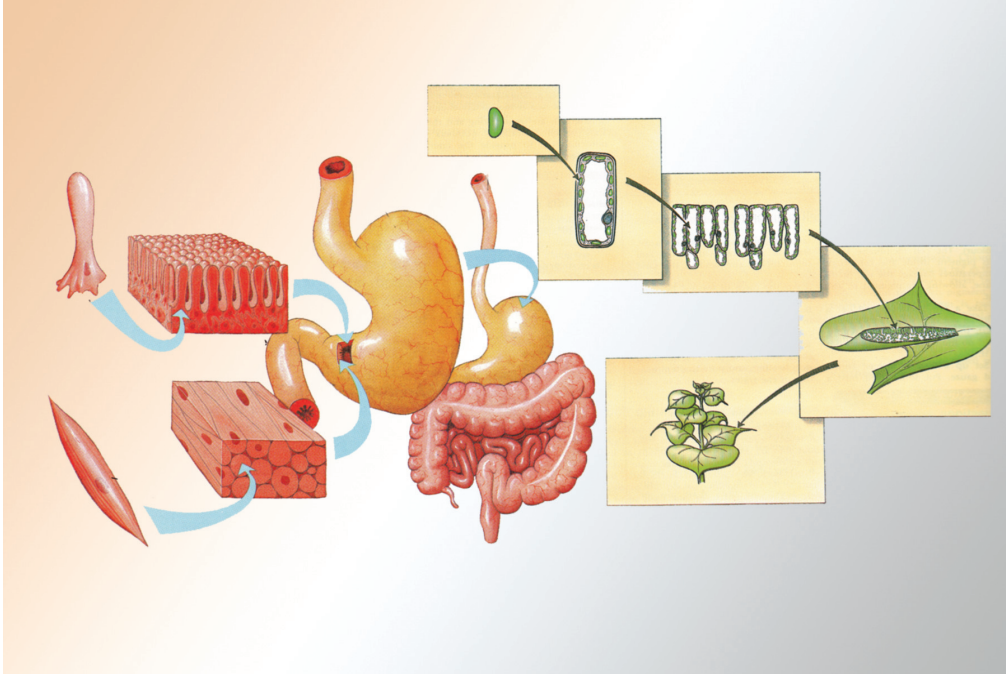


03

Organisational patterns in body structures of organisms



By the end of this chapter you will be competent to...

- investigate the organizational patterns of the animal body to conduct the different functions
- investigate the organizational patterns of the plant body to conduct the different functions.

3.1 Patterns of organization in the animal body to carry on life functions

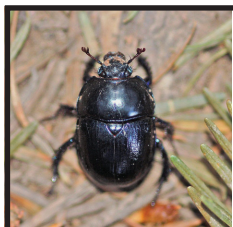
3.1.1. Common structure in the organization of animals

The main difference between non-living things and the living beings is that living beings are capable of conducting various activities. These activities that can only be seen in living organisms are called **life functions**.

In order to carry out these functions, plant and animal bodies have various structural organizations. Recall some animals that you come across often. Recall their body form and shapes. Most of them will have a body divisible into three main parts, namely head, thorax and abdomen. Further they will have appendages or limbs attached to some of these parts.



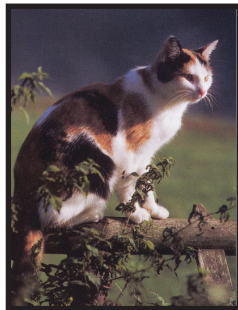
Scorpion



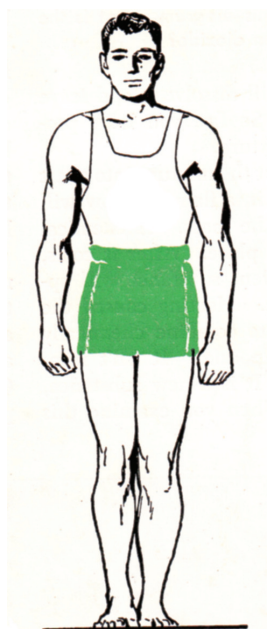
Beetle



Chimpanzee



Cat



Man

Fig 3.1 External body organization of various animals

Observe Standard Fig 3.1 and identify the head, thorax and abdomen of each and the appendages or limbs attached to them.

Man too like other organisms carry on life functions to maintain life. Feeding , respiration, growth, excretion, movement and reproduction are some of the life functions.

In order to carry out these life functions the animal body has specific organized systems.



Do you know?

All animals move about with their head (which has the sensory organs) thrust forward in order to get sensations about the environment. Man differs from other animals mainly, by the ability to stand erect and the use of only one pair of limbs in walking.

Given below are some of the systems which carry out the different functions in the human body.

- | | |
|-----------------------|------------------------|
| 1. Digestive system | 4. Excretory system |
| 2. Respiratory system | 5. Reproductive system |
| 3. Circulatory system | 6. Nervous system |

Digestive system

Compare your body with a motorcycle. The motorcycle works on the energy supplied by the burning of fuel. Similarly, the human body works by the energy supplied by the food we eat.

Often the food we eat are made up of large, complex compounds. Therefore they cannot be absorbed into the body directly. The food must be converted to a simpler form. This process is called digestion. Digestion is performed by the digestive system (Fig 3.2).

Digestive system of man

Mouth cavity

Food is broken up into small particles by the teeth. It is mixed with saliva secreted by salivary Glands. Digestive juices in saliva starts digestion.

Oesophagus

Pushes food from the mouth to the stomach.

Stomach

Stores food temporarily. Mixes the food with gastric juice and digest food further.

Small intestine

Food is mixed with bile from the liver and pancreatic juice from the pancreas and is further digested. Digestion is completed by the intestinal juice from intestine. Digested nutrients are absorbed into the body in the small intestine

Large intestine

From the digested food, water is absorbed.

Anus.

Undigested matter in semi solid state is sent out as faeces.

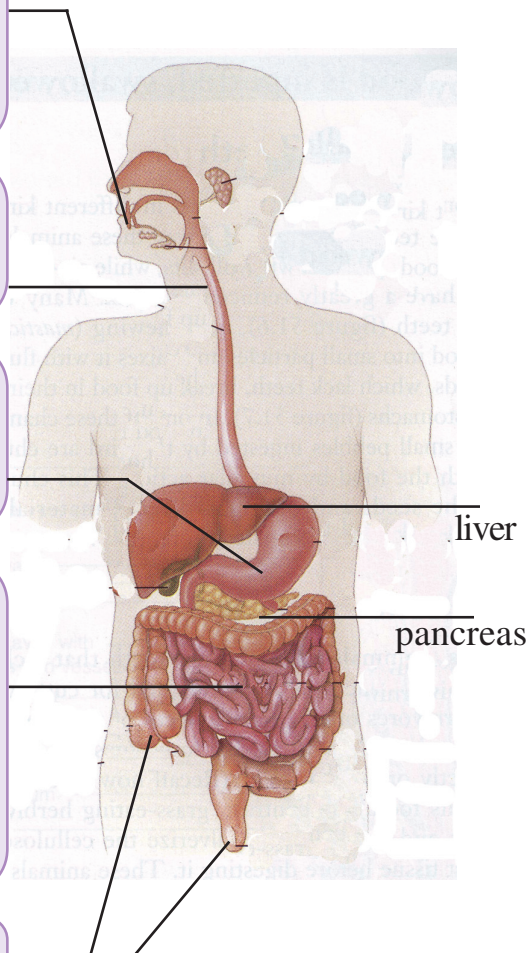


Fig 3.2 Digestive system of man



Do you know?

The small intestine of an adult man is about 4.5 m in length.

Respiratory system of man

Animals as well as man can survive for a short time without water or food. But do you know that they cannot survive for even a few minutes without air.

Respiration is the process by which we exchange gases with the atmosphere. The process which taking air into our bodies is **inspiration**. Giving the carbondioxide and water vapour produced by the body is by **expiration**. The main function of the respiratory system is exchange of gases. (Fig 3.3)

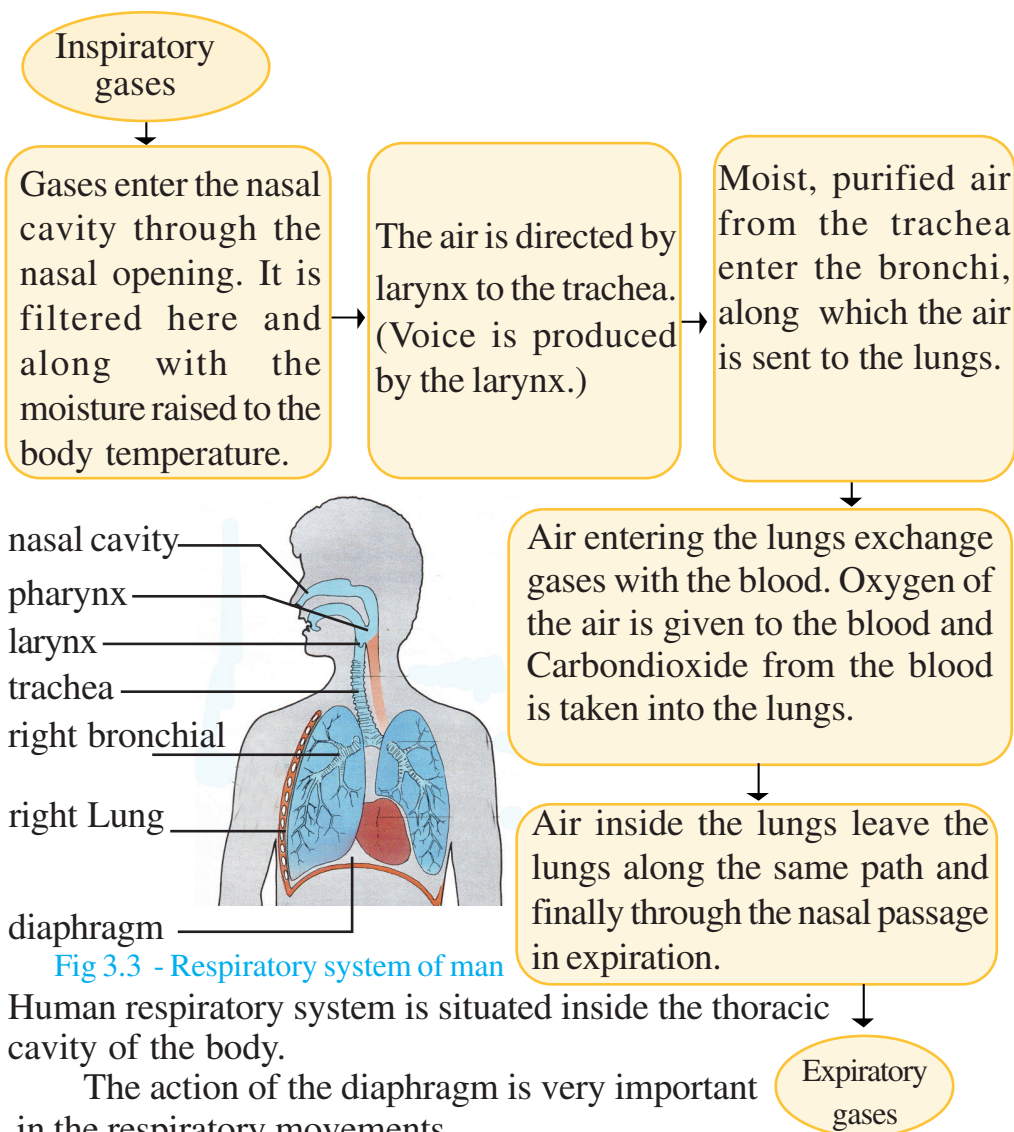


Fig 3.3 - Respiratory system of man

Human respiratory system is situated inside the thoracic cavity of the body.

The action of the diaphragm is very important in the respiratory movements.

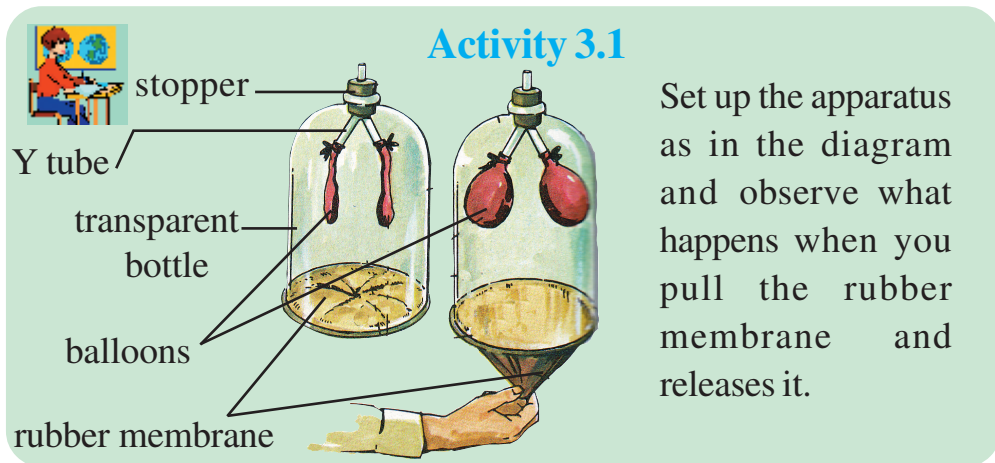


Fig 3.4

When the rubber membrane is pulled down, the balloons get filled with air. This is similar to inspiration. When the membrane is released the balloons collapse, and this is similar to expiration.

Blood circulatory system of man

The oxygen that entered blood inside the lungs and the nutrients that were absorbed by the blood, has to be taken to all parts of the body. The system that does this function is the **blood circulatory system**. This is also called the transport system of the body.

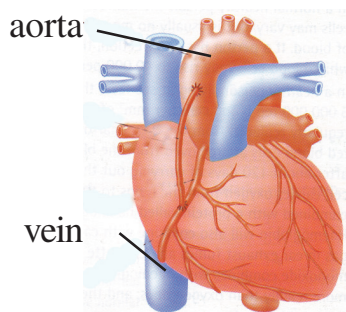


Fig 3.5 - Heart and associated vessels

Blood circulatory system is mainly formed of the heart and blood vessels connected to it. The fluid that circulates inside them is blood. Blood is composed of 90% water. Blood cells, nutrients absorbed in digestion, oxygen, vitamins and by-products of various activities of the body are also the other components of the blood. Circulation of blood is maintained by the continuous working of the heart. (Fig3.5)

Vessels which take blood away from the heart are called **arteries**. Vessels which bring blood back to the heart are called **veins**. Inside the organs of the body arteries and veins are joined by a system of capillaries. The simple nutrients, oxygen, vitamins etc. brought by

arteries are given over to the organs. Carbondioxide and other waste substances produced in the cells of the organs are given to the blood. Exchange of these substances occur between the capillaries and the cells.

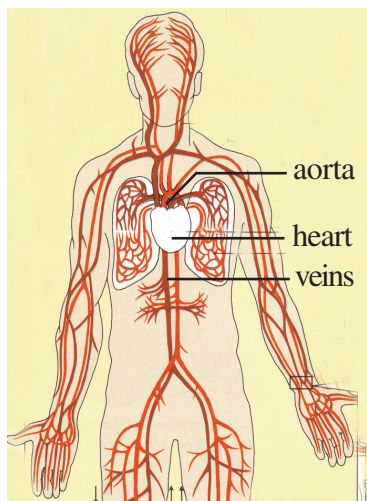


Fig 3. 6 - Circulatory system of man

Blood circulates throughout the entire body by the contraction and relaxation of the the heart. This relaxation and contractive activity of the heart, produces sounds which are useful for doctors to diagnose various disorders in the body (Fig.3.6).



Do you know?

Blood is made up of red blood cells, white blood cells and a fluid plasma. Red blood cells carry oxygen while white cells protects the body from infections.



Activity 3.2

Construct a stethoscope as shown in the Fig 3.7, and listen to the heart beat of your friends.

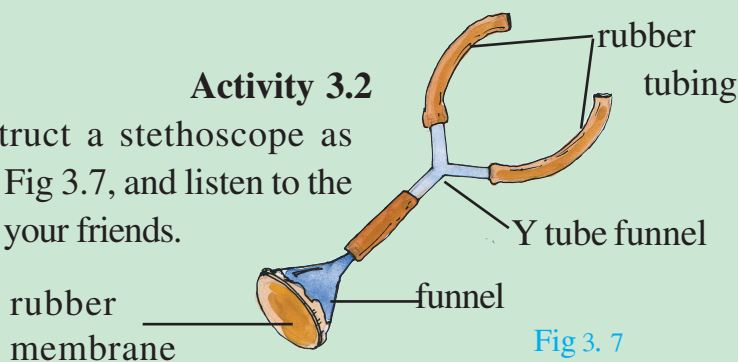


Fig 3. 7

Excretory system of man

Life activities taking place inside the human body produce many waste matter which are not needed by the body. They are transported by the blood to the organs which will send them out from the body. These are called **excretory organs**. This process is called **excretion**.

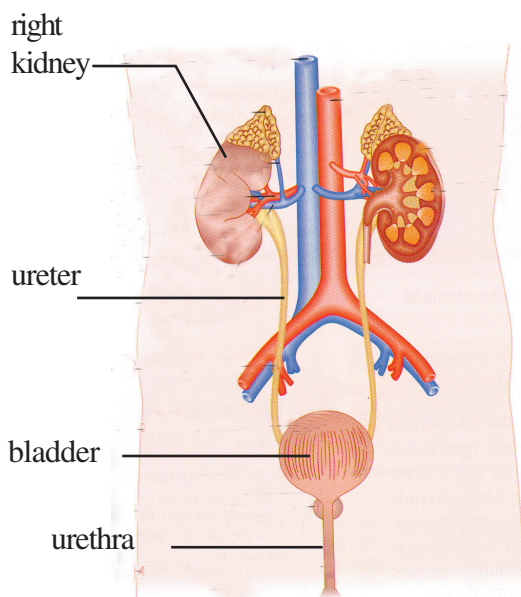


Fig 3.8 - Excretory system

Kidneys

The main excretory organs of the body are the **kidneys**. Urea formed in the liver and other waste products such as ammonia are brought to the kidneys by the blood. In the kidneys these substances as well as any extra salt and water in the blood are subjected to filtration. The product is urine. Urine is sent along the **ureters** to the urinary **bladder** which is an expandable bag. Urine is stored in the bladder for sometime till it is removed. (Fig 3.8)



Do you know?

The amount of urine filtered daily from the kidneys is about 1-2 litres.

Skin

The **skin** that covers our body also does an excretory function. Waste material such as urea and salts along with water, forms sweat. Sweat is brought to the skin by the sweat ducts which open out on the surface of the skin by tiny pores. Sweat is secreted through these pores.

You already know that water vapour and carbondioxide are by-products of respiration. Hence they too can be considered as waste matter. They are sent out in expiration.

Reproductive system of man

Organisms can live only for a limited time. This is common to man as well. Therefore all animals ensure the continuation of their kind by reproduction. The process of producing a new fertile generation is called **reproduction**.

The system organized to carry out this function is the reproductive system. Males and females have separate systems for this purpose. Therefore humans are uni-sexual.

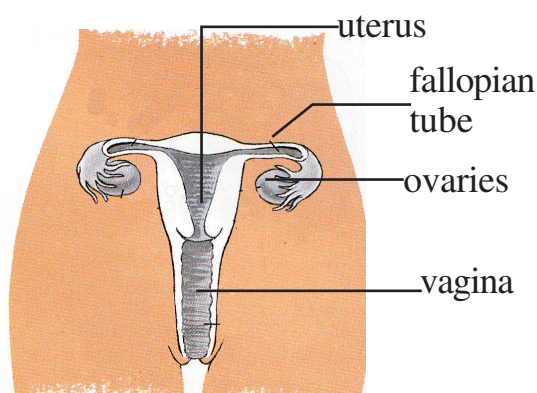


Fig 3.9 - Female reproductive system

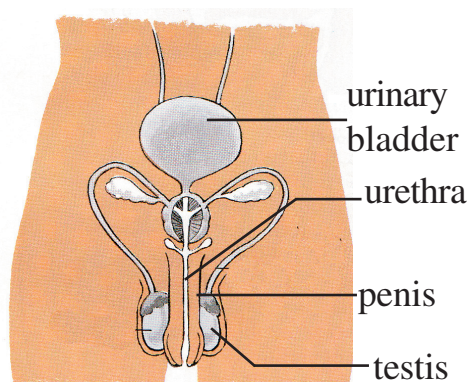


Fig 3.10 - Male reproductive system

Female reproductive system is placed in the lower part of the abdominal cavity. (Fig3.9). It has a pair of ovaries, a pair of fallopian tubes and a uterus. This connects with the outside by the **vagina**. Ovaries produce female gametes.

Most parts of the male reproductive system are found outside the body. (Fig3.9). It has a pair of **testis** and **penis**. Testis produce the male gametes.

Male and female gametes unite to form an embryo which develops into a foetus inside the mother's womb till it is born.

Nervous system of man

So far we studied the various systems of man separately. But they do not act separately. They work in co-ordination with one another. The **system** that carries out this control and co-ordination is the **nervous system**.

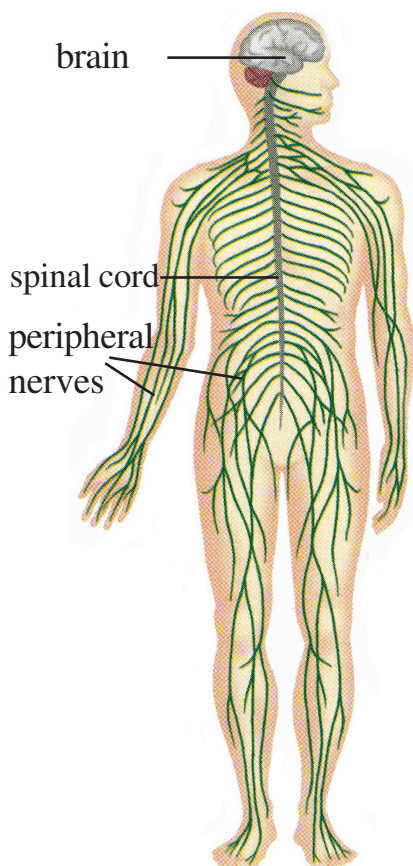


Fig 3.11 - Nervous system of man

The main parts of the nervous system are the brain, spinal cord and the peripheral nerves. Nervous system is responsible for transmitting information about the environment and for responding them. As well it helps to direct the thinking process too. Sense organs such as the eyes, ears, nose, tongue and the skin help us to get information about the environment. The messages from the sense organs are sent to the brain or spinal cord along the peripheral nerves and appropriate responses are made. Working of all the systems of the body are controlled and co-ordinated by the nervous system.

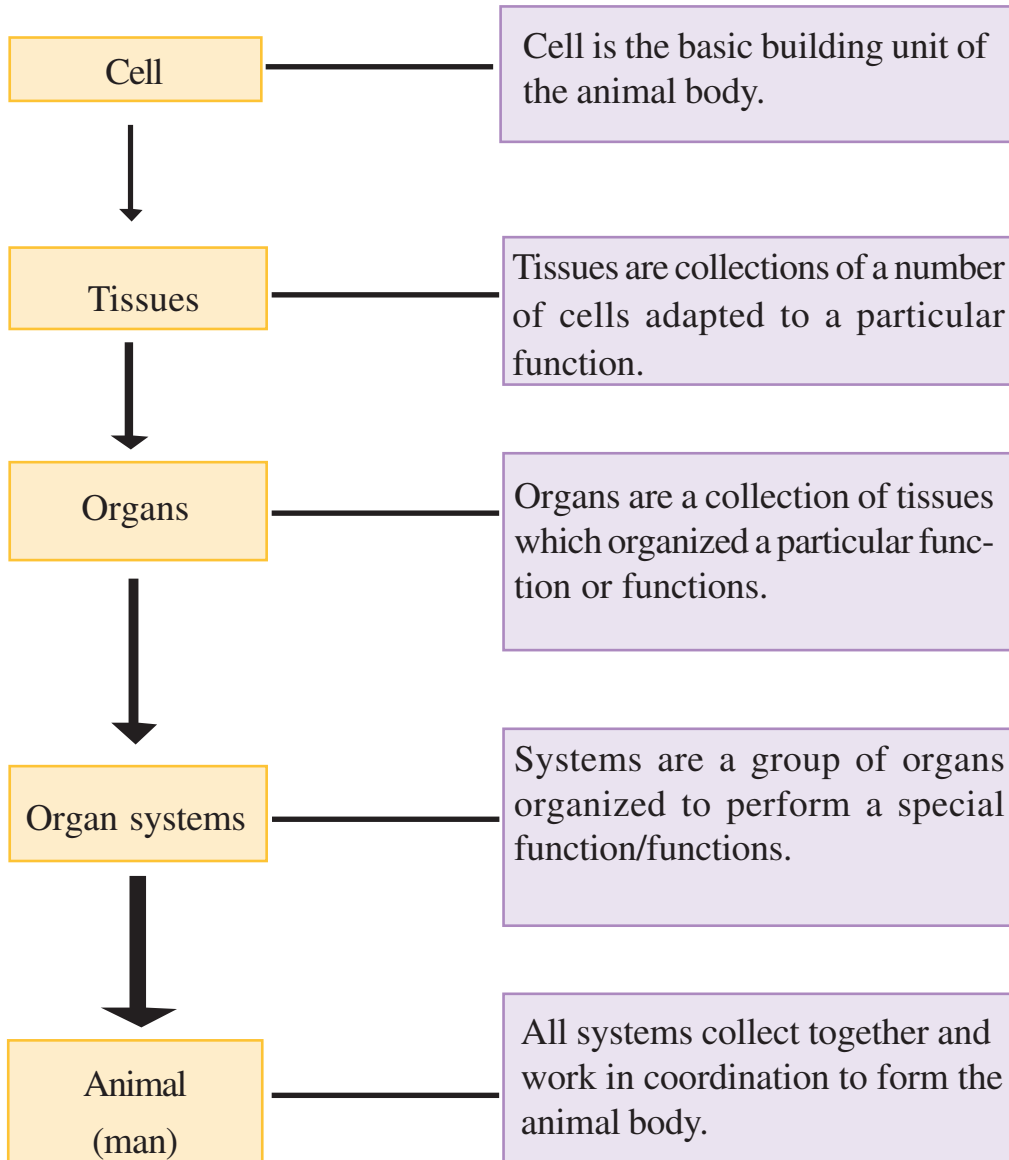
3.1.2 Cells and Tissues

organization levels of the animal body

In the organization of the animal body, various sub-levels can be identified. Cells which are the basic units of the animal body, get grouped together to form tissues. Tissues get organized to form organs,

and organs are grouped together to form systems. All systems work together to form the animal body.

This organization is shown in the following flow – chart



3.2 Patterns of organization in the plant body to carry on its functions

“Plant is the most wonderful creation of nature.” Plants are considered as organisms, because they too like animals perform various life functions. Yet plants differ from animals in certain ways. The most important thing is the ability of plants to prepare their own food. When we look at the trees, shrubs, creepers and herbs around us, the most striking feature is their green coloured leaves. Most cells of the leaf have the green pigment chlorophyll in them. This chlorophyll can prepare food using the energy of sunlight. Therefore we can consider plants as food producing factories.

3.2.1 Common structure of the plant body



Activity 3.3

Uproot a small plant such as Balsam, Acalypa or Vernonia from the garden without breaking its roots. Wash the roots and observe the plant carefully. Identify its parts. (Fig 3.11)



Activity 3.4

Uproot a grass plant without breaking its roots. Wash the roots well and observe the plant carefully. Identify its parts. (Fig 3.12)

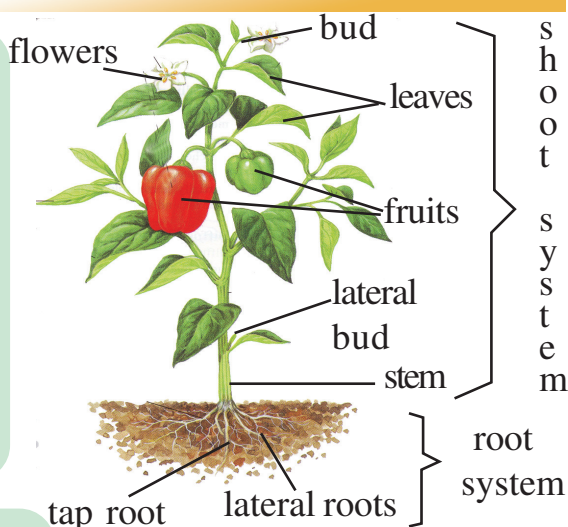


Fig. 3.12 - Parts of a plant with tap root system

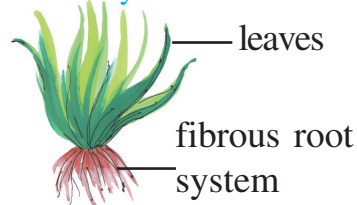


Fig. 3.12 - Parts of a plant with fibrous root system

Basic parts of a plant

A plant has two main parts.

Shoot system - This is the part that grows above the soil growing towards to sunlight.

Root system - This is the part that remains underground and grows into the soil.

Shoot system

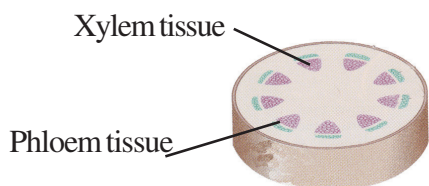


Fig 3.14- Cross section of a stem

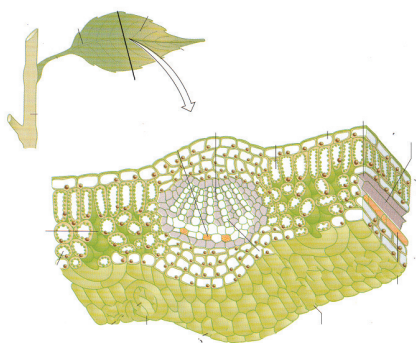


Fig 3.15 - Microscope view of a longitudinal section of a leaf

The parts that belong to the shoot system are stem, leaves, buds (terminal buds and axillary buds), flowers and fruits. (Fig 3.12). Stem of a plant bears the leaves, flowers and fruits. Shoot systems are of various types such as branched, un-branched, bush like, creepers etc. Water and food is conducted through the stem to all parts of the plant.(Fig 3.14). Water is transported by specialized cells in the **xylem tissue**. Food translocation takes place by similarly adapted cells of the **phloem tissue**. Most important parts of the shoot system are the leaves. Their main function is

photosynthesis. Leaves are arranged on the stem so as to get maximum sunlight for this activity. The main organs for gaseous exchange in plants are also the leaves. (Fig 3.15)

Flower is the reproductive organ of the plant. After the reproductive function, some parts of the flower are shed off while the **ovary** develops into the fruit and the **ovules** inside it become the seeds. These seeds help the plant to produce its next generation. In addition, leaves, stems, buds can also be used for getting more plants. Normally

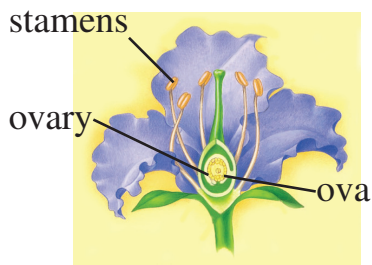


Fig 3.16 - half flower

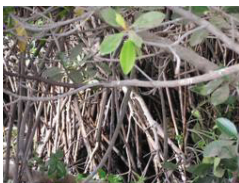
stems are found above the soil, but there are stems which grow underground as well. **They mostly store food for the next generation.** Some underground stems are potatoes, ginger, onions, colocasia etc.



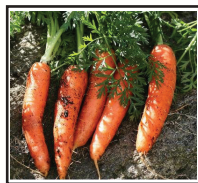
Fig 3.17 - Underground stem -Potatoes

Root system

Plants have two types of root systems namely, the tap root system and the fibrous root system. The main functions of roots are fixing the plant firmly to the soil, absorbing water and nutrients needed by plants. Some roots store food as well. Examples are manioc, sweet potatoes, carrot, radish etc. Although the root system is normally seen under the ground, sometimes it may be above the ground as well. The stilt roots of pandanus, breathing roots of sonneratia and clinging roots of pepper and betel are some such examples.



prop roots
Kadol - stilt roots



Storage roots
Carrot



respiratory roots
Sonneratia - (Kerala)



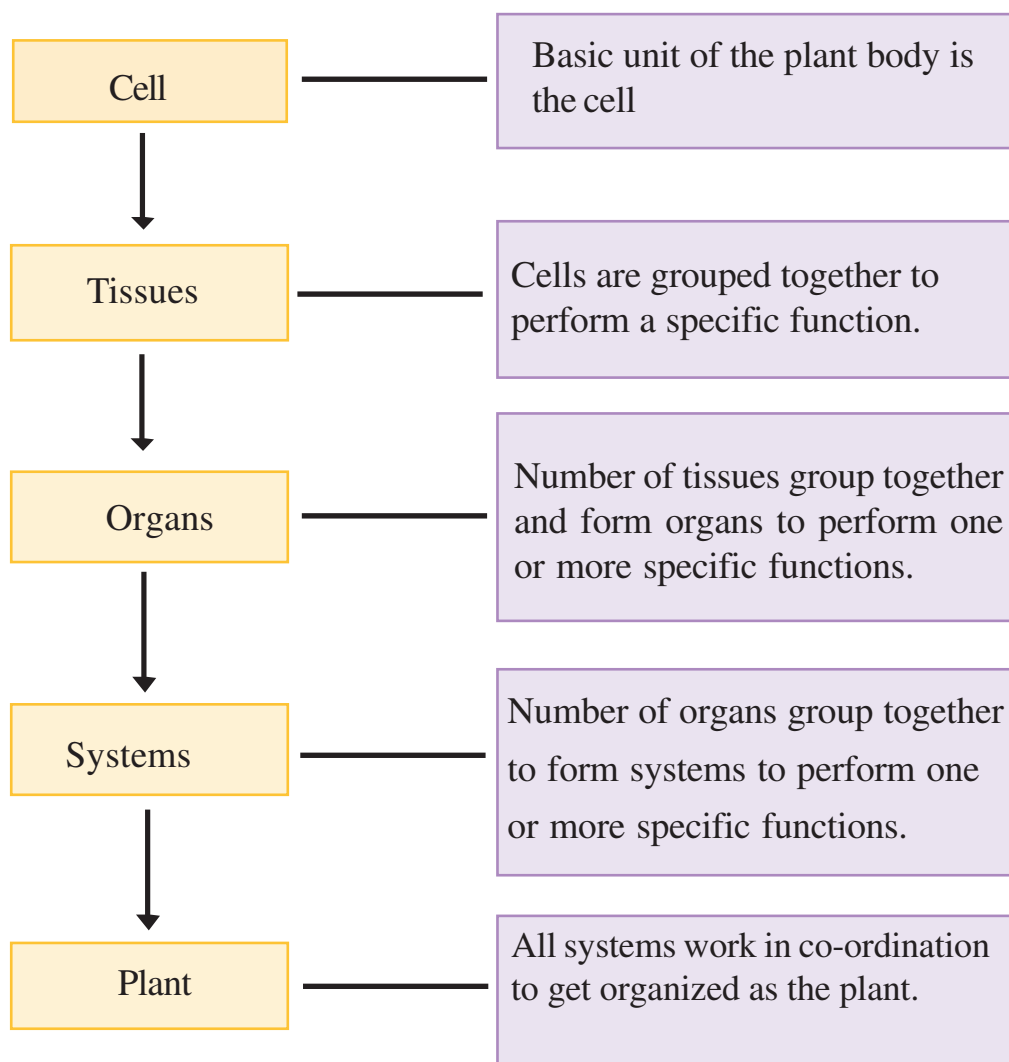
clinging roots
Betel

Fig 3.17 - Various types of roots

So far we considered the two main parts of a plant, the shoot system and the root system.

Organizational levels of the plant body

In the organization of the plant body too, various sub levels can be identified. The basic unit of organization here too is the cell. Cells get together to form tissues. Number of tissues form organs and a number of organs form systems. Systems are organized to form the plant body.





Exercises

1. Write 'right' or 'wrong' as suitable against the following sentences.
 - i) Carbondioxide is an excretory product.
 - ii) Elimination of faeces is a function of the excretory system.
 - iii) The basic building unit of organisms is the tissue.
 - iv) Water is conducted in the stem along xylem tissue.

2. Connect appropriate statement from column **A** with that of column **B**.

A

- i) Digestive system
- ii) Respiratory system
- iii) Excretory system
- iv) Reproductive system
- v) Blood circulatory system
- vi) Nervous system

B

- Reproduce their kind.
Gets rid of waste matter.
Conduction of substances.
Digestion and absorption
Co-ordination of the systems
Exchange of gases
Prepares food.

3. State the functions of the following parts in the plant ?
 - i) Stem
 - ii) Leaves
 - iii) Flowers
 - iv) Roots