5 MOVEMENT AND LOCOMOTION

The energy that is released from food is utilised for various life activities. The movement in organisms is the most visible activity at the expense of energy. The chemical energy obtained as a result of respiration is converted to mechanical energy and this makes movement possible.

Movement of one way or another, is seen in all organisms. What are the benefits of movement to organisms?

- Gathering food
-
-

Movement - voluntary and involuntary

Observe Figure 5.1. What are the activities that people are involved in? In these activities which organs are involved in movement?

These movements can be controlled by our will. They are called voluntary movements. Find out other examples for voluntary movements.

- Movement of the tongue
-
-

Fig. 5.1 People involved in different activities

The heart is an organ that beats continuously. Can we control the beating of the heart according to our will? Such movements are called involuntary movements. Find out examples for involuntary movements and note them down in your science diary.

You have learnt that muscles make movement possible. Muscles are formed from muscle cells. These cells are seen as fibres in muscles.

Muscles that make voluntary movements possible are called voluntary muscles. Since they work in association with the bones, they are also known as skeletal muscles. The fibres of the voluntary muscles are cylindrical in shape. When we look at muscle fibres through a microscope we can see horizontal lines on them. Hence they are also called striated muscles.

Examine Figure 5.2 and identify some of our voluntary muscles.

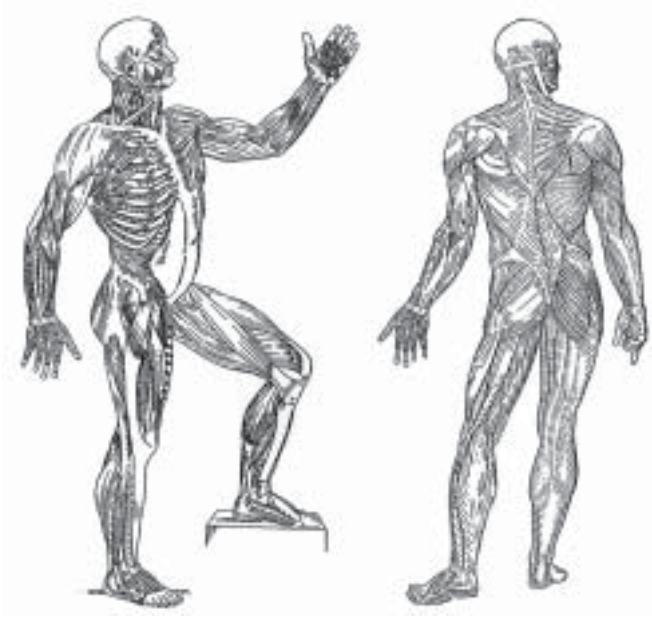


Fig. 5.2
Some voluntary muscles in human beings

How are voluntary movements effected?

For doing work, our hand is the organ mostly used. Observe Figure 5.3 and find out how movement of the hand is made possible.

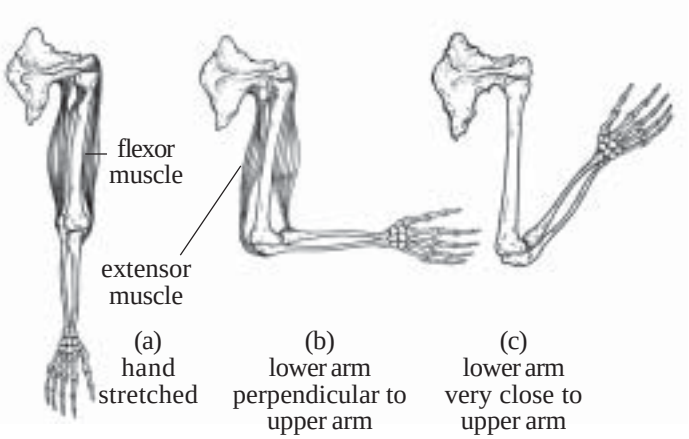


Fig. 5.3 Working of the muscles of the hand

- ★ Which muscle is contracting when the hand folds ?
- ★ Which muscle is relaxing when the hand folds ?
- ★ Which muscle contracts during the stretching of hand?
- ★ Which muscle relaxes when the hand straightens ?

Discuss with your friends. Draw muscles in Figure 5.3.c on the basis of your inferences.

You have understood how the movement of hand is effected by the activity of a pair of muscles in the arm. It is clear that when one muscle of a pair contracts the other relaxes. Such pair of muscles is known as antagonistic muscles. Contractions of such antagonistic muscles working in opposite directions form the basis of most of the body movements.

Muscles require a constant source of energy if they are to work continuously. For continuous hard work of the muscle the available oxygen may not be sufficient. Then, muscles depend on anaerobic respiration for energy. Due to anaerobic respiration lactic acid gets accumulated in the muscles. As a result muscles get tired and become unable to work further. This state is called muscle fatigue. If sufficient rest is taken lactic acid is removed to the liver and the muscles become ready for work again.

Where are involuntary muscles seen? What are their characteristics? Examine the description given.

Involuntarily...

The muscles that cause involuntary movements are not connected to bones. Involuntary muscles are seen usually in tubular organs, for eg. alimentary canal, urinary tract, blood vessels etc., The muscle fibres seen in involuntary muscles are spindle shaped. They do not have any striations. Hence they are also known as non-striated muscles or smooth muscles. They do not suffer from muscle fatigue.

Though cardiac muscles are also involuntary, they are different from other involuntary muscles in structure and function. The muscle fibres of the heart are striated and branched. These muscles can work without fatigue for the whole life time.

You have now understood reasonably about muscles. Figures of different types of muscles are given below (Table 5.1). Identify the muscles and fill up the table.

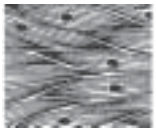
Muscles	Features	Part of the body where the muscle is seen
 ..... muscle		
 ..... muscle		
 ..... muscle		

Table 5.1 Different types of muscles and their characteristics

In association with the muscles

You have understood role of muscles in effecting movement. Are the muscles alone involved in making movement possible? The skeletal muscles work in association with bones. Examine Figure 5.4.

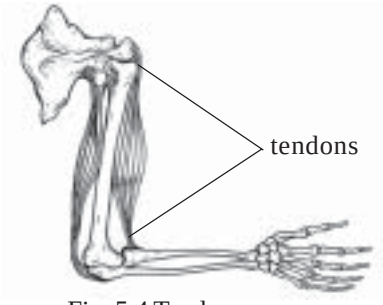


Fig. 5.4 Tendons

It is clear that some strong thread like portions seen attached to muscles connect them to the bones. These are called tendons.

Our skeletal system is divided into two - the axial skeleton and the appendicular skeleton. The bones which form a framework of the body belong to the axial skeleton. The bones which help in movement are included in the appendicular skeleton. Observe Figure 5.5. Identify the bones that belong to the axial skeleton and the appendicular skeleton and fill up Table 5.2 given below. Observe the skeleton available in your school laboratory and identify each bone and compare them with the table.

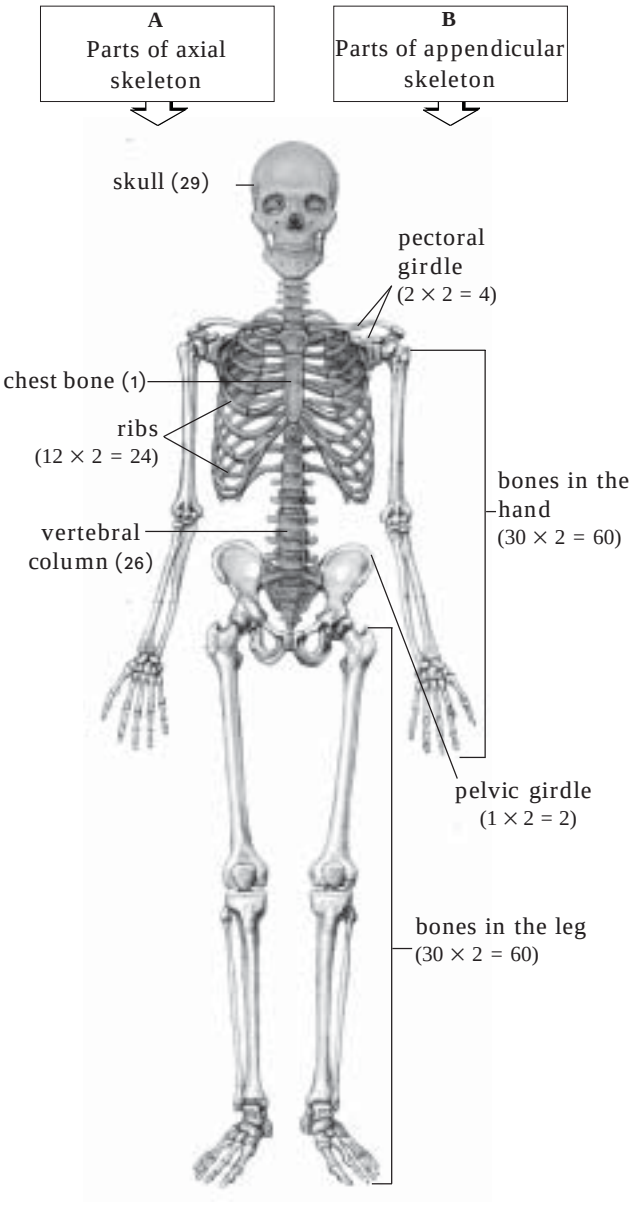


Fig. 5.5 Human skeleton
(number of bones given in brackets)

Human Skeleton			
A.Axial skeleton		**B.Appendicular skeleton**	
Parts	Number of bones	Parts	Number of bones
Total number of bones =		**Total number of bones =**	
Total number of bones in the human body (A+ B) =			

Table 5.2 Bones in the axial and appendicular skeleton

Some joints in the skeletal system help in movement. Such joints are called movable joints. They render the voluntary movements brisk and exact. What types of movable joints are available in our body? Where are these joints found?

Move the parts of your body, identify the type of joints involved and fill up Table 5.3.

Type of Joint	Features	Examples
Ball and socket joint		
Hinge joint		
Gliding joint	The more or less flattened ends of two bones move gently as though they glide.	Shoulder joint Hip joint
Pivot joint	Helps in the movement as though it pivots on an axis.	The joint between the first two vertebrae

Table 5.3 Different types of joints and their special features

How does the structure of movable joints help in movement?

Examine Figure 5.6. On the basis of the indicators given discuss with your friends.

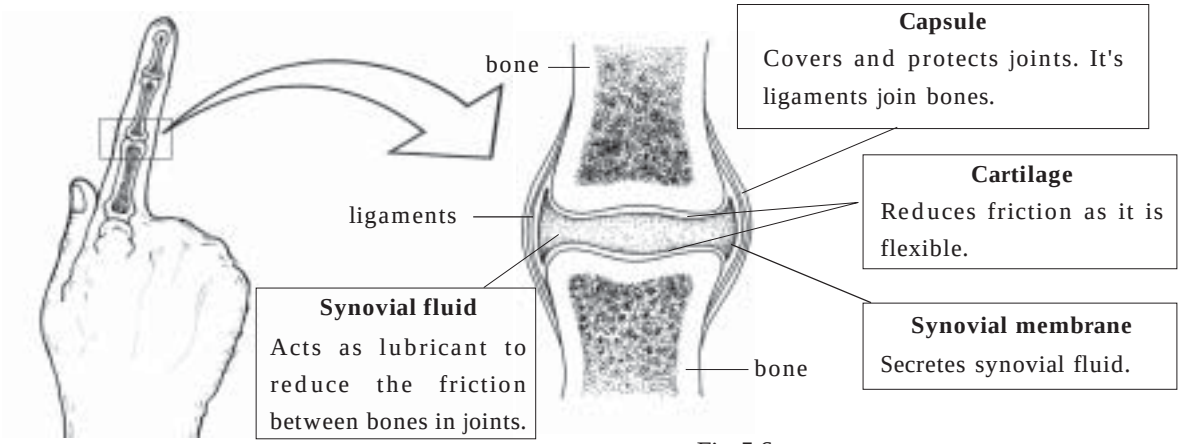


Fig. 5.6
Joint - generalised structure

Indicators

- ★ Name the part that connects bones to each other?
- ★ What is the function of the capsule?
- ★ How is friction between the bones avoided at the joints?

Prepare a note from your inferences.

In our body there are also joints that cannot be moved. These are called immovable joints. Identify the immovable joints of the skull from Figure 5.7.

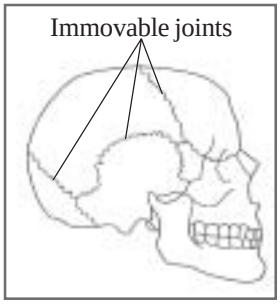


Fig. 5.7 Immovable joints

You have understood the role of cartilages in reducing friction at the joints. Cartilages are less hard than bones and more flexible. It is the cartilage that permits flexibility of the pinna of the ear. Where else in the body do you find cartilage? List them.

The skeletal system of fish like sharks and rays are made wholly of cartilage.

The bones harden by the deposition of calcium salts (mainly calcium phosphate) between bone cells. It is thus clear why the bones of adults are harder than those of infants.

The skeletal system has many other functions besides helping in movement. Do you know what they are?

- Formation of blood cells
-
-

Skeletons - inside and outside the muscles

Our skeletal system is covered with muscles. Such a type of skeleton is called endoskeleton. Examine the organisms in Figure 5.8.

Fig. 5.8
Some organisms with exoskeleton

They have muscles inside the skeleton. Their skeleton is known as exoskeleton. Prepare a list of animals with exoskeleton. Are remnants of exoskeleton seen in vertebrates? Discuss and prepare a note.

Have you thought of the difference between movement and locomotion? Movement is the change of position of any part of the body. When the body as a whole moves from one place to another, it is called locomotion. Have a look at nature. We can see a wide variety in the mode of locomotion among organisms.

Those who move in the air

As on land organisms move also through air. You know that the ability to fly is developed mainly in two types

of animals. Some mammals can also fly.

In ancient times some reptiles like the *Pterodactyl* (Figure 5.9) could fly. *Draco* and flying squirrel do not actually fly. They use some extensions of the skin (petagium) and glide through the air.

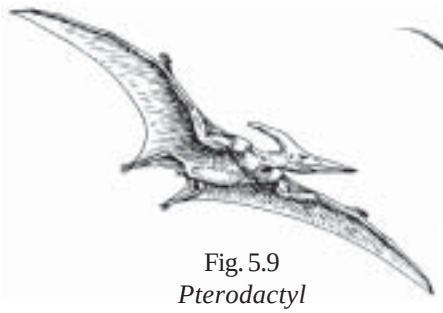


Fig. 5.9
Pterodactyl

Fig. 5.10
Draco

Fig. 5.11
Flying squirrel

By swimming and rowing

A number of organisms live in water. Most of them have special features that enable them to move through water. Examine Figure 5.12.

Observe the movement of fish in the aquarium. On the basis of your observations, the description and the indicators given, prepare a note on the locomotory organs in fish.

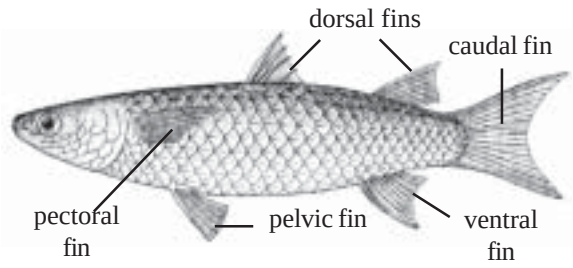


Fig. 5.12 Fish - Structures of locomotion

Locomotion in Fish

The air bladder in the body of the fish helps them to swim in water. They are able to move across different levels in the water with the help of the air bladder. By the alternate contraction and relaxation of the muscles on either side of the body of the fish, a wave like motion is generated. This pushes the water backwards. As a result, the fish move forwards. The fins help in maintaining balance and regulating the direction of locomotion.

Indicators

- ★ How does the shape of the fish help in its locomotion in water?
- ★ Which are the features in the body of fish that help in movement?
- ★ How are fins useful to fish?

Different organisms adopt different methods of locomotion in water. Read the descriptions given. Collect information and pictures of different modes of locomotion in water and display them on the bulletin board.

Once in a while through air

Some fish glide metres high through the air above the surface of water. They are known as flying fish (Figure.5.13). Some of these can fly upto 50 metres through the air.

Fig. 5.13 Flying Fish

Rowing and rowing...

Flippers are the locomotory organs in whales which are modified forelimbs. Unlike fish, the tail of whale is horizontally flat.

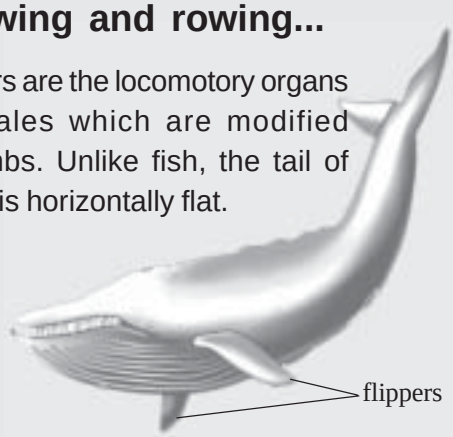


Fig. 5.14 Whale

The wonders of locomotion

We know that certain organisms migrate in large groups for gathering food, for reproduction, to escape from adverse climatic conditions etc. Read the description given below.

The Journey of the Eels

The journey of the European eel is a wonder among migrations. The eels are seen in depths of about 275 metres south east of the Bermuda Triangle in the Sargasso sea. The larvae of the eels start a long journey from here. After three years they reach the European coast. And then they travel to inland water bodies through the river mouths. They attain maturity in 8-10 years and return. They crawl along meadows and even damp grounds, and cross rivers during the back journey. After travelling more than 4000 miles they reach back the Sargasso sea. Some may die or become prey to other animals during the journey. After reaching the Sargasso sea, they give birth to next generation and die.

Fig. 5.15 The European Eel

The migration of birds is also one of the wonders of the living world. They traverse thousands of miles and come back. They seek prey, make nests, lay eggs and hatch them. Then they go back in the right path. You are wonderstruck, aren't you? Take up the task of collecting information on such wonderful migratory journeys as an assignment and prepare notes. Present them in the class.

Locomotion - various types

Moving the tentacles for gathering food and contracting the whole body when there is a threat are common movements in hydra. But the hydra also has different modes of locomotion well. Observe Figure 5.16 showing the mode of locomotion of hydra and prepare a note.

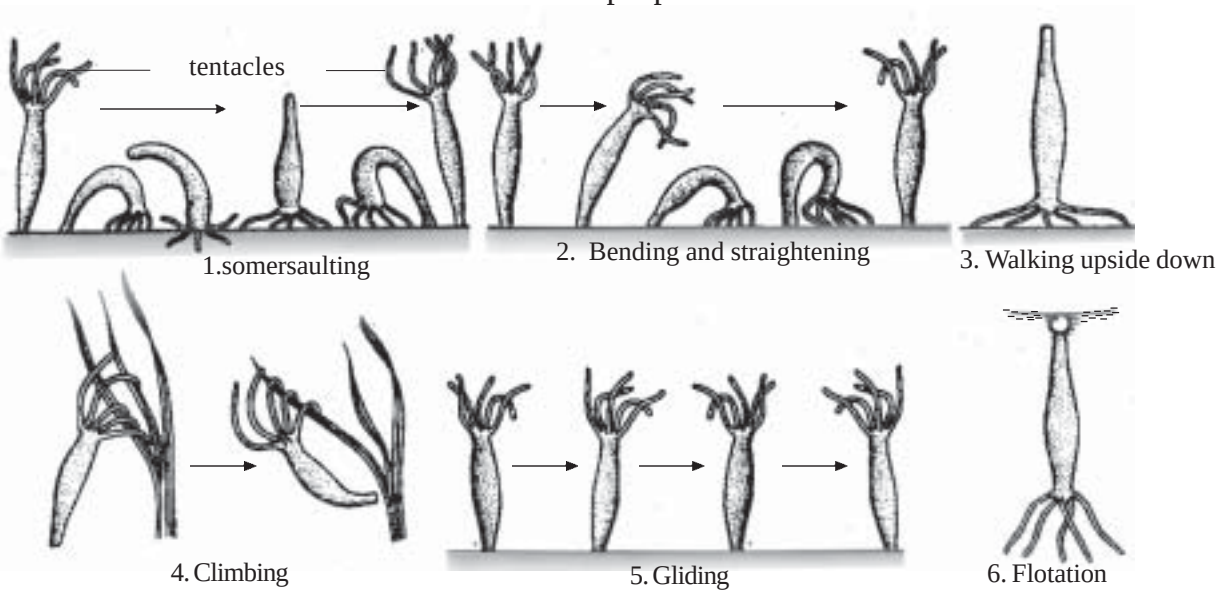
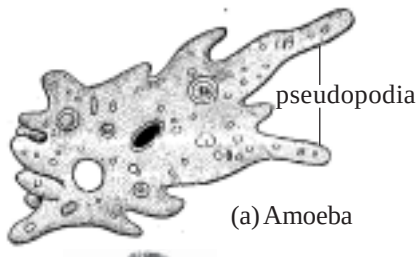


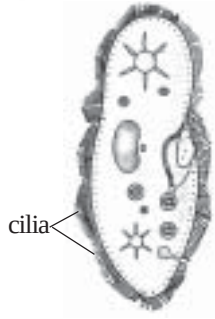
Fig. 5.16 - Modes of locomotion of the Hydra

Wonders of locomotion in the microscopic world



(a) Amoeba

Pseudopodia are the locomotory organs in unicellular organisms like amoeba. The extensions of cytoplasm towards the direction of movement are the pseudopodia.

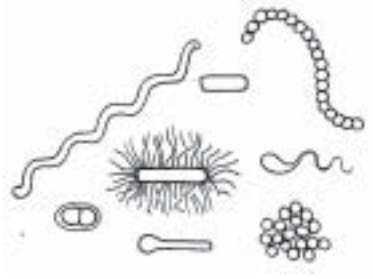


(b) Paramecium

The cilia are the hair -like cytoplasmic filaments seen on the surface of the cell. Their rhythmic movement makes locomotion possible, eg. Paramecium.

(c) Euglena

The flagella are long cytoplasmic filaments. Certain microscopic organisms move by whipping these flagella in a fluid medium, eg. Euglena



(d) Bacteria

In certain bacteria locomotory organs like flagella are seen, eg., *Vibrio cholerae*. In some bacteria locomotion is effected by the movement of a spiral shaped body, eg., Treponema. Some bacteria do not have specialised organs for locomotion. They move according to the direction of flow of water or wind.

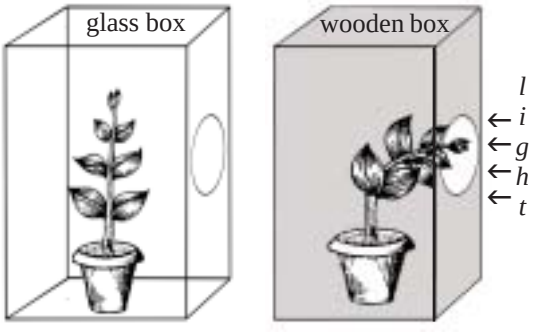
Fig. 5.17 - Locomotory organs in microorganisms.

You have understood the vast diversity in the locomotory organs in micro-organisms. Take up an assignment for observing the water of a pond with decaying leaves under the microscope and examine the movements of microorganisms in it. Prepare notes.

Movement in plants

You know that plants do not move. But they too exhibit many types of movements. You might have definitely noticed the response in a touch-me-not plant when you touch it. The blooming of a bud is another movement that is seen in a plant. There are plenty of other examples of movements in plants. Find out and list them.

As in other organisms stimuli are responsible for plant movements. Stimuli are circumstances that cause response in living organisms. The presence of light, water, chemicals, gravity, touch etc., are the stimuli for plant movements. Don't you want to know what sort of movements are caused in plants by these stimuli? Examine Figure 5.18 given below.



(a) control setup (b) experimental setup

Fig. 5.18 The response of a plant to light.

★ How does the experimental setup differ from the control setup?

★ In which direction has the stem bent in the experimental setup?

★ What could be the reason for this?

It is clear that the stimulus of light influenced the direction of movement of the plant. When the direction of the stimulus influences the direction of the movement, the movements are called tropic movements. When the movement is towards the stimulus, it is called positive tropism. But when these movements are in the opposite directions they are called negative tropism.

What type of phototropism did the stem in the experiment show? Note it down in your science diary.

You would have understood why coconut trees growing along the border of paddy fields bend towards the fields.

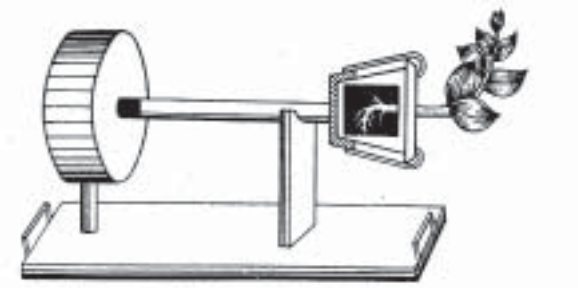
Roots generally exhibit negative tropism.

Another stimulus that influences the growth of plants is gravity. You would have seen that a plant in a pot that has fallen bends to grow upward. Is the influence of light the only reason for this? In Figure 5.19, what would be the direction of roots of the plant? Write down your guess.

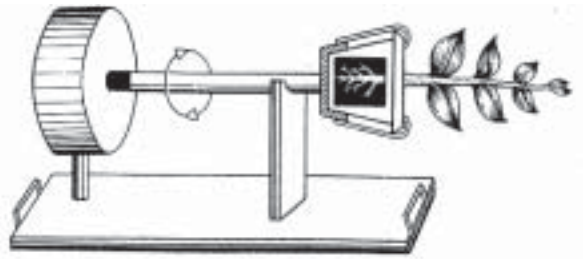
Figure 5.19

Certain movements are seen in plant growth also due to gravity. Such movements are called geotropism or gravitropism.

Observe the figures given below.



(a) When the seedling was placed in a stationary setup for few days



(b) When the seedling was placed in a slowly rotating setup

Fig. 5.20

In Figure 5.20 b, since the plant rotates slowly, the pull of gravity is experienced evenly in all parts. What about the plant in Figure 5.20 a?

- ★ In what manner did gravity influence the movements shown by the plant in Figure 5.20 a? Which plant part showed positive geotropism?
- ★ Which part of the plant exhibited negative geotropism?
- ★ Why are such movements not shown by the plant in Figure 5.20 b?

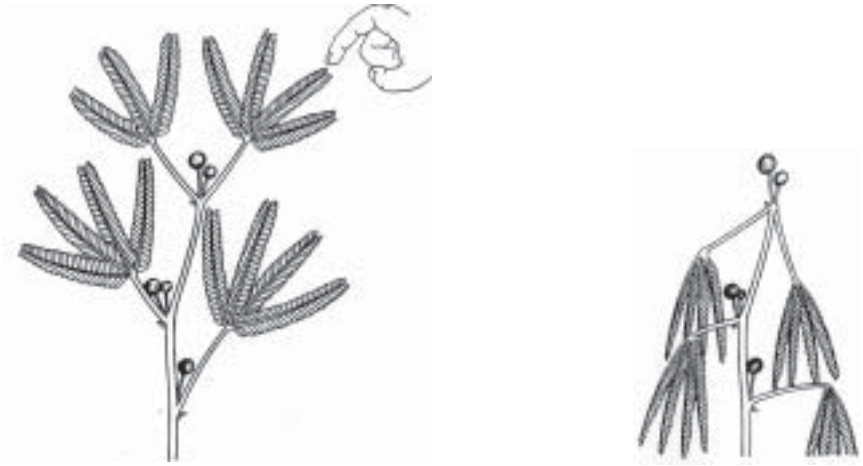
Discuss with your friends and formulate inferences. Assess your guess previously formed, based on the inferences now drawn and prepare a note.

Another stimulus that influences the movement of plants is the presence of water and nutrients. Haven't you noticed the growth of roots towards water? What we see here is the positive hydrotropism exhibited by roots. Plant stems generally exhibit negative hydrotropism. Set up an experiment to observe hydrotropism and write your inferences in your science diary.

It is common that roots grow into manure pits. It is clear that the presence of chemicals which are nutrients to the plant has influenced the direction of growth of the roots. After pollination, the pollen tube grows towards the ovary. Some chemicals produced by the ovary influence the direction of growth of the pollen tube. The influence of chemicals on the movement of plants it is called chemotropism.

You would have seen that some creepers climb around supporting

Fig. 5.21



(a)
before touch

(b)
after touch

fig. 5.22 Touch - me - not plant

plants. Observe Figure 5.21. The stimulus of touch (tactile stimulus) influences the climbing movement. Movements which are stimulated by touch are called haptotropism. Find out examples and note them down in your science diary.

The movement that occurs when you touch a touch-me-not plant is different from this. If you touch any part of the plant, the leaves droop downwards. Here, the stimulus of touch does not influence the direction of movement. Such movements are called nastic movements. Find more examples of nastic movements and note them down in your science diary.