

## CHARACTERISTICS OF LIVING ORGANISMS

Attempts at classifying living things into groups have been made since time immemorial. Greek thinker Aristotle classified animals according to whether they lived on land, in water or in the air. This is a very simple way of looking at life, but misleading too. For example, animals that live in the sea include corals, whales, octopuses, starfish and sharks. We can immediately see that these are very different from each other in numerous ways. In fact, their habitat is the only point they share in common. This is not an appropriate way of making groups of organisms to study and think about. We therefore need to decide which characteristics to be used as the basis for making the broadest divisions. Then we will have to pick the next set of characteristics for making sub-groups within these divisions. This process of classification within each group can then continue using new characteristics each time

Biology is the study of living organisms. For something to be alive it needs to perform all seven functions of living things. **MRS GREN**  
Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition.



### 1. Movement

Most organisms are able to move their whole body even plants can shift their stem towards the sunlight and their roots move towards healthy soil.

### 2. Respiration

It is the breakdown of food inside a living organism that is vital for survival.

Two types

- Aerobic Respiration which involves  $O_2$  & glucose breaking down to form  $CO_2$  water & energy.
- Anaerobic Respiration which is the incomplete breakdown of food. Happens when there is not enough oxygen. Equation, Glucose &  $O_2$  (not enough) to form  $CO_2$  Lactic Acid or Alcohol (depending on the organism) & a little energy

### 3. Sensitivity

It is the ability to detect and respond to a stimulus.

### 4. Growth

It is the permanent increase in size and quantity of cells using materials absorbed from the environment.

## 5. Reproduction

It is forming new individuals of the same species either sexual (2 parents) or asexual (1 parent)

## 6. Excretion

It is the removal of harmful products of metabolism. Egestion is the removal of undigested products which haven't entered the cell.

## 7. Nutrition

It is the intake of food material from the environment.

Autotrophic nutrition: Organisms that make their own food such as plants.

Heterotrophic nutrition: Organisms that need readymade food including herbivores, carnivores & Omnivores.

## **Classification**

Classification is sorting organisms into smaller groups based on their similarities which then allows us to make comparisons between them.

Organisms are split into the following:

- Kingdom
- Phylum
- Class
- Order
- Families
- Genus
- Species

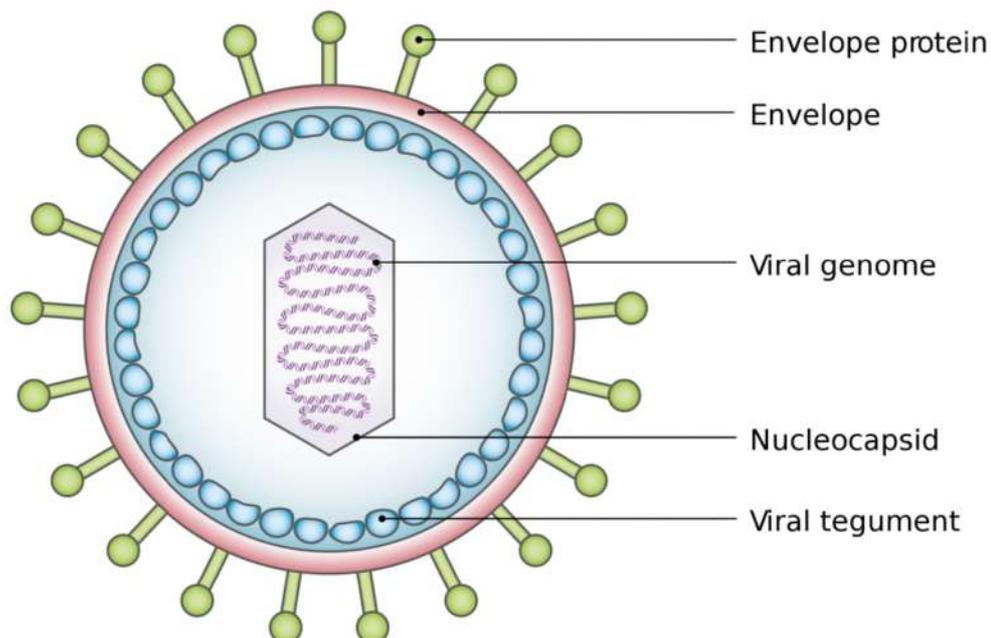
A species is a group of organisms that share many similar appearances and can breed with each other. Species are scientifically named by two names in Latin to avoid differences in languages. The first name is the name of the genus while the second name is the species name e.g. Human (*Homo sapiens*). Below this table shows the classification of *Homo sapiens* as an example.

<b>Kingdom</b>	<i>Animalia</i>	all animals, same as zebra
<b>Phylum</b>	<i>Chordata</i>	all animals with a backbone
<b>Class</b>	<i>Mammalian</i>	animals with a backbone, which have hair
<b>Order</b>	<i>Primate</i>	mammals with hands and feet
<b>Family</b>	<i>Hominidae</i>	apes, primitive humans and modern humans
<b>Genus</b>	<i>Homo</i>	primitive humans and modern humans only
<b>Species</b>	<i>sapiens</i>	modern humans only
<b>Scientific name</b>	<i>Homo sapiens</i>	

The main groups of living are the 5 kingdoms. They don't include viruses since it doesn't obey some characteristics of life. The five kingdoms are: Bacteria, Protista, Fungi, Plants, and Animals.

### Viruses

The size of a virus is about 30-300 nm and it's only visible with an electron microscope. It has a protein coat around the DNA or RNA sometimes has spikes. It has no cell structures.

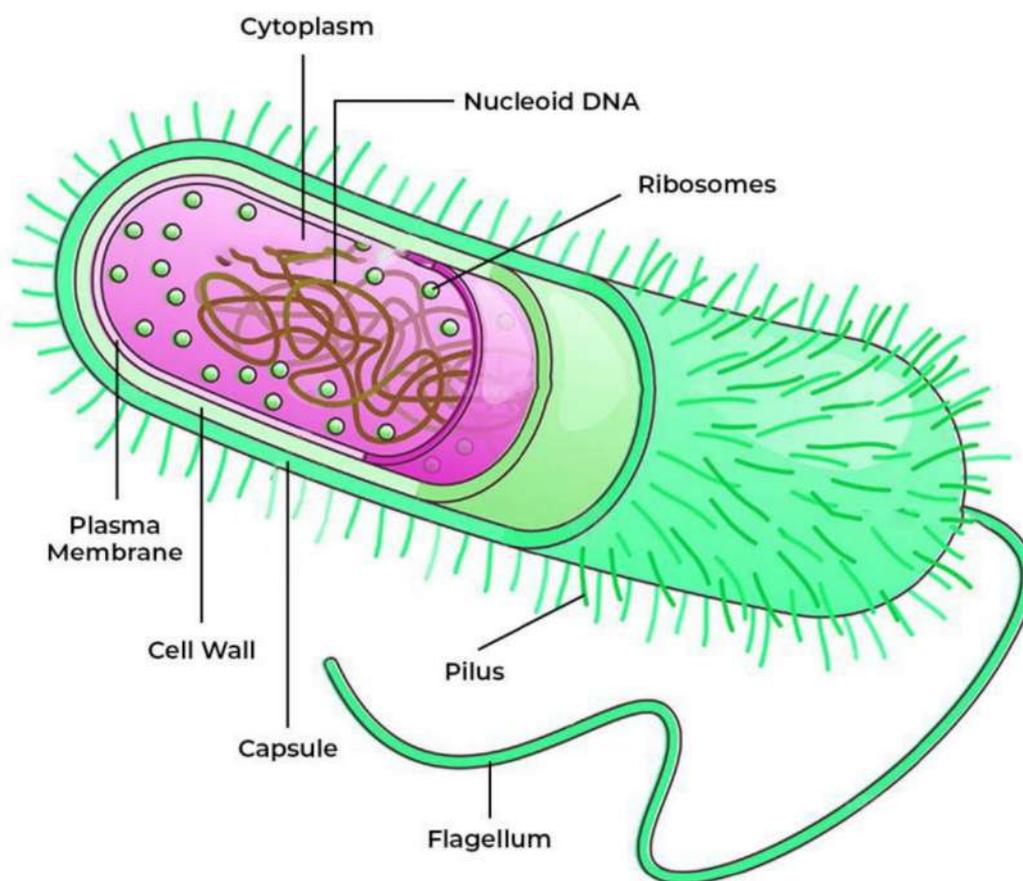


How a virus multiplies

1. Virus injects its DNA or RNA into the cell
2. The genetic material multiplies
3. New viruses are formed inside the cell and then burst out of the cell.

## **Bacteria**

The size of bacteria is about 0.2 to 10  $\mu\text{m}$ . It is only seen under high powered microscopes.

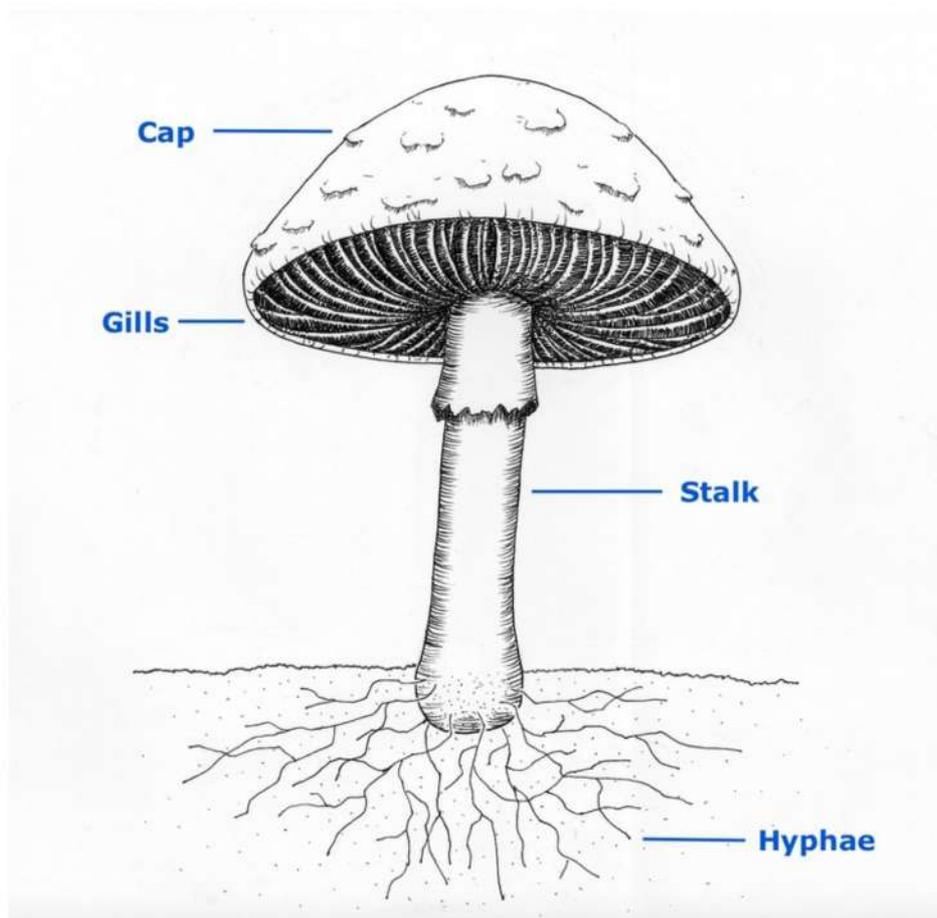


Structure:

- No Nucleus
- No mitochondria
- The size of bacteria is about 0.2 to 10  $\mu\text{m}$ .
- It is only seen under high powered microscopes.

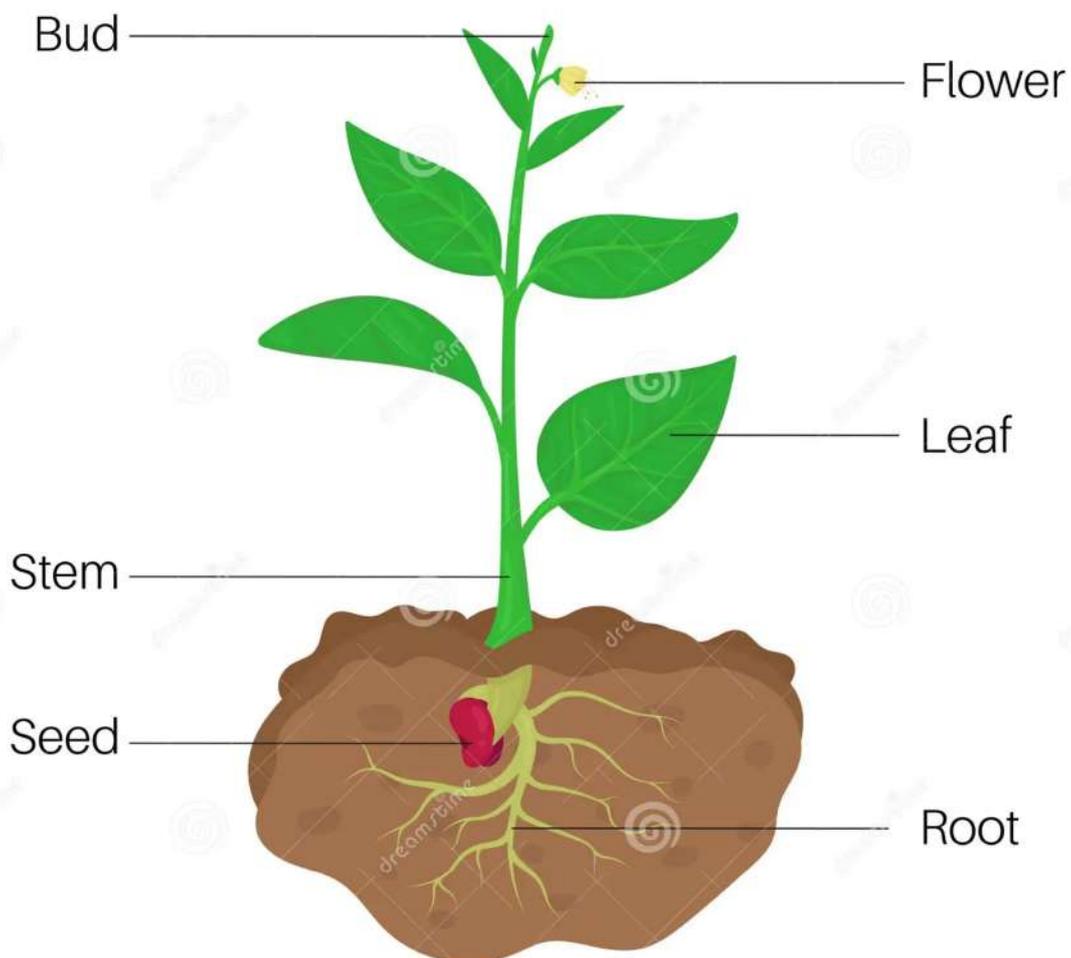
## Fungi

- Mostly multicellular (many cells) (yeast is an exception)
- Cell wall made of chitin
- It has cytoplasm & it may be a saprophyte or a parasite.
- It reproduces asexually by spore formation or by budding (in yeast) but in bad conditions it reproduces sexually for survival.
- Budding is when a yeast cell splits into two cells and it keeps happening over and over again numbers can get up to millions in just a day. A mushroom is an example of a parasitic fungus



## Plants

- Plants produce seeds from inside the flower.
- The plant kingdom is divided into algae, ferns, mosses, and seed plants.
- Seed plants are divided into conifers and angiosperms.
- Angiosperms are divided into two groups Monocotyledons and Dicotyledons.



## **THALLOPHYTA**

Plants that do not have well-differentiated body design fall in this group. The plants in this group are commonly called algae. These plants are predominantly aquatic. Examples are Spirogyra, Ulothrix, Cladophora and Chara.

## **BRYOPHYTA**

These are called the amphibians of the plant kingdom. The plant body is commonly differentiated to form stem and leaf-like structures. However, there is no specialised tissue for the conduction of water and other substances from one part of the plant body to another. Examples are moss (Funaria) and Marchantia

## **PTERIDOPHYTA**

In this group, the plant body is differentiated into roots, stem and leaves and has specialised tissue for the conduction of water and other substances from one part of the plant body to another. Some examples are Marsilea, ferns and horse-tails.

## **GYMNOSPERMS**

This term is made from two Greek words: gymno– means naked and sperma– means seed. The plants of this group bear naked seeds and are usually perennial, evergreen and woody. Examples are pines and deodar

## **ANGIOSPERMS**

This word is made from two Greek words: angio means covered and sperma– means seed. The seeds develop inside an organ which is modified to become a fruit. These are also called flowering plants. Plant embryos in seeds have structures called cotyledons.

Cotyledons are called ‘seed leaves’ because in many instances they emerge and become green when the seed germinates. Thus, cotyledons represent a bit of pre-designed plant in the seed. The angiosperms are divided into two groups on the basis of the number of cotyledons present in the seed. Plants with seeds

having a single cotyledon are called monocotyledonous or monocots. Plants with seeds having two cotyledons are called dicots

## Animals

- There are two main groups in the animal kingdom.

The chordates and the invertebrates.

### Non- Vertebrates

Non-vertebrates or invertebrates are the animals that do not possess a vertebral column or backbone. It includes a variety of animals such as porifera, arthropods, mollusca, annelids, cnidarians, etc. Different characteristics of invertebrates are given below.

- They lack a backbone or vertebral column.
- They show radial symmetry or bilateral symmetry depending on their evolution.
- They are cylindrical, triploblastic, coelomate, or pseudocoelomate animals.
- Respiration is either through gills, trachea or body surface.
- Mode of reproduction can be sexual or asexual.
- Fertilisation is external, though internal fertilisation also occurs in some species.
- Open type of circulatory system is present.

The important characteristic features of the different phyla are described below.

### **PHYLUM – PORIFERA**

The organisms belonging to this phyla are usually known as sponges. These sponges have the system of water transport system in their body. These are usually marine animals, which means most of them live in oceans and seas. These are multicellular organisms and have cellular levels. The skeleton of these organisms is made up of spicules. Reproduction in sponges is done asexually by the process of fragmentation and sexually by the process of Gametes formation. Fertilisation in these organisms is internal. **Examples:** Euspongia and Spongilla.

### **PHYLUM – COELENTERATA (CNIDARIA)**

These organisms are more symmetrical when compared to other organisms. These are mostly aquatic and free-swim animals that live in marines, seas, and other aquatic places. These organisms have Cnidoblasts on their tentacles and body. These Cnidoblasts are used in their defence mechanism and to capture the food. Cnidarians have mainly two body forms known as polyp and medusa. Polyp produces medusae using asexual reproduction and medusae produce polyp using sexual reproduction. **Examples:** Gorgonia, Meandrina, and Physalia.

### **PHYLUM – CTENOPHORA**

Ctenophores are usually known by the names such as Sea walnuts. These are diploblastic organisms that live in marines and are radially symmetric. The organisation in these organisms is of tissue-level organisation. The process of digestion takes place both intracellularly and extracellularly. In Ctenophores

reproduction takes place only by sexual reproduction. Fertilisation take place externally. **Example:** Pleurobrachia and Ctenoplana.

### **PHYLUM – PLATYHELMINTHES**

They have flattened body-like structures. So, they are called flatworms. These organisms are found in many living organisms including human beings. Parasitic worms have hooks and suckers on their body. Many of these flatworms absorb nutrients from their host's body directly to survive. These organisms have special cells called flame cells which help in the process of excretion. Sexes are not separate in these worms. The process of fertilisation occurs internally and development happens through several larva stages. **Example:** Taenia (commonly known as tapeworm) and Fasciola.

### **PHYLUM – ASCHELMINTHES**

The shape of the body of Aschelminthes is circular. These organisms may be aquatic or terrestrial parasitic organisms that live in both plants and animals. These organisms choose either plants or other animals as their host and live. They have organs in their body. These organisms are bilaterally symmetrical in nature. Sexes are separate in these organisms as we can distinguish male and female in Aschelminthes. Usually, females are longer than male. The process of fertilisation takes place internally and the development of the organism may be direct or indirect. **Example:** Ascaris (commonly known as roundworm) and Ancylostoma(Hookworm).

### **PHYLUM – ANNELIDA**

These organisms can live in both water and on land. They can live in both salt and freshwater. The organisation of the body is the organ level system. Their

circular muscles and longitudinal muscles help in their locomotion. Their body surfaces consist of fragments. Nephridia help in excretion in these organisms. Reproduction in these organisms is sexual. **Example:** Nereis and Pheretima (common name is Earthworm).

### **PHYLUM – ARTHROPODA**

The largest phylum among Animalia is Arthropoda. This phylum includes insects. Almost 66 percent of species on earth belong to the phylum of Arthropoda. The organisms in this phylum have organs in their body. These organisms are bilaterally symmetrical. In these kinds of organisms, excretion takes place through Malpighian tubes. Their bodies consist of the head, eyes, thorax, abdomen, etc. Respiration in Arthropods takes place through the lungs and gills. Fertilisation is mostly internal and development happens either directly or indirectly. **Examples:** Apis(bee), Bombyx, Limulus, Locusta, and Anopheles.

### **PHYLUM – MOLLUSCA**

The second largest phylum after Arthropoda in the whole animal kingdom is the Mollusca phylum. The organisms that belong to this phylum are both aquatic and terrestrial animals. They can live in both freshwater and marine water. The body of these organisms is covered with a shell called a calcareous shell. With a muscular foot, visceral mass, and head, its body is unsegmented. The space between mantle and visceral mass is usually known as the mantle cavity. They have gills-like structures to breathe. These are mostly unisexual. **Example:** Octopus, Loligo, and pila

## **PHYLUM – ECHINODERMATA**

Most organisms belonging to the phylum Echinodermata are marine animals. They live in saltwater. Fully grown echinoderms are radially symmetrical. But in the larva stage, they are bilaterally symmetrical. They possess a water vascular system for locomotion, the process of respiration, and capturing food. There are no specially defined excretory organs in these organisms. The nervous system and sense organs are poorly developed in echinoderms and the brain is absent. Sexes are mostly separate and the fertilisation process is external.

**Example:** Antedon, Cucumaria, and Ophiura

## **PHYLUM – HEMICHORDATA**

The phylum hemichordata was initially placed in the sub-phylum of Chordata. Now it is considered a separate phylum under non-chordates. These organisms are worm-like structures and mostly aquatic animals. They mostly live in marine water. Their body is in a cylindrical structure. Respiration in these creatures is done through gills that open into the pharynx. They have a dorsal heart. **Example:** Saccoglossus and Balanoglossus

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

Chordates are further classified into three subphyla:

1. **Subphylum – Urochordata or Tunicata:** The organisms in the subphylum Urochordata are marine organisms and we can find them from the surface to depths in the ocean. Their body is composed of a tunic which is formed by cellulose and their body is unsegmented. The circulatory system in their body is of circular type. Activities like free swimming develop in their tadpoles. They have a ventral heart which reverses the flow of blood. **Example:** Salpa, Pyrosoma, and Doliolum
2. **Subphylum – Cephalochordata:** Cephalochordates are aquatic animals. We can find these animals mostly in marine water. They possess a notochord, pharyngeal slits, and tubular nerve chords. Respiration occurs through their body surface. The circulatory system in their body is closed. Excretion in Cephalochordata is done through solenocytes. The process of fertilisation is external. **Example:** Branchiostoma
3. **Subphylum – Vertebrata:** The Subphylum Vertebrata is divided into many classes:
  - Amphibia
  - Reptilia
  - Aves
  - Mammalia
  - Pisces

## Vertebrates

Vertebrates are a subphylum of chordates that are characterised by the presence of a vertebral column or backbone. It encloses and protects the spinal cord. It includes animals such as fish, amphibians, reptiles, birds, and mammals. Different characteristics of vertebrates are given below.

- They are characterised by the presence of a vertebral column or backbone. It encloses and protects the spinal cord.
- They show bilateral symmetry.
- Vertebrates have an internal skeleton made of bone or cartilage, providing structural support and protection for internal organs.
- They are triploblastic, and coelomate with the organ-system level of organisation.
- The body has a closed circulatory system.
- The notochord is present only in the larval tail, but in some, it is present throughout their life from head to tail region.

Vertebrates are grouped into five classes.

## PISCES

These are fish. They are exclusively aquatic animals. Their skin is covered with scales/ plates. They obtain oxygen dissolved in water by using gills. The body is streamlined, and a muscular tail is used for movement. They are cold-blooded and their hearts have only two chambers, unlike the four that humans have. They lay eggs. Example: Tuna

## **AMPHIBIA**

These animals differ from the fish in the lack of scales, in having mucus glands in the skin, and a three-chambered heart. Respiration is through either gills or lungs. They lay eggs. These animals are found both in water and on land. Frogs, toads and salamanders are some examples.

## **REPTILIA**

These animals are cold-blooded, have scales and breathe through lungs. While most of them have a three-chambered heart, crocodiles have four heart chambers. They lay eggs with tough coverings and do not need to lay their eggs in water, unlike amphibians. Snakes, turtles, lizards and crocodiles fall in this category.

## **AVES**

These are warm-blooded animals and have a four-chambered heart. They lay eggs. There is an outside covering of feathers, and two forelimbs are modified for flight. They breathe through their lungs. All birds fall in this category.

## **MAMMALIA**

Mammals are warm-blooded animals with four-chambered hearts. They have mammary glands for the production of milk to nourish their young. Their skin has hairs as well as sweat and oil glands. Most mammals familiar to us produce live young ones. However, a few of them, like the platypus and the echidna lay eggs, and some, like kangaroos give birth to very poorly developed young ones. Some examples are cats, humans, and whales.

## **NOMENCLATURE:**

The system of scientific naming or nomenclature we use today was introduced by Carolus Linnaeus in the eighteenth century. The scientific name of an organism is the result of the process of classification which puts it along with the organisms it is most related to. But when we actually name the species, we do not list out the whole hierarchy of groups it belongs to. Instead, we limit ourselves to writing the name of the genus and species of that particular organism.

The world over, it has been agreed that both these names will be used in Latin forms. Certain conventions are followed while writing the scientific names:

1. The name of the genus begins with a capital letter.
2. The name of the species begins with a small letter.
3. When printed, the scientific name is given in italics.
4. When written by hand, the genus name and the species name have to be underlined separately.