are the members of cartilaginous fish while whale, dolphin and seals are aquatic mammals belong to class mammalia.
38. (b) In poriferans (sponges) choanocytes (collar cells) form lining of spongocoel. Flagella present in collar cells provide circulation to water in water canal system.
39. (c) The vertebrates process myogenic heart which is self contractile system or autoexcitable; it will thus keep working outside the body for some time.