

Chapter 7 - Diversity in Living Organisms

1. What is the basis of classification?

Organisms differ in their form, structure and mode of living. Hence, based on their similarities they should be grouped. The grouping of related organisms helps us in studying their evolutionary relationships. Classification is the division of organisms on the basis of characteristics into groups and sub-groups. A characteristic may be a particular form or function.

2. Classification and Evolution

Most life forms that we see today have arisen by an accumulation of changes in body design that allow the organism possessing them to survive better. There is a possibility that complexity in design will increase over evolutionary time, it may not be wrong to say that older organisms are simpler, while younger organisms are more complex.

3. The hierarchy of classification groups

Charles Darwin put forward the idea of evolution in 1859, in his book, *The Origin of Species*. Ernst Haeckel, Robert Whittaker and Carl Woese have tried to classify living organisms into broad categories, called kingdoms. Robert Whittaker, in 1969 proposed 'Five kingdoms classification' of living organisms.

The hierarchy can be represented as Kingdom sub grouping into Phylum for animals or Division for plants, Class, Order, Family, Genus and Species. Hence, the basic unit of classification is species. Species includes all the organisms that are similar to breed and produce fertile offspring.

3.1 Monera

It includes prokaryotic cells lacking organized nucleus and membrane bound cell organelles. Some of them have cell walls while some do not. Some of the Monerans are autotrophic and some of them are heterotrophic forms. Bacteria, cyanobacteria, blue-green algae, mycoplasma are some of the examples of Kingdom Monera.

3.2 Protista

It includes algae, diatoms and protozoans. These are unicellular and the simplest form of eukaryotes exhibiting both autotrophic and heterotrophic mode of nutrition. Locomotion and movement are possible by whip-like flagella and hair-like cilia or finger-like pseudopodia. Examples are unicellular algae, diatoms and protozoans.

3.3 Fungi

These are multicellular, eukaryotic saprophytes. The cell wall of fungi is made up of chitin. They feed on dead and decaying matter. They include mushrooms, rhizopus and mucor. Some fungi are symbiotic forming an association with algal cells. These symbionts are termed to be lichens.



3.4 Plantae

It includes all the plants that are non-motile, multicellular and eukaryotic organisms with their cell walls made up of cellulose. These are complex organisms which can perform photosynthesis. Plants comprise cells with thick cell walls.

3.5 Animalia

It includes all the animals that are motile, multicellular, eukaryotic organisms with their cells possessing no cell walls. It exhibits species diversity. Members of this kingdom are complex organisms with tissue differentiation.

4. Plantae

4.1 Thallophyta

Eichler classified the plant kingdom into two sub-kingdoms - Cryptogamae and Phanerogamae. Cryptogamae - This sub-kingdom includes plants with hidden reproductive organs and plants do not bear flowers or seeds. Cryptogams are further divided into three groups: Thallophyta, Bryophyta and Pteridophyta.

Thallophyta are the simplest of plants that do not have a well-differentiated body design. The plants in this group are commonly called algae. These are predominantly aquatic. Ex: Spirogyra, Ulothrix, Cladospora and Chara

Bryophyta are often called amphibians of the plant kingdom as they require both aquatic and terrestrial conditions for the completion of their life cycle. The plant body is commonly differentiated to form stem and leaf like structures. e.g. Moss or Funaria

Pteridophyta include fern plants which possess the plant body differentiated into stem, leaves and roots. They also possess naked embryos in the form of spores underneath the leaf.

Phanerogamae - This sub-kingdom includes plants that develop seeds and have well-formed stem, leaves and roots. Phanerogams are further classified into Gymnosperms and Angiosperms.

Gymnosperms were the first plants to have a seed habit. These are the plants which possess naked seeds and are usually perennial, evergreen and woody. e.g. Pinus, cycas and deodar.

Angiosperms are highly evolved plants with flowers, fruits and seeds. They are also called as flowering plants. These plants possess seeds enclosed inside the fruit. The seed germinates and develops into a new plant. Plant embryos in seeds have structures called cotyledons. Cotyledons are called seed leaves and represent a bit of pre-designed plant in the seed. Angiosperms are divided into two groups, namely, monocots and dicots based on the number of cotyledons that they have. Ex: Paphiopedilum- Monocot, Ipomea- Dicot.



5. Animalia

These are organisms which are eukaryotic, multicellular and heterotrophic. Their cells do not have cell wall. Most animals are mobile. Animals are classified on the basis of different features like cellular or tissue level of body organization, body symmetry, type of body cavity called as coelom, presence or absence of segmentation and presence or absence of a backbone.

Classification of the kingdom Animalia includes Invertebrata and Vertebrata.

Invertebrata: It includes group of animals that do not possess a vertebral column. Invertebrata is classified into different phyla such as Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca and Echinodermata.

Porifera are multicellular organisms exhibiting minimal level of tissue organization. They lack nervous system. These are non motile. There are holes or pores all over the body. These animals are covered with a hard outside layer or skeleton. They are commonly called sponges. Porifera includes Sycon, Spongilla and Euplectella.

Coelenterates are radially symmetrical organisms which live in water. Some are solitude and some are colonial. They show more body design differentiation. There is a cavity in the body. e.g. Corals, Hydra, sea anemone.

Platyhelminthes are either free living or parasitic. They are bilaterally symmetrical and triploblastic animals. There is some degree of tissue body cavity or coelom. These are called flatworms. e.g. Planaria (free living) liverfluke (parasite).

Nematoda are bilaterally symmetrical, triploblastic parasitic worms. Body is cylindrical. Pseudo coelom is present. They cause diseases such as elephantiasis. e.g. Ascaris.

Annelids are bilaterally symmetrical, triploblastic segmented animals. They have a true body cavity. These are found in a variety of habitats. e.g. Earthworm, Nereis, leech etc.

Arthropoda animals are bilaterally symmetrical, segmented, triploblastic animals with true coelom. They include Insects. They have jointed legs. Their circulatory system is open, so blood does not flow through blood vessels. Eg: prawns, butterflies etc.

Molluscs are bilaterally symmetrical, triploblastic animals with reduced coelom. Locomotion in molluscs is by means of a muscular foot. They have little segmentation. They have an open circulatory system and kidney like organs for excretion. Eg. Pila, Unio, octopus

Echinodermata animals are triploblastic with true coelomic cavity. Echinodermata are spiny skinned organisms. Skeletons of echinoderms are hard calcium carbonates. They exhibit radial symmetry. Eg: Starfish and sea urchins



Protochordata - These are bilaterally symmetrical, triploblastic and have a coelom and are primitive chordates. Protochordates possess a notochord during their early stage of development. The notochord is a long rod-like support that runs all along the back of the animal separating the nervous tissue from the gut. These are marine animals. e.g. Balanoglossus, Herdmania and Amphioxus.

Vertebrata:

These are the most advanced group of animals with true vertebral column and strong endoskeleton. Vertebrates are grouped into different classes based on bilateral symmetry, notochord, dorsal nerve cord, paired gill pouches, triploblastic, and coelomate. These classes are Pisces, Amphibia, Reptilia, Aves and Mammalia.

Pisces - includes all fish. These are aquatic cold blooded organisms and covered by scales. The body is streamlined and a muscular tail is used for movement. Fish breathe through their gills. Skeleton may be cartilaginous or bony in nature. They have two-chambered heart and reproduce by laying eggs. Eg: Torpedo, Mandarin fish, Sting ray etc.

Amphibians are cold-blooded animals. Amphibians can live both on land and in water. Respiration is by gills and lungs. They possess a three-chambered heart. Amphibians reproduce by laying eggs. Eg: Frogs, toads and salamanders.

Reptilia are cold-blooded animals have scales and breathe through lungs. Heart is three-chambered except for crocodiles. Reptiles also reproduce by laying eggs. Eg: Snakes, turtles, lizards and crocodiles.

Aves are warm-blooded animals. Their fore limbs are modified for flight. Bones are hollow. Body is covered by feathers. Respiration is through lungs. They have four-chambered heart. They lay eggs.
Eg: Crow, Ostrich, and Sparrow etc.

Mammals are warm-blooded animals with four chambered hearts. Their skin is covered by hair, sweat glands and oil glands that regulate body temperature. Mammals give birth to young ones. They have mammary glands for the production of milk to nourish their young ones. Mammals like platypus lay eggs. Kangaroos give birth to under-developed young ones that are carried in their mother's abdominal pouch.
Eg: Human, rat and cat etc.

