

## Diversity in the Living World

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When you look around you see a large variety of living things. There are all kinds of birds, trees, insects, dogs, spiders, lizards and so on. In the countryside, you would see a still larger variety of organisms. There are all kinds of crop plants like wheat, maize and sugarcane. Then, there are wild plants growing of their own like *keekar*. In a forest you would see strange wild animals and plants. In a pond, one can see a variety of fishes, snails, waterweeds and even some water birds. If you dig out the soil you may find earthworms, beetles, ants, etc. In the sea, there are whales, sharks, corals, sea anemones and so on. Then, there is any number of parasites (like the tapeworms or bacteria) inside our own body and inside, practically, all other animals. All these living forms show similarities indicating mutual relationships. At the same time every kind of organism is very different from the other. Such a study amounts to classifying living organisms on the basis of their wide similarities and subtle differences, in other words, the study of their diversity.

### OBJECTIVES

After completing this lesson, you will be able to:

- recognize the vast diversity in the living world both in size and complexity;
- explain the need for classifying living organisms;
- argue in favour of binomial nomenclature over common names with examples;
- outline the 5-kingdom classification mentioning its different basis;
- classify the kingdom Plantae up to divisions, giving their characteristics and examples;
- classify the kingdom Animalia up to phyla giving their characteristics and examples;
- classify the phylum Chordata up to classes giving their characteristic features and examples.

### 23.1 DIVERSITY OF LIVING THINGS IN SIZE AND COMPLEXITY

#### 23.1.1 Variety in size

*Think of the following:*

- There are huge trees like banyan, peepal, pine, tamarind and so on. They have profuse branches and lots of leaves.
  - There are tall trees like palms and coconuts with almost no branches.
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- There are medium to small-sized plants like guava, banana, rose, sugarcane, wheat and the almost shortest lawn grass.
- There are animals ranging from huge elephants or still larger whales in the sea through the medium-sized cow to the small insects like butterflies or ants. A full-grown whale may weigh as much as 30 adult elephants.
- There are such tiny organisms like the *Amoeba* and bacteria, which you can see only under microscope. Hundreds and thousands of bacteria will occupy a space hardly larger than the head of an ordinary pin.

### 23.1.2 Variety in complexity

- Human body is extremely complex with so many different organs, each composed of a variety of cells performing different tasks. The human brain coordinates the thousands of activities going on inside the body.
- A bird's body is complex in some other ways. Birds have wings supported by bones and covered by feathers.
- A frog's body is less complex than ours. Frogs have a 3-chambered heart whereas we have a four-chambered one.
- Fishes have no legs; instead they have fins to swim in water. The fish heart is only two-chambered.
- Amongst plants, there are trees with tough wood and those producing flowers, fruits and seeds, there are trees like the pine tree which produce seeds but no fruits.
- There are plants like ferns that produce neither seeds nor fruits but they do have leaves and roots.
- There are single-celled organisms as opposed to the ones having trillions of cells.
- There are organisms, which have neither leaves nor any stem nor roots. They only have a network of filaments. These are the fungi.
- On one hand, there are green plants that have chlorophyll and can produce their own food. On the other hand, there are non-green plants like fungi and mushrooms, which decompose organic food and straightaway absorb it. Similarly, there are animals having no mouth or food canal like the tapeworm, which absorb the predigested food from the intestines of their host.

### CHECK YOUR PROGRESS 23.1

1. Mention if the following statements are true (T) or false (F).
    - (i) Mouse is the smallest animal and the banana tree is the smallest plant.  
T/F
    - (ii) Some animals have no food canal.  
T/F
    - (iii) Mushrooms and bread mould are non-living things.  
T/F
    - (iv) Some organisms are made of just one cell.  
T/F
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### 23.2 THE NEED TO CLASSIFY LIVING ORGANISMS

There are different kinds of living organisms found on the earth. Some are closely similar to each other, some are distantly similar and some are very different. Still all of them are similar in being living organisms as distinct from the non-living objects. Grouping or classifying the organisms on the basis of their similarities and differences helps us to know about them even if we have not seen them directly

Classification is the arrangement of organisms into groups or sets on the basis of their similarities and differences

To illustrate the concept of classification look at the organisms shown in the figure (Fig. 23.1) given below.



Fig 23.1 Some familiar living organisms

- Can you recognize all the organisms shown in the figure? Think of features common to all of them? *Yes, they grow and reproduce.*
- Can you group them into any two clear categories in some way? *Yes, one way could be that some are animals and others are plants.*
- Can you further divide the animals into two groups. *Yes, one way is that some of them have bones while the others do not have them.*
- How are the three animals (rabbit, dog and horse) similar to each other? *These are hairy, they give birth to young ones, and they suckle their babies on the milk they secrete from their milk glands.*
- If we say that the whales and bats too belong to the same group as that of rabbits and dogs, can you mention some features you would expect to find

both in the whale and bat? These features could be *giving birth to young ones and having milk glands*.

That was about animals in the diagram. Now let us take the case of plants.

- What is common between grass, rose and the tree? *They all have green leaves*.
- Again, how is grass different from a rose plant or a jamun, guava or any other tree? Guess your own answer.

Thus, what we did in the above-mentioned exercise was a kind of classification.

### 23.2.1 Advantages of classification

- Classification makes the study of such a large number of living organisms easy.
- It presents before us the vast variety of life at a glance.
- It helps us in understanding the relationships among the organisms.
- It helps to give an idea of evolution.
- It serves as a basis for several allied branches of biology

## 23.3 NAMING AN ORGANISM – BINOMIAL NOMENCLATURE

The common names of organisms are variable and very often confusing. Can you think of any animal or plant, which in India is known by several names? Ask your friends what they call the common vegetable *pumpkin* in different Indian languages. To mention a few of such names in Hindi belt alone are '*sitaphal*', '*kashiphal*', '*kumhra*', '*petha*', '*kaddu*', and so on. Can you think of any more names in other Indian languages or in the languages of the different countries?

Communicating any scientific information throughout the world by such local names as for the pumpkin would be impossible. Hence, arose the need of evolving scientific names for uniformity. The scientific name of pumpkin is *Cucurbita pepo*.

### ACTIVITY 23.1

Ask your friends and relatives about the names of any other common animal and a common plant in a few Indian languages. Judge for yourself the relevance of using the international scientific names instead of the local ones.

### 23.3.1 Two part scientific names

The scientific names of all kinds of organisms are composed of two parts:

- the genus (group) name, and
- the species (particular organism) name.

For pumpkin, the genus name is *Cucurbita*, which is the group of cucumbers and gourds, and the species (individual type) name is *pepo* the particular type of the cucurbit, here the pumpkin. **Carl Linnaeus** started the practice of using **binomial nomenclature**.

Species is a group of individuals having common characteristics and which can interbreed to produce fertile offspring.

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Take the example of crow. We have two types of **crows**. One is the common **house crow** found in plains around our houses. The other is the hill or the **jungle crow**. The two crows differ in the intensity of black colour on the neck, and in the size and shape of the beak (Fig. 23.2). **Both are crows but they cannot interbreed.** Thus, they are different species.

#### Do you know?

Mule is the offspring (hybrid) of a cross between a male donkey and a female horse. It is sterile and cannot reproduce. Thus, the mule is not a species.



House crow (*Corvus splendens*)



Jungle crow (*Corvus macrorhynchos*)

Fig. 23.2 Two common Indian crows

**Table 23.1 Scientific names of some common animals and plants**

Animals		Plants	
Common Name	Scientific Name	Common Name	Scientific Name
Man	<i>Homo sapiens</i>	Peepal	<i>Ficus religiosa</i>
Cat	<i>Felis domesticus</i>	Banyan	<i>Ficus bengalensis</i>
Tiger	<i>Felis tigris</i>	Rubber plant	<i>Ficus elastica</i>
Honey bee	<i>Apis indica</i>	Mango	<i>Mangifera indica</i>
Housefly	<i>Musca domestica</i>	Lady's finger	<i>Hibiscus esculenta</i>
House crow	<i>Corvus splendens</i>	Lentil (masoor)	<i>Lens esculenta</i>

Usually, scientific names are given with some appropriate meaning. In the above examples, *domesticus* refers to home, *esculenta* to eating, *religiosa* to sacred, *sapiens* to wise/intelligent, etc.

Thus, the two categories of the Indian crow are:

*Corvus splendens* (house crow) (Gk. *corvus*: crow, *splendens*: shining)

*Corvus macrorhynchos* (jungle crow) (Gk. *macro*: large, *rhynchos*: beak/snout)

#### 23.3.2 Categories higher than the genus and the species

**Family:** A group of two more genera (plural of genus) with common characteristics make a family. For example, lion (*Panthera leo*), tiger (*Panthera tigris*) and the domestic cat (*Felis domesticus*) make the family Felidae.

**Order:** A group of related families. For example, the family of cats (Felidae) and the family of dogs, foxes, etc. (Canidae) is grouped under the order Carnivora.

**Class:** Related orders make a class. For example, several orders like those of the tigers, cats, dogs, monkeys, bats and humans belong to the class Mammalia.

**Phylum:** A phylum is the largest category with related classes grouped together. For example, the classes of mammals, birds, reptiles, amphibians and fishes together constitute the phylum Chordata. In plants, the corresponding category is named **division**.

**Kingdom:** Kingdom is the largest group of organisms differentiated on very general similarities. For example, plant and animal kingdoms.

### CHECK YOUR PROGRESS 23.2

1. Mention if the following statements are true (T) or false (F).
  - (i) Classification means grouping the items according to some criteria. T/F
  - (ii) Scientific names of all species consist of three components. T/F
  - (iii) The scientific names are written in capital letters. T/F
  - (iv) Horse, donkey and mule are three different species. T/F
  - (v) Classification of the organisms gives an idea of their relationships. T/F
2. Rewrite the following scientific names in their correct form:  
Sapiens homo, Felis Domesticus, ficus religiosa
3. Rearrange the following in their correct sequence starting from the smallest category upwards to the highest:  
genus, species, class, family, kingdom, phylum, order

### 23.4 THE FIVE KINGDOM CLASSIFICATION

Until some time ago we had been classifying the organisms into two primary categories—the **Plant kingdom** and the **Animal kingdom**. But this had some serious problems, such as:

- Mushrooms and the bread moulds were grouped under plants. But we know that they have no leaves and no chlorophyll. Thus, it is incorrect to consider them as plants.
- Many organisms like the single-celled bacteria and *Euglena* (Fig. 23.3) could neither fit properly with animals nor with plants. The bacteria have cell walls (as found in all plant cells) but they have no chlorophyll. *Euglena*-like organisms have only cell membrane and no cell wall (like the animal cells) but they have chlorophyll (a plant characteristic).

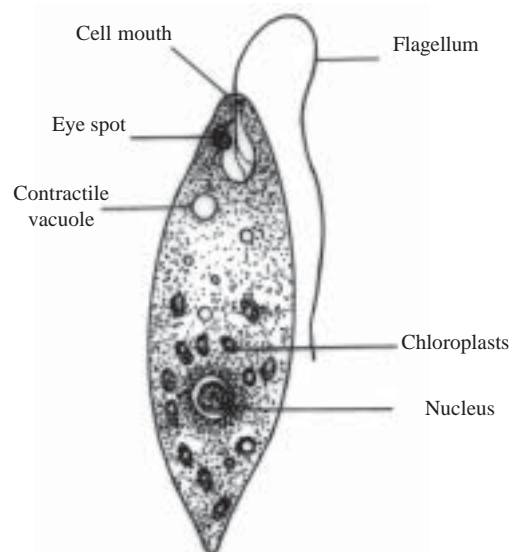


Fig. 23.3 *Euglena* – a single-celled microscopic organism (highly magnified)



To overcome such problems a new scheme of classification was recommended by **R.A. Whittaker** (1969). This scheme of classification comprises five kingdoms instead of two. The five kingdoms according to the new system of classification are **Monera, Protista, Fungi, Plantae and Animalia**.

The main criteria in this classification are as follows:

- Whether the organisms are **single-celled** or **multi-celled**.
- Whether the **genetic material** (chromosome) of the cell is enclosed **within a nuclear membrane** or lies **freely** in the cytoplasm.
- Mode of **nutrition** – whether produces food (**autotrophic**) by photosynthesis or dependant on others, either by eating them up (**heterotrophic**), or sucking or absorbing the food from them (**saprotrophic**).

Let us now study the five kingdoms one by one.

### 23.4.1 Kingdom Monera (bacteria)

It includes bacteria and blue green ‘algae’ (not really algae).

- Monera are single-celled.
- Their chromosome material is not enclosed within a nuclear membrane. It means that they have no compact nucleus.

The Monera are described as **prokaryotes** meaning that their nuclear material is in a primitive form (*pro*: primitive, *karyon*: nucleus). As opposed to these, all other organisms from Protista onwards, are described as **eukaryotes** (*eu*: true) meaning that they have true nucleus.

#### Characteristic features of bacteria

- **Size:** Microscopic, rarely more than 0.01mm in length
- **Cell wall:** Not made of cellulose
- **Chromosome material:** Not enclosed in a nuclear membrane
- **Shapes:** Spherical (cocci), rod-like (bacilli), or spiral (spirilli) (Fig. 23.4)
- **Nutrition:** Absorb food from the surroundings after digesting it by pouring out enzymes
- **Reproduction:** Mostly by division into two
- **Occurrence:** Almost everywhere in soil, in water, outside or inside the body of plants and animals

Some of the bacteria are useful such as those making curd and the vinegar. Some are used in making antibiotics. And, many are beneficial in nature as in the carbon and the nitrogen cycles.

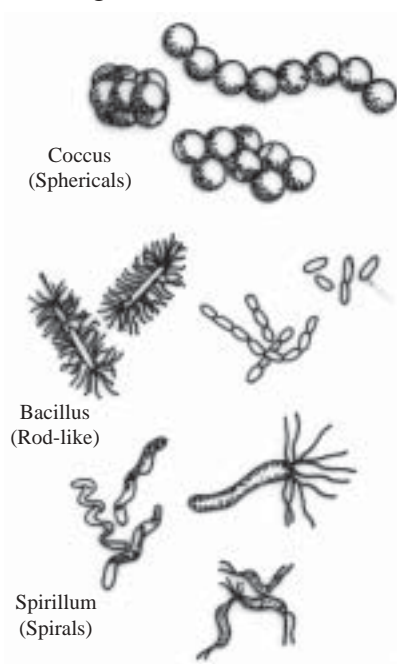


Fig. 23.4 Common types of bacteria – spherical, spiral and

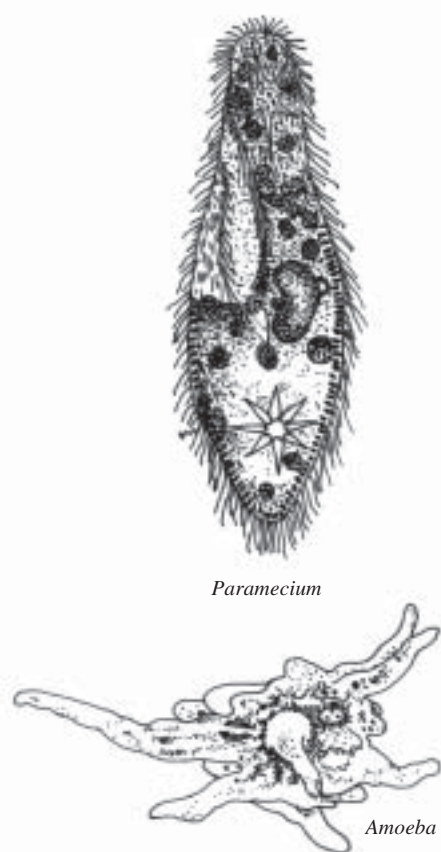


Fig. 23.5 Two examples of freshwater protists: *Amoeba* and *Paramecium*

Many bacteria are harmful. They cause diseases, such as tuberculosis and typhoid. Some bacteria spoil foodstuff.

### 23.4.2 Kingdom Protista

These are **single-celled** (unicellular) organisms, and have a well-defined membrane-bound nucleus. Their modes of nutrition may be quite varied.

- **Active feeders:** Some protists like *Amoeba* and *Paramecium* (Fig. 23.5) ingest food like most animals. Very often these are also referred to as **Protozoa** (*protos*: primitive, *zoon*: animal).
- **Photosynthesizers:** Some protists like *Euglena* (Fig. 23.3) have chlorophyll and manufacture their own food like the plants.
- **Reproduction:** Mostly asexual reproduction by fission and some reproduce sexually.
- **Occurrence:** Many protists live freely in water or in soil and many are harmful parasites which cause diseases. Some of the protists are pathogenic, such as *Entamoeba histolytica* that causes dysentery and *Plasmodium vivax* that causes malaria.



Fig. 23.6 Some examples of fungi

### 23.4.3 Kingdom Fungi

Common **bread moulds** (*Rhizopus* and *Mucor*), **mushrooms** and **toadstools** are some common types of fungi. Most of these are mildly or severely poisonous.

- Most fungi are made of thread-like structures called **hyphae** (as in bread mould). The hyphae grow in the form of a mat-like structure called **mycelium**.
- Hyphae possess rigid cell walls **not** made of cellulose (the cell walls of the true plant cells are made of cellulose).
- Multicellular in nature.
- Absorb nutrients from dead or living organisms.
- Produce spores in special rounded bodies called spore heads (sporangia) as in the common bread mould.

One variety of mushrooms is edible, and it is grown in mushroom culture. Many moulds grow on fruits and vegetables, such as *Penicillium notatum* and *Aspergillus*. *Penicillium* was the source of the first discovered antibiotic, penicillin. Yeasts (*Saccharomyces*) are widely used in baking bread and in winemaking, etc. Some fungi produce diseases, such as ringworm.



### 23.4.4 Kingdom Plantae

- These are multicellular forms.
- Many of the body cells contain the green pigment chlorophyll for photosynthesis.
- Cells have a cell wall made of cellulose.

Kingdom Plantae is very large. It is divided into four divisions – Algae, **Bryophyta**, **Pteridophyta** and **Spermatophyta**.

#### Division Algae

- Found in all kinds of water
- No proper roots, stem or leaves
- Derive nutrition by simply absorbing mineral nutrients from the surrounding water.
- Some of the algal seaweeds may be very tall. *Laminaria* (Fig 23 .7) can reach a length of two meters or even more.
- Some algal seaweeds that are popularly called kelp are used as sources of food for humans and cattle.



Fig. 23.7 *Laminaria* – an alga

#### Division Bryophyta

You must have often seen green velvety layers growing on damp soil, or on walls or inside the flowerpots. These are bryophytes, e.g. mosses and liverworts (Fig.23.8).

- Mosses are generally small.
- They possess some root-like structures but not the true roots.
- They have small green leaves.
- Some of the mosses may show long slender stalks growing out from them. Each such stalk ends in a capsule full of spores. After getting discharged from the capsule and settling at suitable damp places the spores germinate to produce new plants.

The liverworts grow as spreading patches of green, forked or ribbon-like structures lying flat on moist ground. The liverworts are common on the shady moist slopes of hills.



Fig. 23.8 Types of bryophytes – mosses and liverworts

#### Division Pteridophyta

Ferns are very commonly grown in gardens (Fig. 23.9).

- Ferns have a single underground stem with true roots.
- Their green leaves are often quite large.
- The leaves bear spores for reproduction.



Fig.23.9 Fern – a pteridophyte

The first three divisions of **Plantae**, namely **Algae**, **Bryophyta** and **Pteridophyta** are often collectively called **non-flowering plants**. They do not produce any flowers or seeds.



Fig. 23.10 The pine tree  
(a gymnosperm) and its cone

### Division Spermatophyta

It includes a great variety of the **seed-producing plants**, such as pines, mango, maize, lotus, peas, etc. These are of two types:

- plants that produce seeds openly (not contained inside the fruit) (**Gymnosperms**), and
- plants that produce seeds contained inside the fruit (**Angiosperms**).



#### a) **Gymnosperms** (Gk. *gymno*: naked, *sperm*: seed)

Gymnosperms include conifers (cone bearing plants) like the pines (Fig. 23.10).

- They produce naked seeds, which are not enclosed in a fruit.
- The pinecone consists of hard-modified scale-like leaves, which

support the seeds borne on their upper surface.

Many species grow on mountains and hills including the Himalayas. They constitute the conifer forests. Such forests are useful in many ways.

- They provide wood for construction, packing, plywood, etc.
- Provide oils, such as the turpentine oil.
- The edible *chilgoza* is the seed of a particular species of pine (*Pinus gerardiana*).
- Some are the sources of drugs, such as ephedrine, from the plants of the genus *Ephedra*.

#### b) **Angiosperms** (Gk. *angio*: a case or vessel, *sperm*: seed)

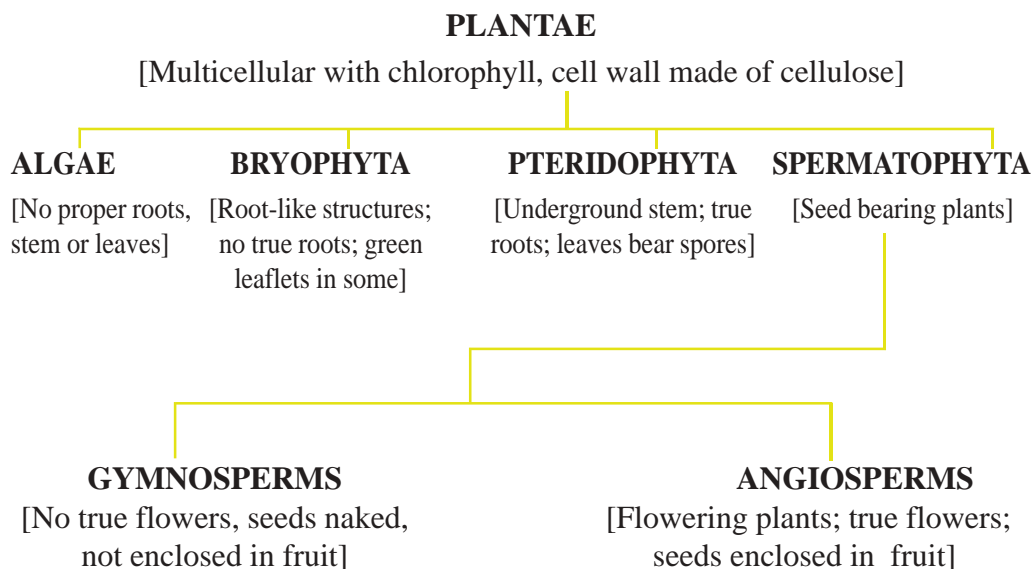
These are flowering plants in which seeds are always contained inside the fruit (fig. 23.11).

- Flower is a special organ in which the male and female reproductive organs are grouped together.
- The seed contains an embryo together with the nourishment-containing cotyledons (one in some and two in others).
- The angiosperms with **one cotyledon** are called **monocots**, such as grass, maize and rice.
- The angiosperms with **two cotyledons** are called **dicots**, such as gram, mango, rose, etc.



Fig. 23.11 An angiosperm  
(flowering plant)

## SUMMARY OF THE CLASSIFICATION OF THE KINGDOM PLANTAE



### CHECK YOUR PROGRESS 23.3

- What are the three basic criteria that have been taken into consideration for the five-kingdom classification of the living organism?
- The five kingdoms of living organisms are \_\_\_\_\_, Protista, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ (Fill in the blanks).
- Name the kingdoms to which the following belong:
  - Mushrooms \_\_\_\_\_
  - Algae \_\_\_\_\_
  - Ferns \_\_\_\_\_
  - Bacteria \_\_\_\_\_
  - Flowering plants \_\_\_\_\_
- Name the groups of angiosperms with one cotyledon and two cotyledons, respectively.

### 23.5 KINGDOM ANIMALIA

Animals include a vast variety of organisms, such as sponges, fishes, insects, frogs, snakes, feathery birds, and hairy mammals including humans and, so on.

Some of the characteristics of all animals in general:

- All animals are **multicellular**, **eukaryotic** (true nucleus), **heterotrophic** (obtaining food by methods other than photosynthesis)
- Almost all animals **move about** (locomotion) in the search of food or for other needs.
- Most animals possess a **nervous system** with **sense organs**.

Animals are found in all types of places – in water, on land, in soil, and in air, many are found as parasites living either inside the body of other animals and plants or on their body.

**[A point to remember –** The heterotrophic unicellular Protistans like *Amoeba* used to be described as Protozoans under the animals. But according to the new five-kingdom classification. They no longer belong to the animal kingdom.]

The kingdom Animalia is very vast and highly varied. It is subdivided into nine phyla (*singular*: phylum).

- i. **Porifera** (sponges)
- ii. **Cnidaria** (jellyfishes, corals, etc.)
- iii. **Platyhelminthes** (flat worms)
- iv. **Aschelminthes** (round worms)
- v. **Annelida** (earthworms)
- vi. **Arthropoda** (insects, spiders, crabs, etc.)
- vii. **Mollusca** (snails, oysters, etc.)
- viii. **Echinodermata** (starfishes, sea urchins, etc.)
- ix. **Chordata** (animals with backbone)

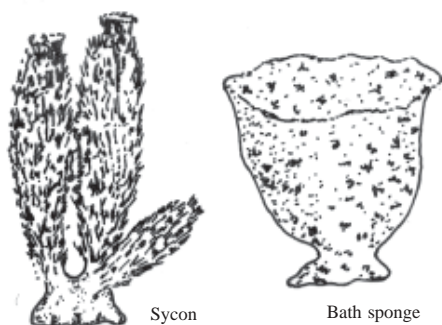


Fig. 23.12 Examples of Porifera

### 23.5.1 Phylum Porifera (sponges)

- Most organisms are found in the sea but a few are found in fresh water.
- Body consists of a hollow tube, fixed to the substratum.
- A vast number of pores are present in the body wall for the entry of water carrying food and oxygen and a single large opening for the exit of water.
- Body is supported by a skeleton of minute spicules or special kind of fibres.

Examples: **Sycon, bath sponge**

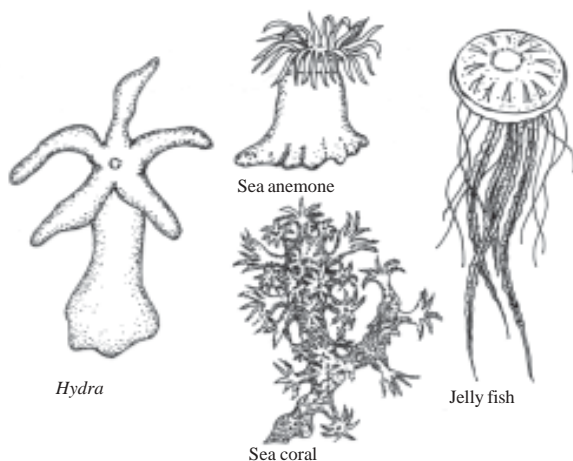


Fig. 23.13 Examples of Cnidaria

### 23.5.2 Phylum Cnidaria (hydra, jellyfishes)

- Body somewhat tubular or umbrella-like with a single (digestive) cavity that has a single opening the mouth at one of the ends.
- Tentacles that surround the mouth capture the prey paralyzed by their stinging cells and push it into the mouth. The same mouth throws the undigested left out food out of the body again. Some members like the corals develop hard skeleton of calcium carbonate.
- Reproduction is by budding as well as by sexual method.

Hydra is a fresh water form found usually attached to the submerged rocks and plants in lakes, ponds and streams. It reaches a length of about 1cm when fully extended.

### 23.5.3 Phylum Platyhelminthes (flat worms)

- Small, soft, flattened unsegmented worms
- Alimentary canal with only a single opening, the mouth or no mouth at all.
- Mostly parasites, either external or internal, but a few are free-living forms found in the sea or in fresh water (Fig. 23.14).

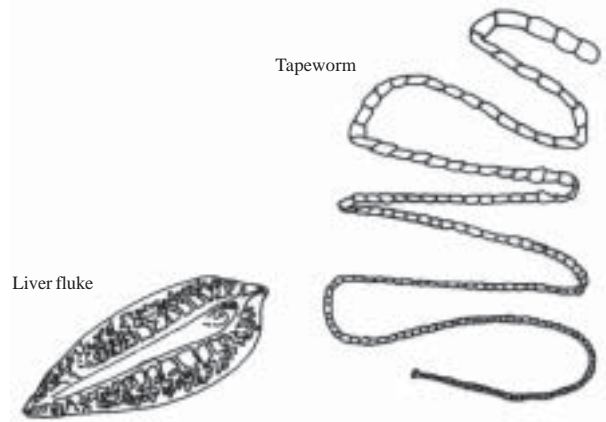


Fig. 23.14 Examples of Platyhelminthes

Examples: Liver fluke (in the liver of sheep), tapeworm (*Taenia* sp.) which is a parasite of the human intestine in case of non vegetarians who eat pork or beef), *Planaria* (free-living aquatic form) (ctiofig. 23.14).

Tapeworms appear to be segmented, but in reality they are not. In them, new segments continue to add on the front in the neck region while the old ones at the back continue to shed one after another.

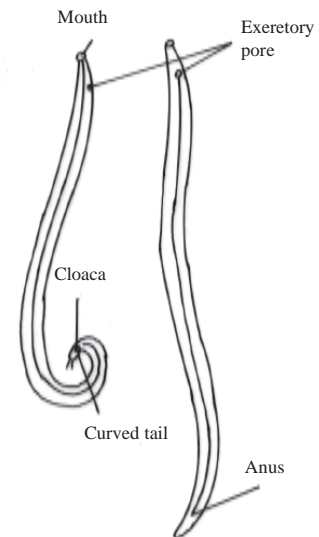


Fig. 24.15 *Ascaris* – an Aschelminth

### 23.5.4 Phylum Aschelminthes (round worms)

- Long cylindrical and unsegmented body
- Alimentary canal open at both ends (mouth and anus)
- Mostly parasitic but some live freely in the soil

Examples: *Ascaris* (Fig. 23.15) is found in human intestine. Eelworm is a parasite of potato plant.

### 23.5.5 Phylum Annelida (segmented worms)

- Long cylindrical body divided into ring-like segments
- Well-developed digestive system, alimentary canal open at both ends (mouth and anus)

Examples: Common earthworm *Pheretima posthuma* (Fig. 23.16) found in the burrows in damp soil, and the common leech *Hirudinaria medicinalis* found in ponds but readily sticks to the body of cattle and even human beings.

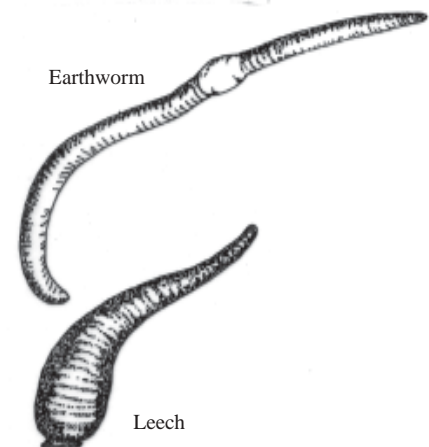


Fig.23.16 Examples of Annelida



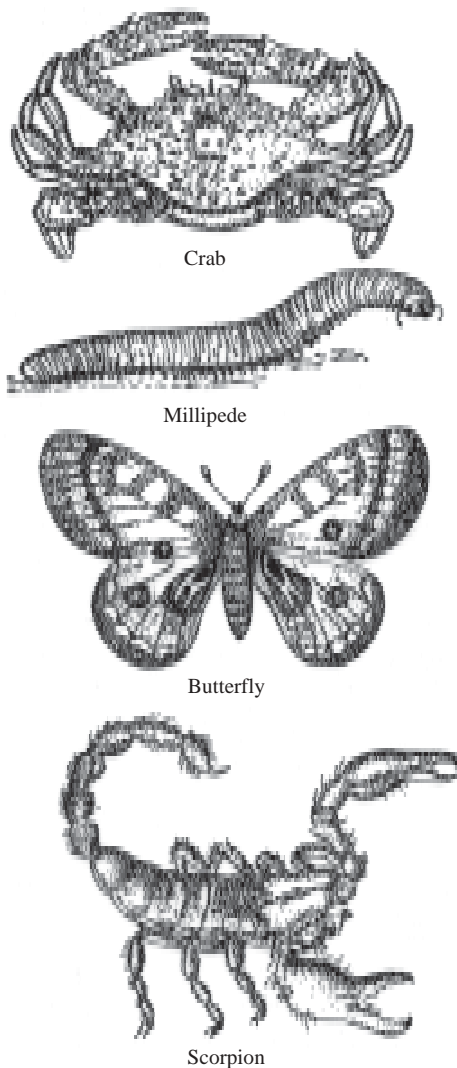


Fig.23.17 Examples of Arthropoda



Fig.24.18 Examples of Mollusca

### 23.5.6 Phylum Arthropoda (joint-legged animals)

- Jointed appendages, one pair each on some or all body segments
- Body covered by a hard chitinous skeleton
- During the growth period the exoskeleton is shed off (moulting) and a new one is produced

This is the biggest phylum with four major kinds of organisms.

- Insects**, such as cockroaches and butterflies, have three pairs of legs and usually two pairs of wings.
- Spiders** and **scorpions** have four pairs of legs.
- Prawns** and **crabs** have many pairs of legs.
- Centipedes** and **millipedes** have paired legs on each body segment.

### 23.5.7 Phylum Mollusca (snails, oysters)

- Soft unsegmented body enclosed in a hard calcareous shell
- Muscular foot for creeping or for other kinds of locomotion

Examples: Snails, slugs, oysters, and octopuses and cuttlefish (foot divided into arms for swimming).

### 23.5.8 Phylum Echinodermata (starfishes)

- Usually thorn-like spines on the body
- Body radially symmetrical having similar parts (usually five) arranged regularly around a central region

Examples: Starfish, brittle star, sea urchin, sea cucumber, etc.

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### 23.5.9 Phylum Chordata (animals with backbone and some others)

- Possess a flexible rod-like notochord along the mid-dorsal axis of the body in the embryos of all chordates including humans. The notochord is later replaced by a backbone (vertebral column).
- Possess a hollow dorsal nerve cord.
- Paired gill slits (in the pharynx) present either throughout life or at least in the embryonic stages of all chordates.
- All possess a tail extending behind the anal opening. (In some cases, as in humans, the tail in the embryo gets 'lost' before birth).

The phylum Chordata is divided into three subphyla.

#### a) Subphylum Urochordata (*uro*: tail)

Notochord is confined to the tail region only and, that too, in the larval stages only. All forms are marine. Example: *Herdmania*

#### b) Subphylum Cephalochordata (*cephalo*: head)

Notochord extends up to the front end of the body. No head is formed. Single example: marine *Amphioxus*

#### c) Subphylum Vertebrata

Organisms possess a vertebral column (notochord replaced) and the head is well differentiated.

**Vertebrata** is the largest group in Chordata. It is divided into five very distinct classes.

- Pisces (fishes)
- Amphibia (frogs)
- Reptilia (lizards)
- Aves (birds)
- Mammalia (animals with milk glands)

#### i. Class Pisces (fishes)

- Body covered with scales
- Have fins and no limbs
- Breathe by gills, no lungs
- 2-chambered heart

Fishes are mainly of two types – **cartilaginous fishes** and **bony fishes**.

Cartilaginous fishes, such as the sharks, have their skeleton made of cartilage and their gills are exposed (not covered by any gill-cover).

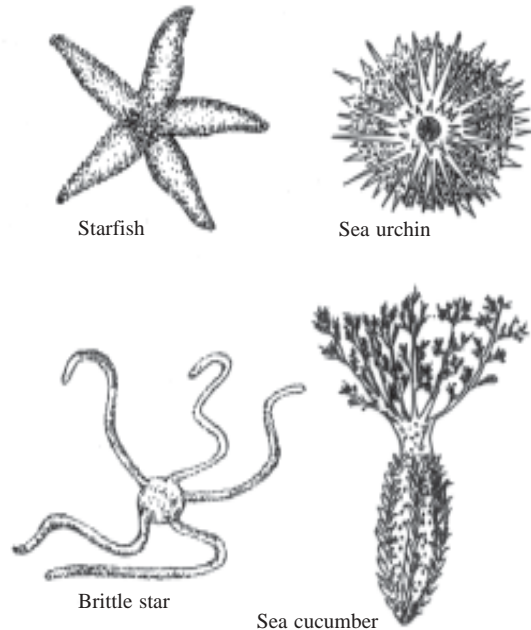
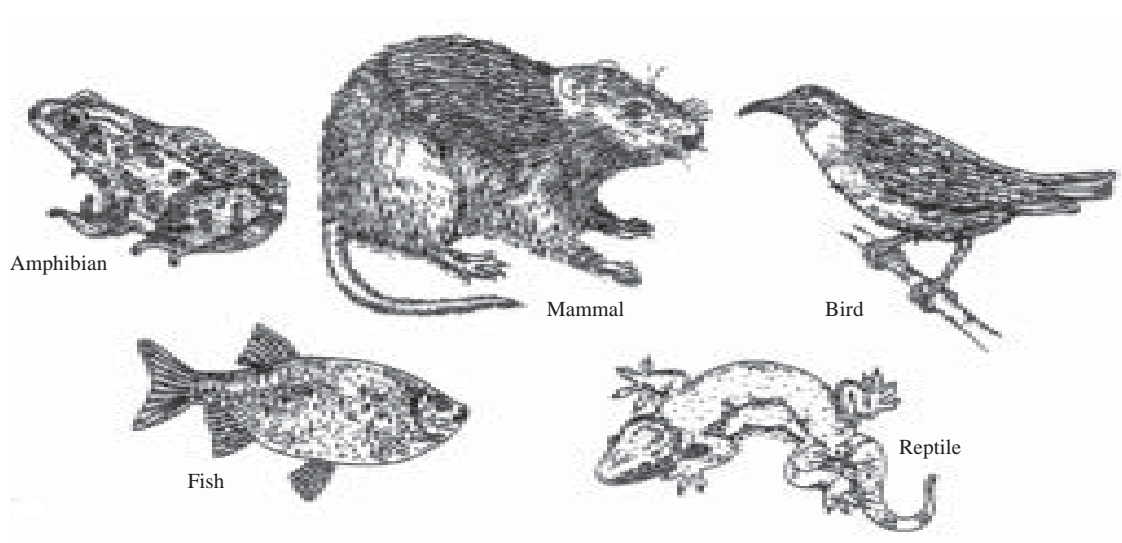


Fig.24.19 Examples of Echinodermata



*Fig. 23.20 Examples of the five classes of Chordata*

Bony fishes, such as rohu, catla, herring and trout, have their skeleton made of bones and their gills are covered by a gill-cover (operculum).

**ii. Class Amphibia (frogs, toads)**

- Live both in water and on land
- Smooth moist skin without scales
- Aquatic respiration by skin (when under water) as well as by lungs (when on land)
- All larval stages as well as some adults breathe by gills.
- Heart 3-chambered
- Cold blooded (body temperature changes with that of the surroundings)
- Ear drum (tympanum) on the surface of the skin
- Eggs laid in water, no eggshell, larvae undergo metamorphosis

**iii. Class Reptilia (lizards, crocodiles)**

- Completely adapted to living on land, some secondarily aquatic (like the turtles)
- Cold blooded (therefore live in warmer regions only)
- Eggs with a leathery (non-calcareous) shell
- Breathe by lungs right from birth
- Rough horny scales on the skin
- 3-chambered heart, but the ventricle is partially divided in crocodiles
- Ear drum sunken into a tubular depression

Examples: Lizards, snakes, tortoises, crocodiles, gharial, etc. (Gharial is found in India and in some adjoining countries of the east.)

**iv. Class Aves (birds)**

- Body covered with feathers
- Only the two hindlegs present, forelegs are modified into wings.
- Scaly legs
- 4-chambered heart

- Bones with air cavities to lighten the body weight for flight
- Warm blooded (maintain constant body temperature, usually 38°- 41°C)
- Lay eggs with calcareous shell

Examples: Pigeon, sparrow, crow, owl, penguin, ostrich, emu, etc.

**v. Class Mammalia** (*mammæ*: breasts)

- Most mammals give birth to young ones. Very few mammals lay eggs.
- All feed their babies on the milk produced in their milk (mammary) glands
- Possess hairy skin
- Have projecting external ears (pinna)
- Testes are external contained in the scrotal sacs
- 4-chambered heart
- Warm-blooded
- Mature red blood cells without nucleus (except only in camels, a surprising situation difficult to explain).

Examples: Cat, dog, cow, sheep, rat, bat, seal, monkey, apes and man

### CHECK YOUR PROGRESS 23.4

1. Name the phylum of each of the following animals:
  - i) Sponge\_\_\_\_\_
  - ii) Earthworm\_\_\_\_\_
  - iii) Tapeworm\_\_\_\_\_
  - iv) Cockroach\_\_\_\_\_
  - v) Starfish\_\_\_\_\_
2. Name the phylum showing the following characteristics:
  - i) Body flattened and the food canal with only one opening\_\_\_\_\_
  - ii) Body divided into ring-like segments and the food canal is open at both ends\_\_\_\_\_
  - iii) Soft body enclosed in a hard calcareous shell\_\_\_\_\_
  - iv) Body supported by a flexible rod like notochord\_\_\_\_\_
3. Tick-mark the correct matching pairs of an example and its Phylum / Class.
  - i) Frog – Chordata
  - ii) Whale – Pisces
  - iii) Crocodile – Amphibia
  - iv) Bat – Mammalia
  - v) Pigeon – Reptilia

### LET US REVISE

- The living world varies in size from the tiny microscopic organisms to the very huge ones like the elephant and the whale.
- Organisms are varied in structure, made of either just one cell performing all the activities or of numerous highly complex tissues with different functions.

- Classification is the arrangement of organisms into groups or sets on the basis of similarities and differences.
- Classification helps us in understanding the inter-relationships among the organisms leading to the idea about evolution.
- Species is the lowest category in the classification and the kingdom is the highest with family, order, class and phylum in-between.
- Species is a group of individuals that can successfully breed among themselves to produce fertile young ones.
- Every organism is given a scientific name (binomial nomenclature) consisting of two components (genus and species).
- Scientific names of living organisms are universal and they remove any confusion arising from the local names in the different languages.
- The five-kingdom classification is based on three main criteria : whether the organisms are single-celled or multicellular, whether the genetic (chromosomal material) is enclosed by a nuclear membrane or not, whether the nutrition is of autotrophic (photosynthetic) type or of heterotrophic or saprotrophic (eating, sucking, or absorbing) type.
- The five kingdoms are: **Monera** (single-celled, no nuclear membrane) containing bacteria, **Protista** (single-celled, nuclear membrane) with forms, such as *Amoeba* and *Paramecium*, **Fungi** (no chlorophyll) with forms like bread mould and yeasts, **Plantae** (photosynthetic) that consist of the divisions Algae, Bryophyta (mosses), Pteridophyta (ferns) and Spermatophyta (seed-bearers), and **Animalia** that includes all animals from sponges up to humans.
- The Spermatophyta are subdivided into **Gymnosperms** (naked seeds, and no fruit) and **Angiosperms** (seeds contained in the fruit).
- The kingdom Animalia includes nine phyla: **Porifera** (sponges), **Cnidaria** (hydra, jellyfishes), **Platyhelminthes** (flat worms), **Aschelminthes** (round worms), **Annelida** (earthworms), **Arthropoda** (prawns, spiders, insects), **Mollusca** (snails), **Echinodermata** (star fishes), and **Chordata** (animals with backbone)
- The phylum Chordata is composed of five classes: **Pisces** (fishes), **Amphibia** (frogs), **Reptilia** (lizards), **Aves** (birds) and **Mammalia** (cow, dog, monkey, man).

### TERMINAL EXERCISES

#### A. Multiple choice type questions.

1. Which one of the following names is written in the correct form?
    - a) *PANTHERA TIGRIS*
    - b) *Mangifera Indica*
    - c) *Homo sapiens*
    - d) **ficus religiosa**
  2. Mushrooms belong to the kingdom
    - a) Protista
    - b) Spermatophyta
-



- c) Pteridophyta  
d) Fungi
3. Presence of hyphae and mycelium is a characteristic feature of one of the following kingdoms:  
a) Fungi  
b) Protista  
c) Monera  
d) Plantae
4. The seeds of angiosperms and gymnosperms differ in the aspect that:  
a) Angiosperms do not produce seeds but gymnosperms produce seeds.  
b) Gymnosperms do not produce seeds but angiosperms produce seeds.  
c) Angiosperms have naked seeds but gymnosperms have seeds enclosed inside the fruit.  
d) Gymnosperms have naked seeds but angiosperms have seeds enclosed inside the fruit.
5. The alimentary canal has a single opening in one of the following:  
a) Aschelminthes  
b) Annelida  
c) Arthropoda  
d) Platyhelminthes

**B. Descriptive type questions.**

1. With the help of any two examples describe how the five-kingdom classification is better than the old system of just two kingdoms (plants and animals).
2. Match the items in column I (organisms) with their group in column II (draw connecting lines). *Underline the items that do not match.*

**Column I (Organisms)**

Fern  
Dog  
Yeast  
Fish  
Pine  
Mushroom  
Bacteria  
Sponge  
Spider

**Column II (Group)**

Arthropoda  
Monera  
Bryophyta  
Amphibia  
Pteridophyta  
Porifera  
Reptilia  
Mammalia  
Fungi

3. Why are scientific names of the living beings preferred over the local names?
4. Write two identification characteristics of each of the following:  
i) Chordata  
ii) Arthropoda  
iii) Pteridophyta  
iv) Monera
5. Given below is a list of some organisms each followed by three-characteristics/

classification etc. Identify the correct one in each case and underline.

- i) Amoeba – nuclear membrane, Monera, segmented
  - ii) Earthworm – Arthropoda, Chordata, Annelida
  - iii) Pine – cone, flower, parasite
  - iv) Bread mould – chlorophyll, spores, Bryophyta
  - v) Whale – Pisces, milk glands, gills
  - vi) Bacteria – Protista, Pteridophyta, Monera
6. List any three characteristics of the phylum Chordata. Classify it further into classes.
  7. Differentiate between the following:
    - i) Gymnosperms and Angiosperms
    - ii) Amphibia and Reptilia
    - iii) Protista and Fungi
    - iv) Mollusca and Annelida
  8. List the characteristics of Kingdom Plantae. Classify it into its various subdivisions.

### ANSWERS TO CHECK YOUR PROGRESS

#### 23.1

1. (i) F, (ii) T, (iii) F, (iv) T

#### 23.2

1. (i) T, (ii) F, (iii) F, (iv) F, (v) T
2. *Homo sapiens*, *Felis domesticus*, *Ficus religiosa*
3. Species, genus, family, order, class, phylum, kingdom

#### 23.3

1. Whether single-celled or many celled, nucleus or no well defined nucleus, autotrophs or heterotrophs or saprotrophs.
2. Monera, Fungi, Plantae, Animalia
3. (i) Fungi, (ii) Plantae, (iii) Plantae, (iv) Monera, (v) Plantae
4. Monocots, dicots

#### 23.4

1. Porifera, Annelida, Platyhelminthes, Arthropoda, Echinodermata
2. Platyhelminthes, Annelida, Mollusca, Chordata
3. (i) and (iv)

### GLOSSARY

**Classification:** Arrangement of organisms into groups or sets on the basis of their similarities and differences.

**Class:** A group of related orders.

**Family:** A group of two or more genera with common characteristics.

**Kingdom:** A group of organisms differentiated on very widespread similarities.

**Order:** A group of related families.

**Phylum:** A group of related classes.

**Species:** A group of individuals having common characteristics that can interbreed to produce fertile offsprings.

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