

- The microspore or pollen grain represents reduced gametophyte. The development of pollen grains take place within the microsporangia.
- In ovule, one of the cells of the nucellus differentiates into megaspore mother cell ($2n$). The megaspore mother cell divides meiotically to form four megaspores (n). One of the megaspores develops into a female gametophyte or embryo sac after nuclear division. The female gametophyte is retained within megasporangium.
- **Unlike bryophytes and pteridophytes, in gymnosperms the male and the female gametophytes do not have an independent free-living existence.** They remain within the sporangia retained on the sporophytes.
- After the release of pollen grains from the microsporangium, they are carried in air currents. When they come in contact with the opening of the ovules borne on megasporophylls, pollen tube carrying the male gametes grows towards archegonia in the ovules. The pollen tube discharge their contents near the mouth of the archegonia. Subsequently fertilization takes place and a zygote is formed. Zygote develops into an embryo and the ovules into seeds. These seeds are not covered.

■ Angiosperms

- The angiosperms are found in a wide range of habitats and they also differ in their size. Some of them such as *Wolffia* are microscopic and some such as *Eucalyptus* are tall trees reaching a height over 100 metres. They are valuable to us as they are the source of food, fodder, fuel, medicines and several other commercially important products.
- Angiosperms are also known as flowering plants. In these plants, flower is the reproductive part. Inside the flower, pollen grains and ovules are developed. Another remarkable character of angiosperms is that the ovules are enclosed by ovary.
- On the basis of number of cotyledons present in the seed, angiosperms are classified into two classes– the **dicotyledons** and the **monocotyledons**.
- **Stamen** are the male sex organ in a flower. Each stamen consists of a slender filament with an anther on the tip. The anther produce numerous pollen grains.
- **Pistil** is the female sex organ in a flower. It consists of stigma, style and an ovary. Ovary contains one to many ovules and in each ovule a female gametophyte called embryo-sac is present.
- Each embryo-sac has a three-celled egg apparatus – one egg cell and two synergids at one pole, three antipodal cells at another pole and two central nuclei.
- Dehiscence of anther leads to release of pollen grains. The released pollen grains with the help of various agencies like wind, etc., are carried from anther to the stigma of a pistil. This is termed as **pollination**.
- On the stigma, pollen grains germinate and leads to development of pollen tube. This pollen tube grows through the tissues of stigma, style and reach the ovule. It enters the embryo-sac and discharges two male gametes. One of these male gametes fuses with the egg cell to form a diploid zygote, which is called **syngamy**. The second male gamete fuses with the central diploid secondary nucleus to produce a triploid **primary endosperm nucleus** (PEN) which is called triple fusion. As in angiosperms two fusions are involved, this event is termed as **double fertilization**.
- After fertilization, zygote develops into an **embryo** (one or two cotyledons) and the PEN develops into **endosperm**. Endosperm provides nourishment to the developing embryo. After fertilization, synergids and antipodal cells degenerate and ovules develop into seeds and the ovaries develop into fruit.

■ Plant Life Cycles and Alternation of Generations

- Different plant groups show different patterns of life cycles – haplontic, diplontic or intermediate (Haplo-diplontic).

(i) Haplontic Life Cycle

In this type of life cycle, sporophytic generation is represented only by the one-celled zygote ($2n$). There are no free-living sporophytes. Meiosis in the zygote leads to the formation of haploid spores. These spores divide mitotically to form the gametophyte. The dominant, photosynthetic phase in such plants is the free-living gametophyte. Many algae like *Volvox*, *Spirogyra* and some species of *Chlamydomonas* exhibit this pattern.



TOPIC-2

Classification of Animals

Revision Notes

■ Phylum Porifera

- Members of this phylum are commonly known as sponges.
- Most of them are marine and **asymmetrical** animals.
- They are primitive multicellular animals with cellular level of organisation.
- Body wall is two layered – outer dermal layer called **pinacoderm** and inner gastral layer called **choanoderm**.
- Flat cells called **pinacocytes** are present in the pinacoderm and specialised flagellated cells called **collar cells or choanocytes** are present in the choanoderm.
- They possess a large cavity called **spongocoel**, which opens to outside through a pore called **osculum**. Choanocytes line the spongocoel.
- They have a water canal system. Water enters through minute pores called **ostia** in the spongocoel and from the spongocoel goes out through the osculum. The canal system helps in gathering of food, respiratory exchange and removal of waste.
- The body is supported by a skeleton made up of spicules or spongin fibres.
- Digestion is intracellular.
- They are hermaphrodite *i.e.*, male and female sex organs are present on the same individual.
- They reproduce by asexual and sexual reproduction. Asexual reproduction takes place through fragmentation and sexual by formation of gametes. Fertilization is internal.
- Development is indirect and involves a larval stage which is morphologically distinct from the adult.
- Examples : *Sycon* (Scypha), *Spongilla* (fresh water sponge) and *Euspongia* (bath sponge).

■ Phylum- Coelenterata (Cnidaria)

- They are aquatic, mostly marine, sessile or free-swimming animals.
- They possess radial symmetry.
- They exhibit tissue level of organisation.
- They are diploblastic.
- They possess special cells called **cnidoblasts** or **cnidocytes** on the tentacles and the body. These cells help in anchorage, defence and capturing of prey.
- They have a central gastro-vascular cavity with a single opening called **hypostome**. Digestion is extracellular and intracellular.
- Some of the coelentrates like corals possess a skeleton composed of calcium carbonate.
- Coelentrates show two basic body forms – polyp and medusa.
 - **Polyp form** : It is the sessile and cylindrical form which is observed in *Hydra* and *Adamsia*.
 - **Medusa form** : It is the umbrella-shaped and free-swimming form which is observed in *Aurelia* or jelly fish.
- Some coelentrates *e.g.*, *Obelia* exist in both forms. These coelentrates exhibit phenomenon of alternation of generation (metagenesis). Polyp form reproduces asexually to produce medusae and medusa form reproduces sexually to produce polyps.
- Common examples of coelentrates are *Physalia* (Portuguese man-of-war), *Adamsia* (Sea anemone), *Pennatula* (Sea-pen), *Gorgonia* (Sea-fan) and *Meandrina* (Brain coral).

■ Phylum – Ctenophora

- Members of this phylum are commonly known as **sea walnuts** or **comb jellies**.
- They are exclusively marine and possess radial symmetry.
- They are diploblastic organisms with tissue level of organisation.
- Their body bears eight external rows of ciliated comb plates which help in locomotion.
- They exhibit the phenomenon of bioluminescence (the property of a living organism to emit light).
- Digestion is both extracellular and intracellular.
- They are hermaphrodite. They reproduce only by sexual means. Fertilisation is external and development is indirect.
- Common examples of ctenophores are *Pleurobrachia* and *Ctenoplana*.

■ Phylum – Platyhelminthes

- The members belonging to this phylum have dorso-ventrally flattened body. Because of this they are also called as **flatworms**.

- They have soft and unsegmented body covered by a calcareous shell.
- Their body is differentiated into head, muscular foot and visceral hump. A soft and spongy layer of skin forms a mantle over the visceral hump. The space between the hump and the mantle is called the mantle cavity.
- The anterior region of the head bears sensory tentacles. The mouth contains a rasping organ for feeding, called radula.
- In terrestrial forms, respiration takes place through lungs and in aquatic forms respiration takes place through feather-like gills which are present in the mantle cavity.
- Molluscs are usually dioecious and oviparous with indirect development.
- Common examples of molluscs are *Pila* (Apple snail), *Pinctada* (Pearl oyster), *Sepia* (Cuttlefish), *Loligo* (Squid), *Octopus* (Devil fish), *Aplysia* (Sea-hare), *Dentalium* (Tusk shell) and *Chaetopleura* (Chiton).

■ Phylum – Echinodermata

- The echinoderms are marine organisms which have an endoskeleton of calcareous ossicles.
- They have organ-system level of organisation.
- The echinoderms, in larval stage, are bilaterally symmetrical but adults are radially symmetrical.
- They are triploblastic and coelomate animals.
- The digestive system is complete. The mouth is situated on the lower (ventral) side and anus is present on the upper (dorsal) side.
- Their unique characteristic is presence of water vascular system. This system helps in locomotion, capture and transport of food and respiration.
- Echinoderms lack excretory system.
- They reproduce by sexual means. Sexes are separate.
- Fertilization is usually external and development is indirect with free-swimming larva.
- Common echinoderms are *Asterias* (Star fish), *Echinus* (Sea urchin), *Antedon* (Sea lily), *Cucumaria* (Sea cucumber) and *Ophiura* (Brittle star).

■ Phylum – Hemichordata

- It was earlier considered as a sub-phylum under phylum Chordata. But now it is considered as a separate phylum under non-chordata.
- This phylum incorporates worm-like marine animals with organ-system level of organisation.
- Hemichordates are bilaterally symmetrical, triploblastic and coelomate animals.
- Their body is cylindrical and differentiated into an anterior proboscis, a collar and a long trunk.
- They have open circulatory system.
- They respire through gills.
- Proboscis glands are their excretory organ.
- Sexes are separate. Fertilization is external and development is indirect.
- Common hemichordates are *Balanoglossus* and *Saccoglossus*.



TOPIC-3 Chordata

Revision Notes

■ Phylum-Chordata

- Animals belonging to phylum Chordata are fundamentally characterised by the presence of a notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits.

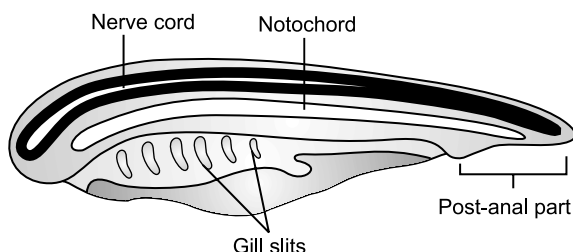


Fig. Chordata characteristics

- They are bilaterally symmetrical, triploblastic, coelomate with organ-system level of organisation.
- They possess a post anal tail and a closed circulatory system.

■ Class 2 – Osteichthyes

- This class includes those marine and freshwater fishes which have bony endoskeleton.
- Their body is streamlined and mouth is terminal.
- They possess four pairs of gills which are covered by an operculum on each side.
- Skin is covered with cycloid/ctenoid scales.
- They possess air bladder which regulates buoyancy.
- They have two-chambered (one auricle and one ventricle) heart.
- They are cold-blooded animals.
- Sexes are separate.
- Fertilisation is usually external and most of them are oviparous.
- Development is direct.
- Common examples of marine bony fishes are *Exocoetus* (Flying fish), *Hippocampus* (Sea horse) while *Labeo* (Rohu), *Catla* (Katla), *Clarias* (Magur) are examples of freshwater bony fishes. Some of them such as *Betta* (Fighting fish), and *Pterophyllum* (Angel fish) are aquarium fishes.

Super class 2. Tetrapoda (bear two pairs of limbs).

Class 1. – Amphibia

- Amphibians can live in aquatic as well as terrestrial habitats.
- Their body is differentiated into head and trunk. Some amphibians also possess tail.
- Their skin is moist and lack scales.
- They have two pairs of limbs.
- The eyes have eyelids and tympanum represents the ear.
- Respiration takes place by gills, lungs and through skin.
- They possess three-chambered heart. Out of the three chambers two are auricles and third one is ventricle.
- They are cold-blooded animals.
- Sexes are separate. They are oviparous.
- Fertilisation is external and development is direct or indirect.
- Some common amphibians are *Bufo* (Toad), *Rana* (Frog), *Atelopus* (Tree frog), *Salamandra* (Salamander) and *Ichthyophis* (Limbless amphibia).

Class 2. – Reptilia

- Members of this class are mostly terrestrial animals and have creeping or crawling mode of locomotion.
- Their body is covered with dry and cornified skin, epidermal scales or scutes.
- They lack external ear openings. Tympanum represents ear.
- Most of them possess two pairs of limbs while some do not have limbs.
- Except the crocodiles, all reptiles have three-chambered heart. (Crocodiles have four-chambered heart)
- They are cold blooded animals.
- Sexes are separate.
- They are oviparous.
- Fertilisation is internal and development is direct.
- Some common reptiles are *Chelone* (Turtle), *Testudo* (Tortoise), *Chameleon* (Tree lizard), *Calotes* (Garden lizard), *Crocodilus* (Crocodile), *Alligator* (Alligator), *Hemidactylus* (Wall lizard) and poisonous snakes like *Naja* (Cobra), *Bangarus* (Krait), *Vipera* (Viper).

Class 3. – Aves

- This class includes all the birds which have ability to fly (except flightless birds like ostrich).
- They are characterised by the presence of feathers.
- They possess a beak.
- Their forelimbs are modified into wings and the hind limbs are modified for walking, swimming or claspings the tree branches.
- Their skin is dry and lacks glands but at the base of the tail, oil gland is present.
- They have fully ossified (bony) endoskeleton. The long bones are hollow with air cavities (pneumatic).
- In birds, there are additional chambers in digestive tract called the crop and gizzard.
- Heart is four-chambered.
- They are able to maintain a constant body temperature. Such type of animals are called warm-blooded or homoiothermous animals.
- They respire through lungs.
- Sexes are separate and fertilisation is internal.
- They are oviparous and development is direct.