LIFE PROCESS
BIOLOGY CBSE CLASS 10

Every organism performs different types of pbysiological activities. For these activities organisms required energy. This energy is obtained by organisms througb different methods of nutrition. Autotrophic organisms obtained nutrition by performing the process of photosynthesis. While heterotrophic organisms dependent on other organisms for food. In animals, the entire process of ingestion of food conversion into easily absorbable components and transport to the different cells is known as nutrition. The process of getting energy from nutritive substances is carried out by cells. Thus, phenomenon is generally known as cellular respiration. During this process energy is realesed which can be utilised by organisms for physiological activities.

12.1. What are Life Processes ?

All the organisms perform certain main functions to keep themselves alive. The main fundamental functions, performed by living organisms to maintain their life are called life processes. They are nutrition, growth, respiration, circulation, excretion, control and coordination, movement and reproduction. The nutrition means taking of food and converting it into smaller absorbable unit by our body. The process of respiration releases energy from the absorbed food. Transport is the process through which absorbed substance are transported to various parts of the body. Waste materials produced in various cells of the body are removed from the body by process of excretion. Control and coordination keep the living organisms to survive in the cbanging environment surrounding them. The process of growth involves the change in size of the living organism (small to big). In the process of movement the living organisms move from one place to another or make movement of smaller to larger parts of the body. The process of reproduction involves multiplication of existing organisms, so they can make existence of tbeir species on the earth.

Nutrients

Nutrients mean substances which provide the two basic requirements of organisms, namely organic raw material and energy.

12.2. Nutrition

Nutrition can be defined as the process of intake of nutrients from which organisms derive energy to work. A substance which supply nutrients to the body is called diet or food. The food taken by an organism contains, carbohydrates, proteins, fats, vitamins, water and minerals. In organisms there are different ways for obtaining food. Hence in various organisms different modes of nutrition can be seen.

Modes of Nutrition :

The modes of nutrition means methods of obtaining food by organisms. All the organisms do not obtain their food in the same way. So organisms have following methods for obtaining food.

(A) Autotrophic (Holotrophic) Nutrition

(B) Heterotrophic Nutrition

[A] Autotrophic nutrition :

The word 'auto' means self and 'trophe' means nutrition. Autotrophic means 'self nutrition'. In autotrophic nutrition organisms synthesize their own food, like carbohydrate, from water and carbon dioxide with the help of chlorophyll in presence of sun light. This process is known as photosynthesis. e.g. green plants, Euglena, Volvox and Bacteria. Carbohydrates are used for providing energy to them. The carbohydrates which are not used are stored in the form of starch. We derived energy from the food which is stored in our body in the form of glycogen.

The following events are involved in the process of photosynthesis :

(i) Absorption of light energy by chlorophyll

(ii) Conversion of light energy into chemical energy

(iii) Reduction of carbon dioxide in to carbohydrates.

Let us see how sunlight, chlorophyll and CO_2 are important for photosynthesis. In leaf some cells contain green organelles viz. chloroplasts which contain chlorophyll. Let us do an activity which demonstrates that chlorophyll is important for photosynthesis.

Activity : I

- Take a potted Croton plant whose leaves are partly green and partly white.
- The green part of the leaf possesses chlorophyll while the white part of the leaf does not have chlorophyll.
- Keep this plant in a dark place for about three days to destarch its leaves.
- Now keep the plant in sunlight for about six hours.

Fig. 12.1 Variegated leaves

- Pluck the variegated leaf from the plant and remove its "chlorophyll" by boiling it in alcohol. Thus green parts of the leaf get decolourised.
- Now dip the leaf in a dilute solution of iodine for a few minutes.
- Observe the change in colour of leaf.
- The inner part of the leaf which was originally green turns blue on dipping in iodine solution, this shows that starch is present in it.
- The outer part of the leaf which was originally white (without chlorophyll) does not turn blue while dipping in iodine solution, showing that no starch is present.
- From this observation we can conclude that chlorophyll is essential for the process of photosynthesis.

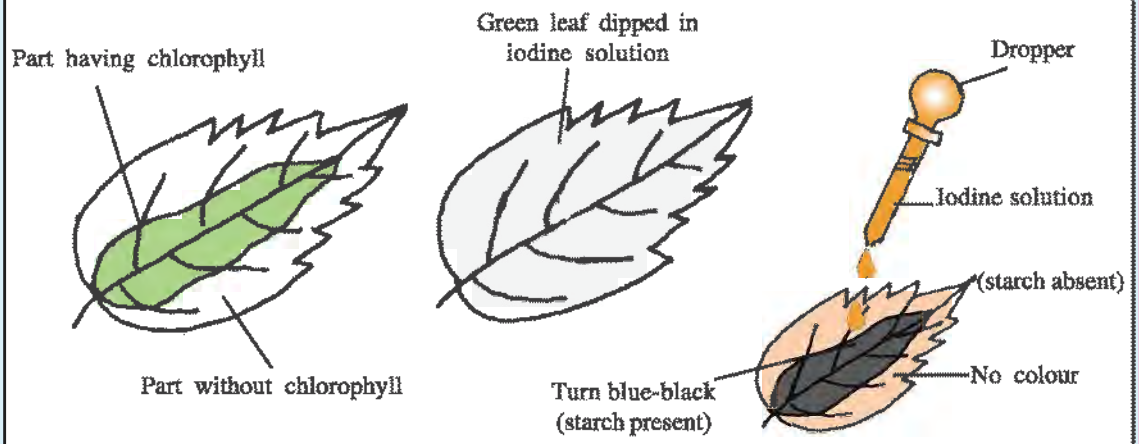

Fig. 12.2 Experiment shows necessity of chlorophyll for photosynthesis

Let us know how the plants obtain carbon dioxide. The plants take carbon dioxide from the atmosphere for photosynthesis. The carbon dioxide enters the leaves of plant through the stomata present on the surface of leaves. The stomata are also present in the green stems of plant.

Fig. 12.3 Stomata

Each stomatum consists of minute pore surrounded by a pair of guard cells. The opening and closing of stomata are controlled by the guard cells. When water enters into the guard cells, the cells become turgid and cause the pore to open. When the guard cells lose water, they shrink and cause the pore to close. Aquatic plants obtain the carbon dioxide gas dissolved in water to carry out photosynthesis.

Activity : 2

Let us do an activity which demonstrate that carbon dioxide is necessary for photosynthesis.

- Take two potted plants which are nearly same in size.
- Keep them in a completely dark place for three days to destarch their leaves.
- Now put each potted plant on a separate glass plate.
- Put a watch glass containing potassium hydroxide by the side of one of the plants. The use of potassium hydroxide is to absorb carbon dioxide.
- Cover plants with separate bell – jars.
- Use vaseline to seal the bottom of the jars to the glass plates so that set-up is airtight.
- Keep the plants in sunlight for more than two hours.
- Pluck the leaf from both plants and check the presence of starch as in activity No. 1. This shows that carbon dioxide is necessary for photosynthesis.

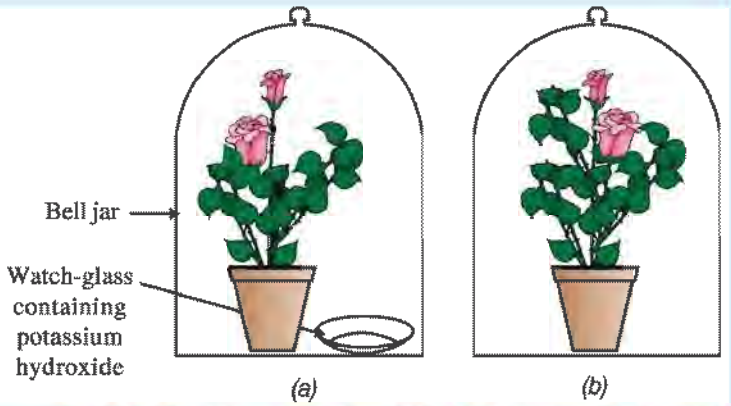

Fig. 12.4 Experimental set-up (a) with potassium hydroxide (b) without potassium hydroxide

Activity : 3

Sunlight is necessary for photosynthesis

- Take the potted plant with green leaves and place it in a dark place for about three days to destrach its leaves.
- Take a thin aluminium foil and wrap it in the centre of one leaf on both the sides, in such way that the remaining part of the leaf remain uncovered and exposed to sunlight. The covered part of leaf does not receive sunlight.
- Keep this potted plant in bright sunlight for three days.
- Pluck the partially covered leaf and remove the aluminium foil.
- This leaf is to be tested for the presence of starch.
- Before testing starch, chlorophyll from the leaf is removed.
- Put the plucked leaf in a beaker containing alcohol
- Put the beaker containing alcohol and leaf, into water bath.
- Heat the water bath, alcohol in the beaker will also get heated and start boiling.

The boiling alcohol will remove chlorophyll from the green leaf completely.

- Now the leaf becomes almost colorless, remove colorless leaf from alcohol.
- Put the colorless leaf in a perti-dish and with the help of dropper put a drop of iodine solution.
- Observe the change in colour of leaf.
- Part of the leaf which was covered with aluminium foil does not turn blue-black because sunlight could not reach there. Hence this part did not perform photosynthesis to make starch.
- The uncovered part of the leaf, which was exposed to sunlight turns blue-black on adding iodine solution.
- The starch is present in this part of the leaf. This means that the part of the leaf which was exposed to sunlight make starch by the process of photosynthesis. So we can conclude that sunlight is necessary for photosynthesis to make starch.

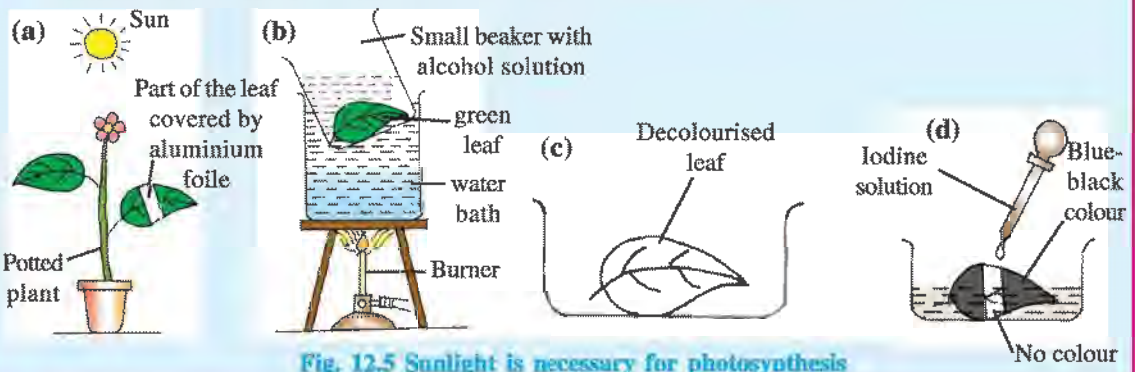

Fig. 12.5 Sunlight is necessary for photosynthesis

Now we have understood how autotrophs meet their energy requirements. We should keep in mind that plants also require other raw materials like water, nitrogen, phosphorus, iron and magnesium for building their body which are taken from soil. For the synthesis of protein, nitrogen and other compounds these are essential elements.

[B] Heterotrophic nutrition

All organisms are adapted to their environment. The heterotrophic nutrition differs depending on the availability and also bow it is obtained by tbc organism. In heterotrophic nutrition thc organisms cannot synthesize their own food by using carbon dioxide, sunlight and water. In heterotrophic nutrition energy is derived by digestion of organic substances obtained from plant and animal. In this type of nutrition, after intake, the food is digested in to simple forms and then organisms utilize it. All animals, bacteria and fungi are heterotrophic organisms.

Heterotrophic nutrition is of the following types:

[1] Saprophitic nutrition :

Here the dead and decaying organic materials are absorbed througb the body wall of the organisms. The organisms depend entirely on the non-living substances. e.g. Bacteria and Fungi.

Fig. 12.6 Fungi

[2] Parasitic nutrition :

When organisms depend on another living organisms for their nutrition, then this mode of nutrition is called parasitic nutrition and the organism from which they obtain food is called 'host'. The parasite has close association with the host and ohtains food from it. The host is not benefited but harmed. Several bacteria, fungi, plant like cuscuta and animal like tapeworm, ascaris etc live as parasites.

[3] Holozoic nutrition :

In this type of nutrition parts of plants or animals or whole organism are taken in as food which is then digested with the help of digestive enzymes into simple substance and then absorbed by body cells of the animals. The undigested food is thrown out of the body of animal through the process of egestion.

12.3 How do organisms obtain their nutrition ?

In different animals, food and the way how they obtained food are different. Animals cannot make their own food and hence, they obtain food either from plants or animals. All the animals can he divided into three groups on the basis of their food eating habits.

(1) Herbivores : Those animals which eat only plants are known as herhivores. eg. Goat, cow etc.

(2) Carnivores : Those animals which eat only animals are known as carnivores. eg. Lion, Tiger.

(3) Omnivores : Those animals which eat both plants and animals are known as omnivores. eg. Man, Rat

Nutrition in Amoeba :

Amoeba is unicellular animal. The mode of nutrition in Amoeba is holozoic. In Amoeba the process of obtaining food is called phagocytosis (means cell feeding). The various processes involved in nutrition are ingestion, digestion, absorption, assimilation and egestion. Amoeba ingests food particles by forming temporary finger like projections known as pseudopodia around them so the food is encaptured along with lysosomes into a bag called food vacuole.

Digestion : In Amoeba food is digested in the food vacuoles by digestive enzymes.

Absorption : The digested food found in food vacuoles is absorbed directly into cytoplasm by diffusion

Assimilation :

A part of the food absorbed in cell is used to obtain energy through respiration. The remaining part is used in the growth of Amoeba.

Egestion :

The undigested food remains in the food vacuole is thrown out of the body hy rupturing cell membranes.

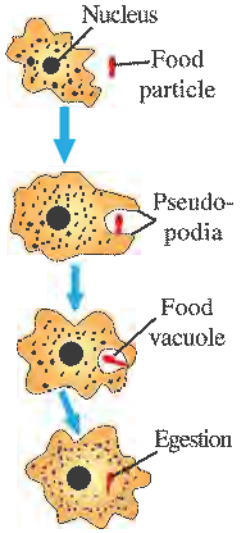

Fig. 12.7 Nutrition in Amoeba

The unicellular animal Paramoecium has thin, hair-like cilia found all over the body. Through sweeping of cilia the food particle found in water enters in the mouth of Paramoecium, this process is known as ingestion. Ingestion is followed by other steps as described in the case of Amoeba.

12.4 Human Digestive System :

The digestive system of human consists of the alimentary canal and its associated glands. The human digestive organs are mouth, oesophagus, stomach, small intestine, large intestine and associated glands like salivary gland, liver and pancreas.

The mouth is the special organ for ingestion of food. With the help of hands the food is put into mouth. The digestion of food starts as we put food in our mouth. The mouth cavity contains teeth, tongue, and salivary glands. The teeth cut the food into small pieces, chew and grind it. The salivary gland secretes the saliva in our mouth. The tongue mixes the food with saliva. Saliva is a watery liquid so it wets the food in mouth. The wetted food is swallowed easily.

The salivary gland secretes an enzyme called amylase, which digests the starch of food into maltose. Thus, the digestion of starch begins from mouth. As the food remains in the mouth for a short time, the digestion of food is incomplete in mouth. The partly digested food in the mouth goes down to oesophagus. Now the food is carried from oesophagus to stomach. The stomach is present on the left side of the abdomen. The food is churned in stomach for nearly three hours. The food breaks into small pieces and converts into semi-solid paste. The wall of stomach contains three tubular glands which secrete gastric juice. The gastric juice contains dilute hydrochloric acid, enzyme pepsinogen and mucus. The mucus protects the stomach wall from its own secretion of hydrochloric acid and pepsin. The hydrochloric acid makes the acidic medium in stomach. It also kills bacteria which enter the stomach with food. In acidic medium, the enzyme pepsin digests protein, present in the food, and converts into small molecules. Thus digestion of protein begins in the stomach. The partly digested food then goes from the stomach into small intestine. The exit of food from stomach is regulated by a sphincter muscle. The small intestine is the largest part of the alimentary canal and in adult person it is about 6.5 meter long. The length of the small intestine differs in various animals depending on the type of food they eat. Herbivorous animals, eating grass, need a longer small intestine to allow the cellulose, present in grass, to be digested completely. The meat is easy to digest, so the carnivorous animals have shorter small intestine.

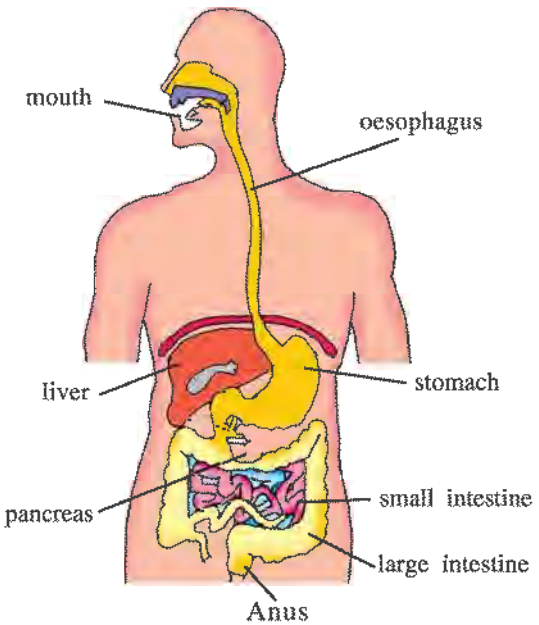

Fig. 12.8 The human digestive systems

The small intestine in man is the site of complete digestion of carbohydrates, proteins and fats. The small intestine receives the secretion from liver and pancreas. The liver secrets bile, which is a greenish yellow liquid and normally stored in the gall bladder. The bile is alkaline in nature and contains salts. It makes the acidic food coming

from the stomach alkaline, so that pancreatic enzymes can act on it. The bile salts break the fats present in the food into small globules, making it easy for the enzyme to act and digest them. The pancreas secretes pancreatic juice which contains enzyme like amylase, trypsin and lipase. The enzyme amylase digests starcb, the trypsin digests proteins and lipase digests fats.

The glands of the wall of small intestine secrete intestinal juice. The intestinal juice contains various enzymes which complete the digestion of carbohydrates into glucose, proteins into amino acids and fats into fatty acids and glycerol.

After complete digestion, the small intestine becomes the main site for the absorption of digested food. The inner wall or the small intestine has millions of small, finger-like projections called villi. The presence of villi increases the surface of small intestine. This helps in the rapid absorption of digested food. The absorbed digested food passes through the wall of the small intestines, goes into our blood.

The blood carries digested food to all the parts of body where it is assimilated as part of the cells. This assimilated food is used by all the cells, where it is utilized for energy, growth and repair of the body. The undigested food passes from small intestine to large intestine, where most of water from the undigested food is absorbed. Now the undigested food becomes almost solid, and is removed from the body via anus. The exit of this waste material (faeces or stool) is regulated by the muscles of anus.

12.5 Respiration

Cells in order to perform various functions require energy. This energy is derived by the oxidation of food. The process of releasing energy from food is called respiration. The process of respiration involves intake of oxygenated air into the cell (inspiration), using it for releasing energy by burning of food, and then removal of the carbon dioxide and water from the body. During the process of respiration energy is released inside the cells. So it is known as cellular respiration. Respiration is essential for life, because it releases energy to carry out different life processes.

Types of respiration :

Respiration is of two types, aerobic and anaerobic.

Aerobic respiration :

The respiration which takes place in the presence of oxygen is called aerohic respiration. Aerobic respiration takes place in the cell, so it is also called cellular respiration. During this food (Glucose) is broken down into carbon dioxide and water in the presence of oxygen. The energy released in the process is stored in ATP.

The overall equation can be represented as follows :

$$\text{Glucose} \xrightarrow[\text{in cytoplasm}]{\text{Glycolysis}} 2\,\text{Pyruvic acid} \xrightarrow[\text{(in mitochondria)}]{\text{Oxygen(Kreb's cycle)}} 6CO_2 + 6H_2O + 38\,\text{ATP Energy}$$

Anaerobic respiration :

The respiration which takes place without oxygen is called anerobic respiration. It is seen in microorganisms like bacteria, yeast, fungi, end parasites and muscle cells. In anaerobic respiration, the microorganisms break down glucose into ethanol and carbon dioxide and release energy. CO_2

and ethanol are formed as end products in plants, while lactic acid is an end product in muscles of animals. The equations are as follows :

$$\text{Glucose} \xrightarrow[\text{in cytoplasm}]{\text{Glycolysis}} 2 \text{ Pyruvic acid} \xrightarrow[\text{Yeast}]{\text{In absence of oxygen}} 2 \text{ Ethanol} + 2CO_2 + 2ATP$$

$$\text{Glucose} \xrightarrow[\text{in cytoplasm}]{\text{Glycolysis}} 2 \text{ Pyruvic acid} \xrightarrow[\text{In muscles of animals}]{\text{In absence of Oxygen}} 2 \text{ Lactic acid} + 2 \text{ ATP}$$

Difference between aerobic and anaerobic respiration :

Aerobic respiration	Anaerobic respiration
(1) It takes place in presence of oxygen.	(1) It takes place in absence of oxygen.
(2) End products are CO_2 and water	(2) End products are ethanol or lactic acid.
(3) It takes place in cytoplasm and mitochondria	(3) It takes place only in cytoplasm.
(4) Aerobic respiration produces a considerable amount of energy.	(4) Much less energy is produced.

Respiration in plants :

Plants also need energy like animal. The plants get this energy by the process of respiration. Plants also use O_2 of air for respiration and release CO_2. The respiration in plants differs from that of animals by the following ways:

(1) All parts of a plant (like root, stem and leaf) perform respiration independently.

(2) There is a little transport of gases from one part to another in plant.

(3) Respiration in plants occurs at much slower rate than in animal.

Exchange of gases in root and stem :

The roots of a plant take oxygen for respiration from the air present in between the soil particles by the process of diffusion. The extensions of the epidermal cells of a root are known as root hair. These root hairs are in contact with air in the soil hence, oxygen diffuses into root hairs and reaches all the cells of the root for respiration. The CO_2 gas produced in the cells of the root during respiration moves out through root hairs by the process of diffusion.

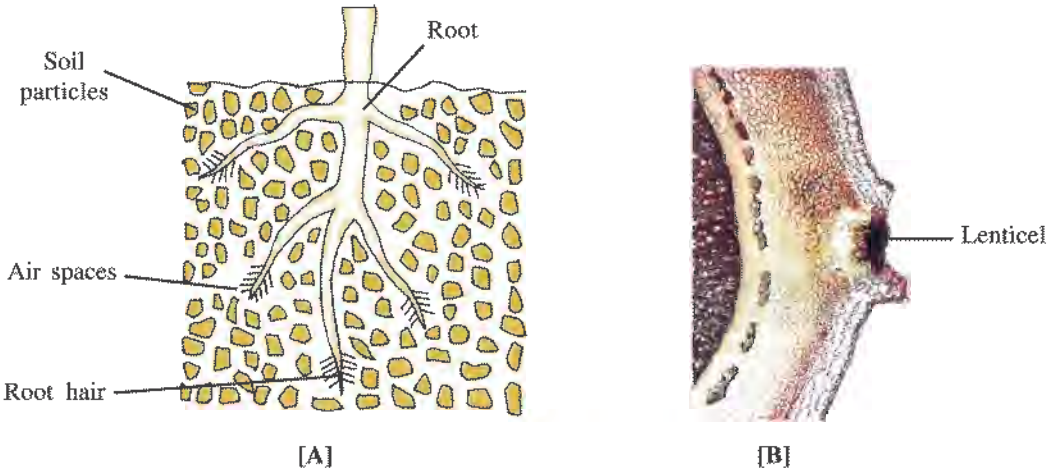

Fig. 12.9 [A] Absorption of Oxygen through root [B] Lenticel

The stems of herbs have stomata, so the exchange of gases takes place through stomata. The oxygen from air diffuses into stem through stomata and reaches all the cells of stem for respiration. The CO_2 gas produced during respiration diffuses out into air through stomata. The hard and woody stems of big plants do not have stomata. In woody stems, the bark, has lenticels for respiratory gaseous exchange. The leaves of a plant have small pores called stomata. The exchange of respiratory gases by the process of diffusion takes place througb stomata. In leaves during day time wben pbotosynthesis occurs O_2 diffuses out and CO_2 diffuses in, but at night time no photosynthesis occurs so O_2 diffuses in and CO_2 diffuses out.

Fig. 12.10 Stomata

Respiration in animals :

Various animals have different modes of respiration. In unicellular animals (eg. Amoeba) respiration takes place in ccll membrane by diffusion of gases. In earthworm the respiratory organ is skin. In insects tracheae are the respiratory organs. The aquatic animals like fish, prawns, crabs and sepia have gills as respiratory organs which obtain oxygen dissolved in water. In frog, lizard, bird and human beings the lungs are the respiratory organs.

Respiration in human being :

Human respiratory system consists of nostril, nasal passage, pharynx, laropharynx, trachea, bronchi, lungs and diaphragm. Nostrils open into nasal cavities. The air for respiration is drawn into our body through nostril. This air then goes into nasal cavity. The nasal cavity is lined by fine hairs and mucus. The dust particles and microbes in the air get trapped in mucus of the nasal cavity. Nasal cavity ends in internal nostril through which air passes to pharynx. The pharynx leads to tracbea, through a slit called glottis. Glottis is protected by a cartilaginous flap like epiglottis. While swallowing food, glottis is covered by the epiglottis so food cannot enter the trachea. Trachea does not collapse even when there is no air because it is supported by 'C' shaped cartilaginous ring. At the upper end trachea bas a voice box known as larynx. Trachea runs down the neck and divides into two bronchi which lead into the lungs. Eacb bronchus divides in the lungs and form many smaller bronchioles. The smallest bronchioles terminate into alveoli. The wall of the alveoli is thin and covered by blood capillaries. In alveoli the gaseous exchange takes places.

Mechanism of breathing :

When the diaphragm pulls down and rib muscles contract, the volume inside the thoracic cavity increases and air pressure inside the cbest cavity decreases hence, air from outside (being at higher pressure) rushes into the lungs. So the alveoli get filled with oxygen rich air and exchange of gases takes place. When the diaphragm moves up (relaxes) the volume inside the thoracic cavity decreases and thus pressure increases so air containing CO_2 is pusbed out of the lung into atmospbere through nostril.

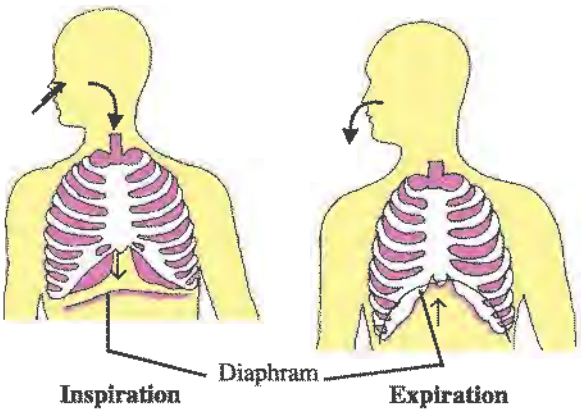

Fig. 12.11 Mechanism of Breathing

The body of multicellular organism possesses complex structure. In order to survive and maintain themselves, the body cells require oxygen, water and food. Different types of substances absorbed or synthesized in one part of the body are transported to another part of the body. This process is known as transportation. In this chapter we will study how plants and animals transport substances from one part of the body to another part.

13.1 Transportation in Plants

We have studied that plants convert solar energy into chemical energy utilizing atmospheric CO_2 and water. Other substances which are also required for the building plant bodies will be taken up separately. These substances are absorbed by the roots of the plants from the soil. If the distances between the roots and leaves are small, energy and raw materials can easily diffuse to all parts of the plant body. But if distances are large, the process of diffusion will not be sufficient to provide raw materials in leaves and energy in roots. Thus a proper transportation system is required in such situation.

As plants do not move, the energy requirement of plants is low as compared to animals which move from one place to another. In plants, energy stored in the leaves, and raw materials absorbed by the roots will be transported to the different parts of the body. Xylem moves water and other substances obtained from the soil and phloem transports products of photosynthesis from leaves to other parts of plants.

Transportation of Water : Higher plants possess xylem which is associated with the transportation of water. Water absorbed by the root from the soil is transported to stem, branches, leaves and flowers. The main structural components of the xylem responsible for the transport of water are tracheids and vessels. We have studied the structure of these components in class IX. Xylem tissue of all the organs of plants are interconnected forming a continuous system for water

conduction. As the root cells are directly in contact with soil, they take up ions. Due to this, a difference is created between the concentration of these ions between the root and the soil. Water therefore, moves into the root from the soil to eliminate this difference. This water movement creates a column of water that is steadily pushed upwards. However, in higher plants this pressure is not sufficient to move water over the heights is commonly found in plants.

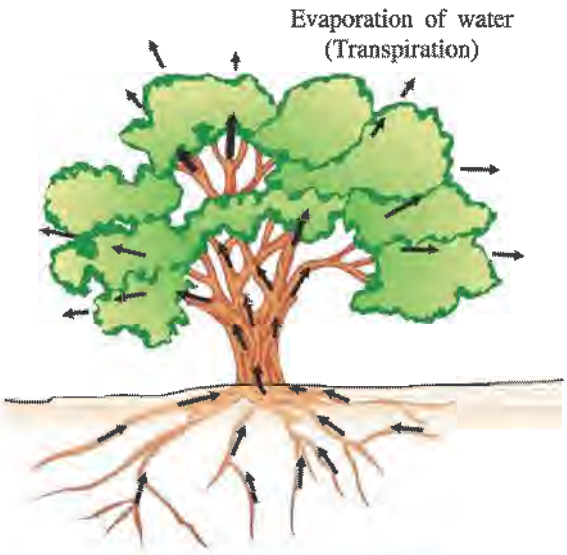

Fig. 13.1 Transport of water

Plants use another strategy to move water in the xylem upwards to the highest points of the plant body. If adequate water is available then the water which lost through the stomata is replaced by the water present in xylem vessel. In fact, evaporation of water molecules from the cells of a leaf creates a suction which pulls the water from the xylem cells of roots.

The loss of water in the form of water vapor from the aerial parts of the plant is known as transpiration. Transpiration also helps in regulation of temperature. As the stomata are open during day time, the transpiration pull becomes the major driving force in the movement of water in the xylem.

Transportation of food and other substances : Carbohydrates are synthesized in the green leaves by the process of photosynthesis. From the green leaves, these photosynthetic products are transported to the various parts of the plant body. Transportation of photosynthetic products is known as translocation and it is performed by sieve tubes and sieve cells of vascular tissue known as phloem. Besides the carbohydrates, the phloem transports amino acids, several plant hormones which are synthesized at the shoot and root tips and other substances. The translocation takes place in both, upward and downward directions. Translocation of substances requires energy which is obtained from ATP. When the material like sucrose is transferred into phloem tissue, the osmotic pressure of tissue increases leading to entry of water into it. This pressure moves the material in the phloem to tissue which have less pressure. This allows the phloem to move material according to the need of plant.

13.2 Transportation in Human Beings

The system which is concerned with the transportation of various substances in animals is called circulatory system. In human being, the transport of nutrients, oxygen, carbon dioxide, hormones, enzymes and excretory substances take place through blood and lymph. As we have studied in class IX that blood is a living red colored liquid connective tissue. The liquid medium of blood is known as plasma in which blood cells are suspended. We will study the various components of circulatory system of human being.

Heart : The human heart is conical in sbape and is of the size of a closed fist. It is located in the small space between two lungs and slightly towards the left side. As both carbon dioxide and oxygen are transported by blood, the heart is four chambered in order to prevent the mixing of oxygen ricb blood with the blood containing carbon dioxide. The upper two chambers are called atria (singular – atrium). Of these one is left atrium and the other is right atrium. The two lower chambers are known as ventricles, of these one is left ventricle and the other is right ventricle. The walls of atria are thin while the walls of ventricles are thick. All the four chambers are separated from eacb other by partitions called septa. For the flow of blood from the left atrium to the left ventricle, there is a bicuspid valve. Similarly there is a tricuspid valve between right atrium and right ventricle. These valves prevent backward flow of the blood from ventricles to atria.

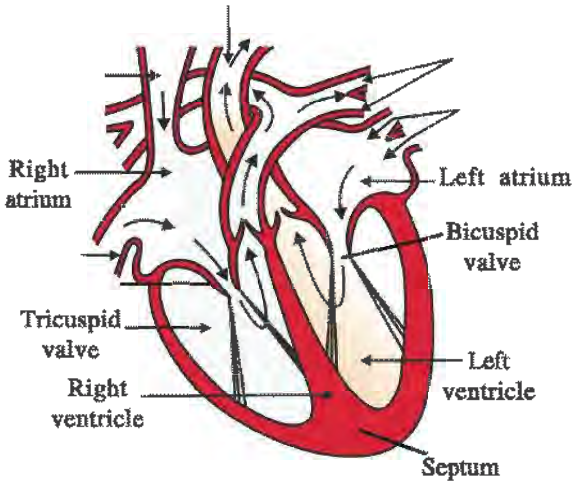

Fig. 13.2 Internal structure of heart

Entry of oxygen in the blood through lungs : Deoxygenated blood from various organs of the body is received by the right atrium through the superior and inferior vena cava. At the same time left atrium receives oxygenated blood from the lung through the pulmonary veins. Now both the atria contract and the deoxygenated blood from rigbt atrium is poured into right ventricle and oxygenated blood from left atrium is poured into left ventricle. Now both the ventricles contract. Due to contraction of right ventricle, the blood enters into lungs through arteries. In lungs CO_2 is released from blood and O_2 diffuses into it. While due to contraction of left ventricle, oxygenated blood is distributed to all the parts of the body througb the aorta.

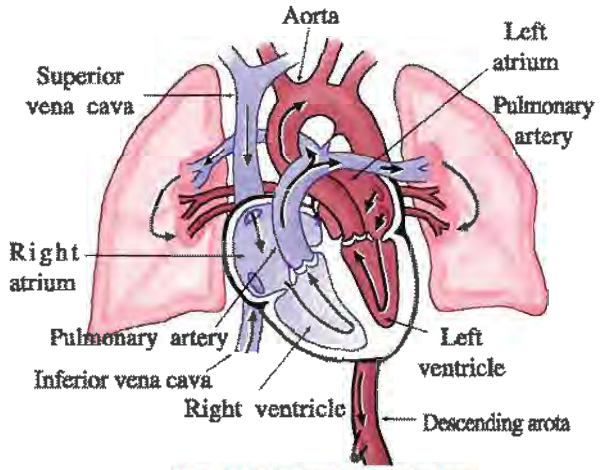

Fig. 13.3 Blood circulation

The separation of both types of the blood in the heart allows a highly efficient supply of oxygen to the body. This is useful in the animals which have high energy need, sucb as birds and mammals, which constantly use energy to maintain their body temperature.

Blood vessels : Blood circulates throughout the body along definite routes through blood vessels. Arteries and veins are sucb blood vessels. Arteries carry blood away from heart to different organs. Veins carry blood away from different organs towards heart. Since the blood is pumped in to the arteries by the heart, it is under high pressure and therefore, arteries bave thick elastic walls. Veins collect the blood from different parts of the body and bring it back to beart. In the veins, blood is not under pressure and hence, wall of vein is thin. In order to prevent backward flow of blood valves are present in veins.

On reaching to the organs or tissues, the artery divides into many smaller vessels to bring the blood in contact with all the individual cells. These smaller vessels have single cell thick walls and are known as capillaries. Exchange of materials between blood and surrounding takes place through capillaries. Capillaries then join together to form veins.

Lymphatic system : Lympbatic system consists of lymph, lymph vessels, lymphatic capillaries and lympbatic nodes. Lymph is another type of fluid which is also involved in transportation. Some amount of plasma, proteins and blood cells, escape into the intercellular spaces through the pores present in the wall of capillaries, form lymph. Lymph is colorless and contains less proteins as compared to that in the blood.

Lymph drains into lymphatic capillaries form intercellular spaces. Lymphatic capillaries join to form lymph vessels that finally open into large veins. Lymphatic system performs following three important functions :

1. Collect intercellular fluid through the medium of lymph vessels and returns it to blood circulation.
2. In the villi of small intestine, lymph vessels absorb lipids and conduct them to blood circulation
3. Protects against diseases.

13.3 Excretion in Plants

Like animals, plant do not possess any excretory organs or system. In plants O_2 may be considered as waste product generated during photosynthesis and released back to the atmosphere directly. They remove excess water by the process of transpiration. Sometimes they store excretory waste in the leaves that fall off. Many plant waste products are stored in cellular vacuoles. Other waste products are stored as resins and gums.

13.4 Excretion in Human Beings

For sustaining life, body cells perform biochemical processes. During these processes useful as well as harmful toxic substances are produced. Accumulation of toxic substances in the body may harm body and hence, there will be a need to remove these substances from time to time. The harmful substances produced during biochemical reactions are known as excretory substances and a biological process involved in removal of these excretory substances in liquid form is known as excretion. Unicellular organisms remove the excretory substances by simple diffusion from the body surface into the surrounding water. This process is complex in the multicellular organisms and hence, they use special organs to perform the same function.

Excretory system of human being : Excretory system of human being includes a pair of reddish brown bean shaped kidneys located in the abdomen on the dorsal side, a pair of ureters, one from each kidney, a urinary bladder and a muscular tube called urethra. Urethra opens out by a small opening known as urinary opening. Kidney is divided into cortex and medulla. These regions consist of the excretory units called nephrons.

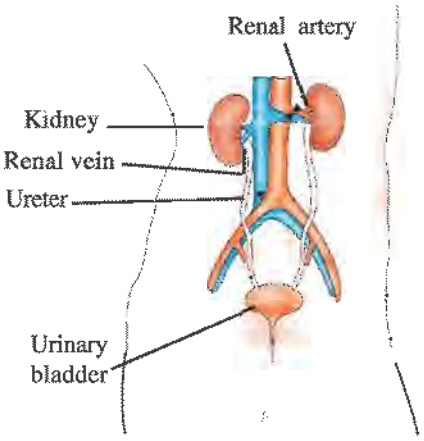

Fig. 13.4 Excretion in Human Beings

Structure of nephron : Eacb kidney has very minute tubular and convoluted structures known as uriniferous tubules. Nephrons in each kidney has ten lacs such tubules. Eacb nephron bas a double walled cup shaped structure called Bowman's Capsule at its upper end. Tbe Bowman's Capsule possesses a mass of capillaries called glomerulus. Tbe sbort tubular region after the Bowman's Capsule is called neck. After this the tubule is narrow and coiled. It consists of a proximal convoluted tubule, a Henle's loop and a distal convoluted tubule. The post end of nephron is called collecting tubule. Collecting tubule opens in the renal pelvis, whicb opens into the ureter.

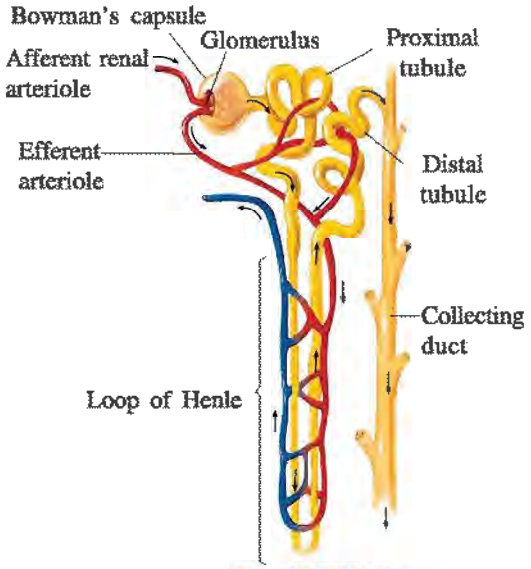

Fig. 13.5 Nephron

Process of urine formation

The waste material along with blood is brought to kidneys by the renal arteries. As the blood is under pressure in the arteries, it is filtered out from the blood capillaries into Bowman's capsule. This process is known as ultrafiltration. This filtrate passes through the lumen of tubular parts of nephron. During this useful substances like water, amino acids, minerals ions etc. are reabsorbed by blood capillaries surrounding the nephron. The remaining fluid contains excretory substances and is called urine. From the ureter urine passes into urinary bladder where it is stored. When the bladder is filled with the urine, it contracts and urine passes out of the body.

What have you learnt ?

Different types of substances absorbed or synthesized in one part of the body are transported to another part of the body. This process is known as transportation. In plants, vascular tissues like xylem moves water and other substances obtained from the soil and phloem transports product of pbotosynthesis from leaves to other parts of plant.

In higher plants, evaporation of water molecules from the cells of leaves creates a suction which pulls the water from the xylem cells of roots. The loss of water in the form of water vapor from the aerial parts of the plant is known as transpiration. The system whicb is concerned with the transportation of various substances in animals is called circulatory system. Heart, blood, lympb and vessels are the components of blood circulatory system. Arteries and veins are the blood vessels. Arteries transport blood from beart to various parts of the body while veins collect the blood from different parts of the body and supply to beart. Lympbatic system consists of lympb, lymph vessels, lymphatic capillaries and lymphatic nodes.

Like animals, plant do not possess any excretory organs or system. But animals possess various structures associated with the process of excretion. In unicellular organisms, the excretory substances are diffused out in the surrounding water. But multicellular organisms have complex mechanism of excretion. They have excretory organs and system. Excretory system of human being includes a pair of reddish brown bean shaped kidneys, located in the abdomen on the dorsal side, a pair of ureters, one from eacb kidney, a urinary bladder and a muscular tube called urethra. The formation of urine involves the processes like ultrafiltration and reabsorption.