# Chapter-8

# Major Activities of Living Organisms

## 8.1 Concept of Nutrition and its importance :

The process of food intake by animals is known as **Nutrition** . The nutritive elements present in food provide energy for various bio-chemical reactions and leads to physical growth of the body. This process of obtaining the food necessary for growth and healthy functioning of the body is known as **nutrition**. Nutrients are the food substances which provide energy to living beings and synthesize new cellular substances.

All living beings require food and the nutritive elements present therein, to perform various complex chemical reactions of the body. The nutritive elements present in the food make possible the growth of living organisms, repair of the damage, development, protection from various diseases, control of various activities reproduction etc. If food is not made available all the physical processes and functions of the body will cease.

Body of living beings is like an engine of a vehicle. Like the engine, even body needs fuel. Even the body requires continuous input of fuel to perform various activities. As soon as, sufficient fuel is not made available, even the body, like an engine will stop functioning. The reason behind it is the fact that the engine needs power to run, which is provided to it by the fuel. Similarly our body also needs energy which is provided by the food and nutritive substances. Food and nutritive substances are needed to maintain the body temperature and also to sustain the continuous growth taking place in the body.

## 8.2 Types of Nutrition :

On the basis of the mode of nutrition living beings can be divided into two main divisions

(a) Autotrophs

(b) Heterotrophs

**(1) Autotrophs :** Green plants contain a substance named chlorophyll. Hence, they prepare their own food using carbon-di-oxide, water and solar energy obtained from their environment. They are known as the **autotrophs**. Some bacteria like sulphur bacteria, nitrifying bacteria, iron bacteria are also autotrophs. They obtain the energy required to prepare their food by oxidising sulphur, nitrogen and iron compounds. They are known as the chemoautotrophic.

**(2) Heterotrophs :** Organism which a r e not able to synthesise their own food and depend on other living beings for their food, are known as the **heterotrophs**. Heterotrophic nutrition can be of the following types:

**(a) Holozoic Nutrition :** It is a type of nutrition in which the organism ingest other living beings or the carbonic substances made by them. Such type of organisms are known as holozoic living beings. They have been classified, on the basis of the source of their food, as under :

**(i) Herbivores :** Herbivors are the animals which depend on plants, directly, for their food. Examples: goat, cow, deer etc.

**(ii) Carnivores :** Animals which consume other animals, as their food are known as carnivores. Examples : Lion, tiger etc. Some plants are **insectivorous** for example : Pitcher plant, *Utricularia, Drosera* etc.

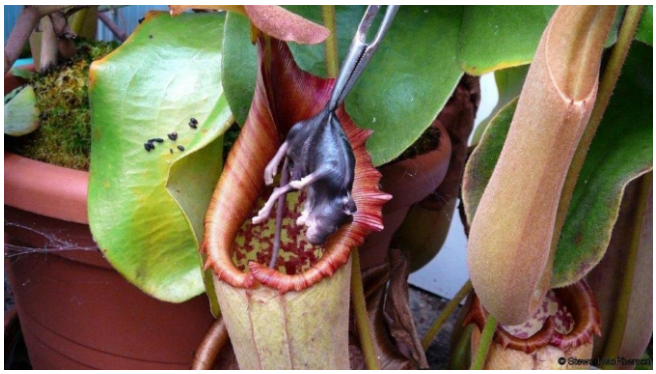
**(iii) The Omnivores :** The animals which consume both, plants and animals in the form of their food are known as omnivores. Examples : Rat, Pig, Human beings etc.

**(b) Parasites :** The organisms which reside inside or on the body of plants and

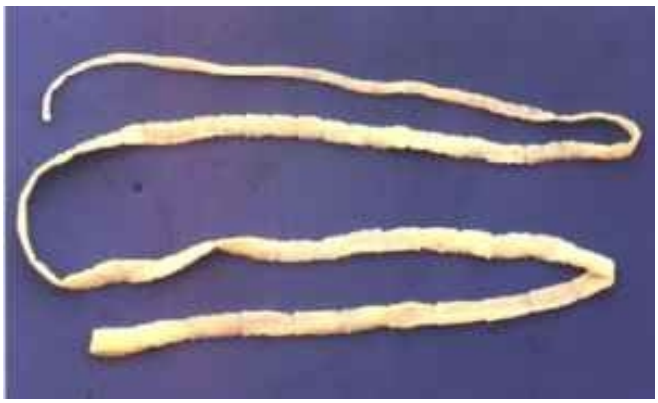
(a) Saprophyte (Mushroom)

(b) Symbotic organism (lichen)

(c) Nitrogen fixing bacteria



(d) Carnivorous plants (pitcher plant)



(e) endoparasits (Tape worm)


(f) ectoparasite (lice)

**Fig. 8.1 Different types of nutrition in living beings**

animals and obtain their food from these plants and animals are known as parasites. These parasites may be of two types :

* **Ectoparasite :** Parasites which obtain their nourishment by attaching themselves to the host skin/surface, are known as ectoparasites.

Example : Lice, Mosquito, Bedbug (animals); *Cuscuta* (plant).

* **Endoparasite :** Parasites which obtain their food by entering into the body-organs, like intestine, body cavity, liver, blood etc of their host are known as the endoparasites. Examples : Liver fluke, tape worm, plasmodium etc.

**(c) Symbionts :** The organisms which obtain their nourishment by living together are known as the **symbionts.** In **symbiosis** type of nourishment, different species live together and benefit each other. The two species living together does not cause any harm to each other.

Examples : Algae and fungi together form lichen. They spend their entire life with each other.

**(d) Saprobic Nutrition :** Some organisms obtain their nourishment from the dead and decaying organisms. They are known as **saprophytes** and their mode of nourishment is of saprobic type. Examples : Microbes, fungi, some protozoa etc.

## 8.3 Nutrition in Plants :

All living beings need food to remain alive. Energy is obtained from food. The body conducts various vital activities with this energy. If the body does not get food, all the activities and functions of our body will stop. In plants the prominent method of food formation is photosynthesis.

**8.3.1 Photosynthesis :** Photosynthesis in plants is an important activity from the perspective of environmental balance. During this activity the plant synthesize food in the presence of chlorophyll and sunlight using carbon-di-oxide and water present in the atmosphere and soil respectively and in return makes available the vital gas - oxygen. There is a vast difference in method of obtaining energy in plants and animals. Animals cannot synthesize their own food and obtain it from green plants. On the other hand, green plants use solar energy and converts it into chemical energy. The energy is stored in the form of Adenosine - tri-phosphate (ATP) and reduced Nicotinamide adenine-di-phosphate (NADPH). Plants use this energy for reduction of carbon-di-oxide. The entire process leads to the synthesis of carbohydrates, from which the animals obtain their food.

The process of absorption of solar energy by green plants and converting it into chemical energy is known as photosynthesis.

**8.3.2 Photosynthetic Pigments :** All photosynthetic organisms obtain light energy and converts it into chemical energy. This work is performed by the pigments. These pigments remain arranged in specific organelles which lie scattered in the cytoplasm. Haeckel coined the term 'plastid' for these organelles. They are present in all plants except the fungi and prokaryotes like bacteria and blue green algae.

**Chloroplasts :** These are green coloured plastids. Their green colour is because of the **chlorophyll pigment** present in them. The plants and leaves appear green because of their presence. Their function is to perform food by photosynthesis. There are two distinct regions in chloroplasts - Stroma and Grana.

**(i) Stroma :** It forms the matrix of chloroplasts. The ribosomes which synthesize proteins, remain scattered in it. The dark reaction of photosynthesis takes place in this part of the chloroplast.

**(ii) Grana :** The light reaction of photosynthesis occurs in this part of the chloroplast. There are 40-60 grana in each chloroplast. In the granum region are present numerous plate-like or disc like structures, arranged like a stack of coins. These structures are known as the thyllakoid. In higher plants four types of chloroplast pigments are present. The two green pigments are the chlorophyll a and b and the orange and yellow coloured pigments which are known as the carotene and xanthophyll respectively.

**8.3.3 Mechanism of Photosynthesis :** Carbon-di-oxide and water are the two major raw materials of photosynthesis. Chlorophyll and other

pigments absorb light energy and transform it into chemical energy. The entire process of photosynthesis can be represented by the following equation :

$$6CO_2+12H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6+6H_2O+6O_2\uparrow$$

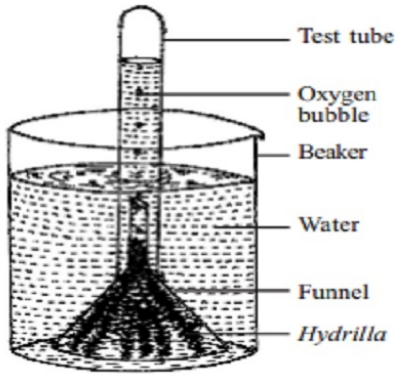



**Fig. 8.2 : Oxygen is evolved during photosynthesis (Inverted funnel experiment)**

The process of photosynthesis, basically, completes in two steps :

(i) Light reaction
(ii) Dark reaction

**(i) Light Reaction :** During this process the radiant energy of the sun is converted into chemical energy. Following are the main processes of this step of photosynthesis :

(1) Absorption of light of definite wavelength by chlorophyll
(2) Excitation of chlorophyll
(3) Photolysis of water takes place.
(4) Oxygen is evolved
(5) Conversion into chemical energy: The ATP formed stores the energy and the reducing power NADPH is synthesized.

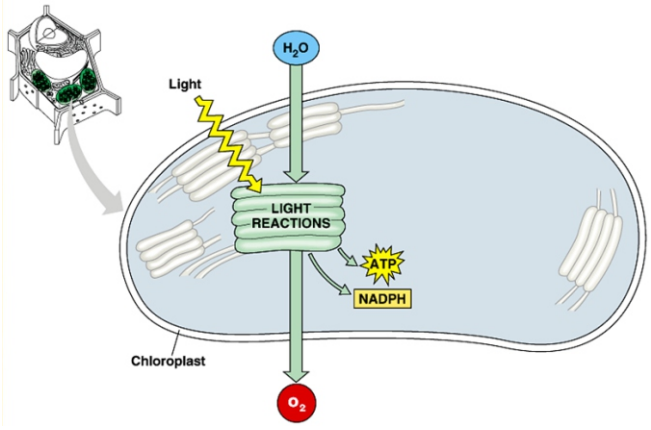



**Fig. 8.3 Light reaction**

This step is light-dependent, hence is known as the light reaction or the photo-chemical reaction. This process takes place in thyllakoid membrane present in the chloroplast.

**(ii) Dark Reaction :** During this step of photosynthesis 'synthesis' occurs. Here Carbohydrates are formed from carbon-di-oxide. This process does require light, hence is known as the dark reaction. It takes place in the stroma of the chloroplast.

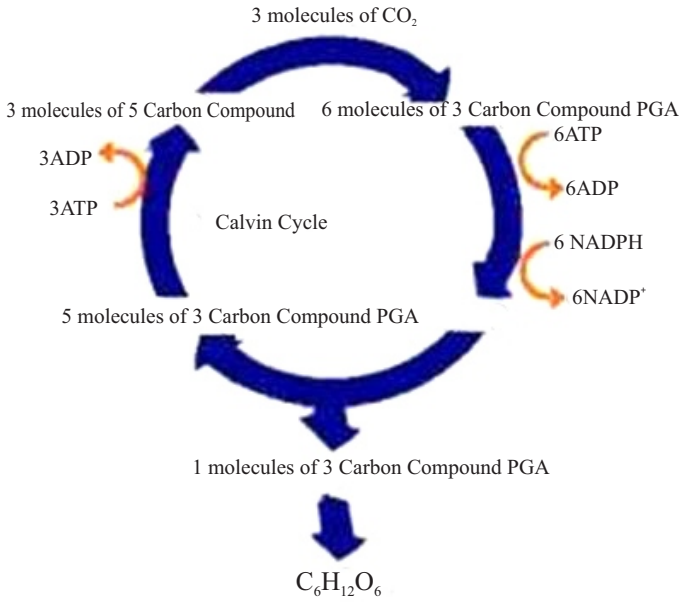



**Fig. 8.4 Dark reaction**

In this process, there is fixation and reduction of carbon-di-oxide. The first stable product of this reaction process is PGA (phosphoglyceric acid), which is a three carbon molecule. Hence this cycle is also known as the $C_3$ cycle or the

**Calvin cycle**.

**8.3.4. Factors affecting photosynthesis:** The factors affecting photosynthesis can be divided into two main types : External factors and Internal factors.

I. **External factors :** This involves sun-light, carbon-di-oxide concentration, oxygen, temperature and water.

II. **Internal factors :** Chlorophyll is a major factor under this category.

**8.3.5. Bacterial photosynthesis :** Bacterial photosynthesis is a special type of photosynthetic process which takes place in some major types of bacteria. During this process too carbon-di-oxide is reduced by using solar energy - example : Cyanobacteria, Purple bacteria.

## 8.4 Major Components of Food :

The complex chemical substances present in food, which are essential in proper amount, to accomplish different types of reactions in the body and to keep it healthy, are known as the **components of food** or **Nutrients**.

Nutrients have been classified into the following six types :

1. Carbohydrates
2. Fat
3. Protein
4. Mineral salts
5. Vitamin
6. Water

Although water does not provide for any nourishment as such, but since it is essential for different physical processes, it has also been included among the nutrients. There is one more substance which is not nutritive but must be a part of our food : Roughage or food fiber. In the animal food it is majorly the indigestable plant cell-wall part. It is helpful in removal of the residue, left after food digestion, from the body.

## 8.5 Nutrition in Animals :

The vegetation obtains carbon-di-oxide from the atmosphere and converts it into carbohydrates by the process of photosynthesis. Animals consume these vegetation or other animals which in turn eat plants to obtain their energy.

## 8.6 Digestion :

The food obtained by various animals, from the plants is in a non-diffusable state. They are converted into diffusable simple compounds with the help of digestion. There are specific organs for performing digestion. They are known as the digestive organs. These digestive organs form the digestive system.

**8.6.1 Importance of Digestion :** There are many types of nutritive elements and molecules present in the food stuff which are used in the formulation of new tissue and repair of the existing tissues. Since the animals cannot synthesize these nutritive elements, so these substances, synthesized by plants, are reduced by digestion and are then absorbed by the animals. Thus, digestion is the transformation of food into simple products.

**8.6.2 Major parts of the Human Digestive system :** The digestive system can be divided into two parts

1. Alimentary canal
2. Associated glands.

Alimentary canal starts with the mouth cavity continues into the pharynx, oesophagus,

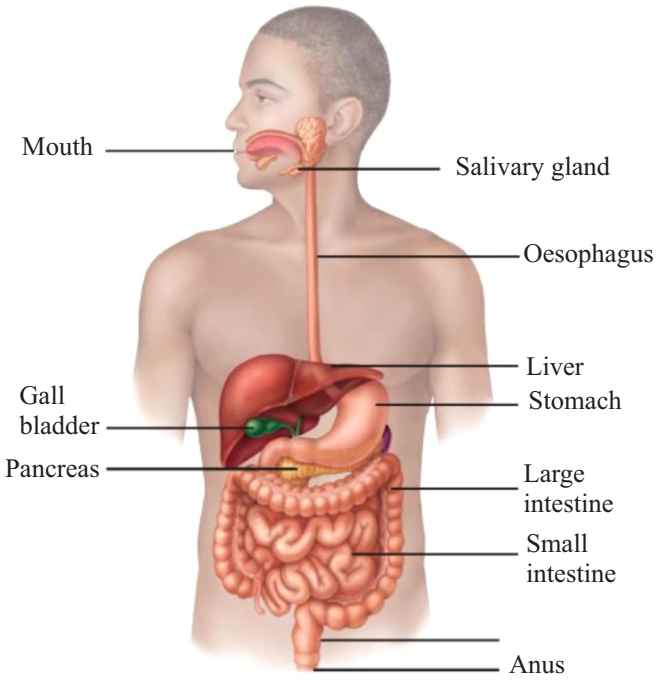



**Fig. 8.5 Digestive System in humans**

stomach, small intestine, large intestine, and ends at the anus. Salivary glands, pancreas and liver are the associated glands.

**1. Alimentary Canal :** The alimentary canal is made up of the following parts :

**(i) Buccal cavity :** This cavity present inside the mouth is guarded by the upper and lower lip. Jaws are present in the buccal cavity in which teeth are present. The teeth are present to cut, break, munch and chew the food.

A muscular tongue is present in the buccal cavity on which taste buds are present. These taste buds help in recognizing various taste. Salivary glands are also present in the buccal cavity which secretes saliva. The amylase enzyme present in the saliva (ptylin) converts starch into maltose. Along with this the saliva moistens and converts the food into a pulp. It functions like an antiseptic in the mouth.

**(ii) Pharynx :** The function of the pharynx, situated between the buccal cavity and the oesophagus, is to swallow the food.

**(iii) Oesophagus :** It is a small narrow tube which connects the pharynx with the stomach. No digestive enzyme is secreted by the oesophagus. It leads the food to the stomach.

**(iv) Stomach :** It is the most broad, sac like structure of the alimentary canal which appears like the alphabet 'J'. It is present towards left side in the abdominal cavity, below the diaphragm. When the food reaches the stomach, various gastric juices are secreted which are digestive in function.

**Gastric Juice :** It is secreted from the internal lining of the stomach wall. It is colourless, sour in taste, fluid, having 90% water and 0.5% hydrochloric acid, along with enzymes like pepsin, rennin and lipase. Its pH is 0.9 – 1.5.

**Functions of the stomach :**

1. It stores food.
2. The protein digestion initiates in this part of the alimentary canal.
3. The hydrochloric acid of the stomach makes the food acidic and kills the bacteria ingested along with the food. Pepsin in combination with HCl converts proteins into peptones and proteases. Rennin converts the protein caesinogen present in milk into casein which is then digested by pepsin.
4. Stomach absorbs glucose, water, alcohol and many type of medicines.

**(v) Small Intestine :** It is a very much curved and twisted tube lying between the stomach and the large intestine. Its length is approximately 22 feet. Although it is longer than the large intestine but since its diameter is smaller than the large intestine, it is known as the 'small intestine'. This tube like structure is divisible into three parts.

1. **Duodenum :** This is the first part of the small intestine, just beyond the stomach. It is a C-shaped tube that is 25 cm long. The bile and pancreatic ducts open into this part of the intestine.
2. **Jejunum :** It is the central coiled region. Its function is to digest food and absorb it. This part secretes the intestinal juices.
3. **Ileum :** The third portion of the small intestine is three meter long and ends near the caecum, where it connects to the large intestine. There are many digestive glands in it and it also performs the work of absorption.

**Functions of the small intestine:**

1. Pancreatic juice is secreted from the pancreas in the duodenum part of the small intestine. This makes the digestive media in the small intestine alkaline, with a pH 7.1 to 8.2. The chief enzymes present in the pancreatic juice includes amylase, maltase, sucrase, pancreatic lipase,

chymotrypsinogen, trypsinogen etc.

2. In the small intestine the carbohydrates, proteins and fats are digested completely. These compounds are reduced to their simplest components.
3. Small intestine absorbs the digested food with the help of microvilli present on its inner lining.

**Names and functions of the intestinal juices :**

The juice secreted by the digestive glands present in the intestinal walls is known as the intestinal juice or Succuss entricus. Following enzymes are present in it :

1. **Peptidase :** It acts on the peptones of the protein and converts them into amino acids.
2. **Maltase :** Converts maltose into glucose.
3. **Sucrase :** Breaks down the sucrose sugar into glucose and fructose.
4. **Lactase :** It acts on the milk sugar lactose and converts it into glucose and galactose.
5. **Lipase :** Acts on lipids and breaks down the fatty substances into fatty acids and glycerol.
6. **Enterokinase :** It converts the inactive trypsinogen secreted by pancreas into active trypsin.

**(vi) Large intestine :** The illium part of the small intestine joins with the colon part of the large intestine. The large intestine is also divisible into three parts - colon, caecum and rectum.

1. This is the starting part of the large intestine. The internal lining of this region is devoid of microvilli and the goblet cells secrete mucus.
2. **Caecum :** It is a 10 cm long tube which is attached to the colon and have appendix at its end.
3. **Rectum :** It is the terminal end of the alimentary canal and is in the form of a long tube with a circular hole, the anus, at its open end.

Large intestine is not involved in any type of major digestive activity as such.

**Functions of the large intestine:**

1. It absorbs water, minerals and medicines.
2. Secretes mucus to smoothen the anus and facilitates the excretion of the undigested substances.

## 8.7 Major Information of digestion in animals:

1. **Digestion in amoeba :** This animal of phylum Protozoa is present in water. It is a unicellular organism and hence digestive organs are absent in amoeba. On coming in contact with food the pseudopodium of amoeba forms food vacuole all around the food particle. In the amoeba body, secretion of metabolic juices start in the food vacuole which digests the food material.

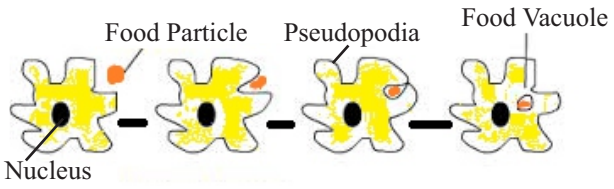



**Fig. 8.6 Digestion in Amoeba**

2. **Digestion in Euglena :** Euglena is autotrophic or phyto-holophytic as well as saprophytic or hetero-trophic. This dual type of nutrition is known as mixotropic nutrition.
3. **Digestion in Earthworm :** Earthworm feeds on dead organic matter. It ingests vegetation along with soil. The food intake is because of the pumping action of the pharynx. First it embeds the mouth in the soil and then by the contractile sucking action of the pharyngeal wall sucks the soil particle into the mouth cavity. This activity of pharynx is supported by muscular

fibers that are stretched from the pharynx to the body wall.

The alimentary canal of earthworm is a complete straight tube which extends the entire body length. Mouth and anus are the anterior and posterior openings respectively.

## 8.8 Respiration

**8.8.1 Meaning and importance of respiration :** Aerobic organisms need oxygen to remain alive because oxygen causes the oxidation or degradation of food substances and provide energy. This process of oxidation of nutritive substances is known as **cellular respiration**. In plant - respiration oxygen is inhaled by pores which is then used at cellular level for respiration; while in animals a complex system of respiratory organs function for the process.

Living cells need a continuous supply of oxygen. The organism performs respiration to fulfil this need. Removal of carbon-di-oxide formed, during the process, from the cells is essential. Respiration is a vital characteristic of all living cells. This process continues day and night, even when we are not engaged in any activity.

In this process there is oxidation of the sugar or glucose and energy is released. Energy is stored in the form of energy currency - the ATP. This energy in then used by the living being to carry-out various body functions smoothly. Respiration can take place in the presence as well as the absence of oxygen. Respiration can be compared with combustion as under :

(i) In both, organic compounds are degraded and energy is released.

(ii) Carbon-di-oxide and water are formed in both.

(iii) Oxygen is required for burning during both the processes.

However, there are differences between the two processes which are tabulated below :

| | **Respiration** | **Combustion** |
|---|---|---|
| 1. | It occurs at normal body temperature (37°C in humans) | High temperature is required for combustion |
| 2. | It is a slow process. | If is a fast process. |
| 3. | There are various stages of the oxidation of food. | Here the fuel forms carbon-di-oxide and water directly. |
| 4. | It is controlled by various enzymes. | It is not regulated by enzymes. |
| 5. | Here energy is stored in the form of ATP. | Here energy is released in the form of heat and at times even as light. |

**8.8.2 Plant respiration :** In plants specific organs are not present for gaseous exchange, as are present in animals, rather they have pores and stomata for this purpose. Transportation of gases in plants is minimal hence demand for exchange is also very less. Moreover in plants, most of the cell-surface is in contact with air, hence availability of oxygen is not a problem.

Plant cells synthesize food in such a manner that the energy released by reduction of glucose is not released in the atmosphere in the form of heat. For this purpose, cellular respiration is a multistep process, so that maximum of the energy released is converted to ATP.

In animals two types of cellular respiration is present :

1. Anaerobic respiration
2. Aerobic respiration

**1. Anaerobic respiration :** This type of respiration does not require oxygen. It occurs in yeasts, bacteria, parasites and some lower animals which are unable to get free atmospheric oxygen. In deficiency or absence of oxygen, the glucose converts into ethyl alcohol or lactic acid and lesser amount of energy is produced. This process is also known as sugar **fermentation**.

(a) $C_6H_{12}O_6 \rightarrow 2\,C_3H_6O_3 + \text{energy}$

Glucose → Lactic acid (in muscles, by bacteria)

(b) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + \text{energy}$

Glucose Ethyl alcohol (by yeast)

**2. Aerobic respiration :** This type of respiration requires oxygen. Glucose is reduced in the presence of atmospheric oxygen to produce carbon-di-oxide, water and greater amount of energy.

This type of respiration occurs in

most of the animals and plants. In this respiration even plants take oxygen from the atmosphere and release carbon-di-oxide.

**Respiration in animals :** Different types of organs have evolved in animals to obtain oxygen and release carbon-di-oxide in the atmosphere. Terrestrial animals get their oxygen from the surrounding atmosphere (like in human beings lungs are used for the purpose); but the animals which live in water, like fishes, absorb the dissolved oxygen from water with the help of gills. Since the amount of dissolved oxygen is very less in water, than that present in the atmosphere, the rate of respiration of the aquatic animals is faster as compared to that in the terrestrial animals.

The unicellular organisms like Amoeba, Paramecium etc exchange gases by diffusion across their cell membrane. Similarly, in porifera, like-sponges; coelentrata, like hydra etc, the gaseous exchange is through their moistened body wall.

As the size of organisms increased, specifically made organs were required. In all such organs the common character is the presence of structures that increase the surface area. The respiratory system of earthworm is more complex than that of the amoeba and hydra. The mucus secreted from the skin keeps the external surface moistened in earthworm. The exchange of oxygen and carbon-di-oxide gases occurs through this moistened skin.

In insects, respiration takes place by special the absence of air in it.

**Bronchi and Bronchioles :** The trachea move down and divides into two parts, the bronchi, in the thoracic cavity. The bronchi further sub-divides into the bronchioles. The bronchioles branches into the lungs in the form of the alveolar ducts. These ducts open into small alveoli or the air sacs. Blood vessels are found on the alveoli which carry oxygen to the entire body. The area of the lungs increase many-fold due to presence of the air sacs.

**Lungs :** A pair of spongy, pink sac like lungs are present in the thoracic cavity of human beings. They are situated in the pleural cavity near the heart. There is a thin covering all around the pleural cavity, which is known as **pleura**. The right lung is longer than the left one. The volume of the thoracic cavity increases and decreases because of the contraction and relaxation of the ribs. This results in the entry and exit of the air from the lungs.

**Diaphragm :** The lower floor of the thoracic cavity is closed by a thin dome like plate which is known as the diaphragm. The diaphragm flattens at the time of exhalation.

**Breathing mechanism in Human :**

The breathing process is divisible into two :

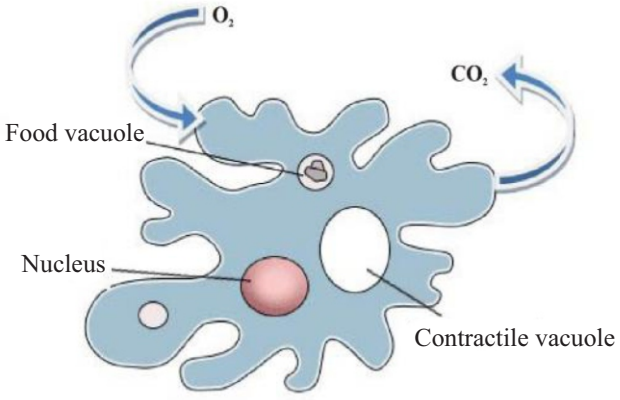



**Fig. 8.7 Respiration in Amoeba**

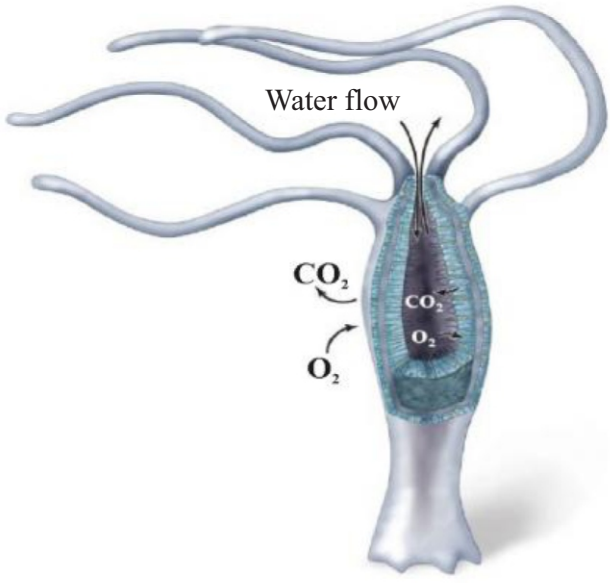



**Fig. 8.8 Respiration in Hydra**

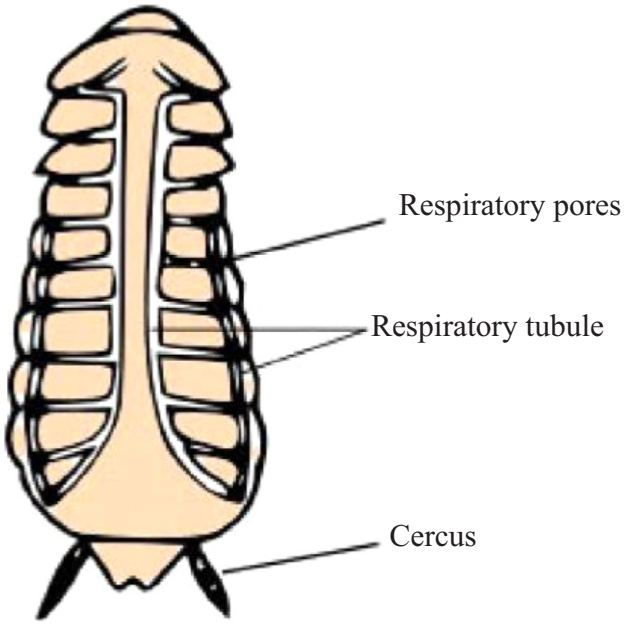



**Fig. 8.9 Respiration in cockroach**

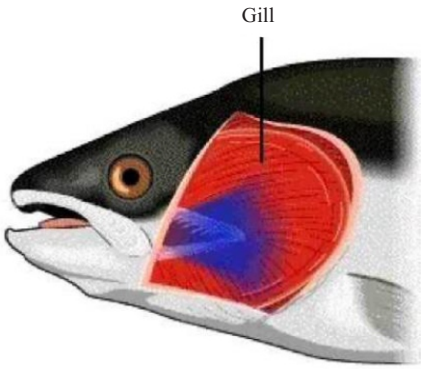



**Fig. 8.10 In fishes respiration takes place with the help of gills.**

(1) Inhalation
(2) Exhalation

**Respiratory pigment :** Haemoglobin is the respiratory pigment. It is present in the Red Blood Corpuscles (RBC). It binds the oxygen molecules and carry them to all the cells of the body.

## 8.9 Circulation :

**8.9.1 Meaning and the need :** Circulation is the process of carrying various substances, like the absorbed nutrients, water and waste products, from one part of the body to another in living beings. The

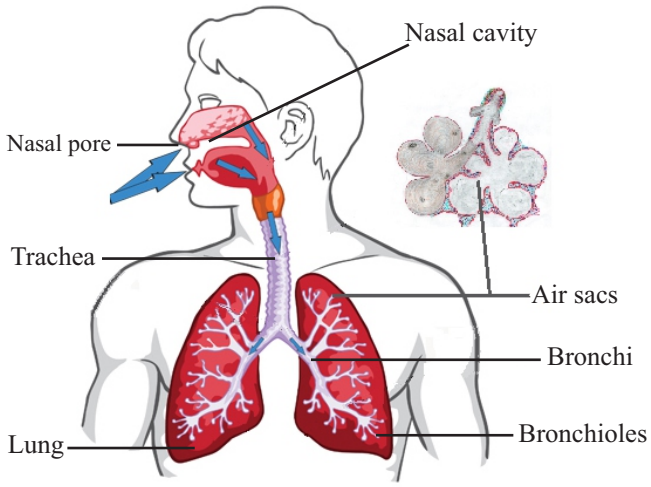



**Fig. 8.11 Respiratory System in Humans**

system related to this process is known as the circulatory system.

The circulatory system is made up of a few organs, vessels and capillaries, in which flows a fluid. The food substances, oxygen, water, excretory products and other essential substances move across the body through this fluid only. This fluid chiefly is the lymph, blood or water. Each body cell receives nutrients and energy through these substances. It is because of this energy and the nutrients that the cells perform their functions and the body runs smoothly.

**8.9.2 Basic knowledge of circulation in animals :** Two types of circulatory systems are present in animals :

1. **Open circulatory system :** In this type of circulatory system the blood flow in vessels, only partially i.e. only in some body parts. In the remaining parts it diffuses in the open spaces present between the various tissues and organs. In this system the cells and tissues of the animal, are in direct contact with the blood.
   Example : Cockroach, Shrimp, Snail, *Unio* etc.
2. **Closed Circulatory System :** In this type of circulatory system the blood circulates the vessels and capillaries. The nutrients are carried to various organs and the excretory products are collected from there by means of the circulating blood. Example : Earthworm, fish, frog,

birds, human etc.

**8.9.3 Circulatory system in cockroach :** The transportation of nutritive substances, excretory substances and hormones take place by the open circulatory system, in cockroach and other insects. However, gases cannot be transported by means of this system. There is a separate system of tracheal or respiratory vessels for the transportation of gases in these organisms. In cockroach, there is a cavity known as the **haemocoel**. It is divisible into three sinuses by two diaphragms. They are known as the pericardial haemocoel, the perivisceral haemocoel and the perineural haemocoel. In the pericardial haemocoel there is a thirteen chambered muscular, tubular and contractile heart in which the blood flows forward i.e. from back to front. The blood in cockroach is colourless because of the absence of any pigment in it. It is for this reason that it does not transport gases. The main function of this circulatory system is transportation of food and excretory substances.

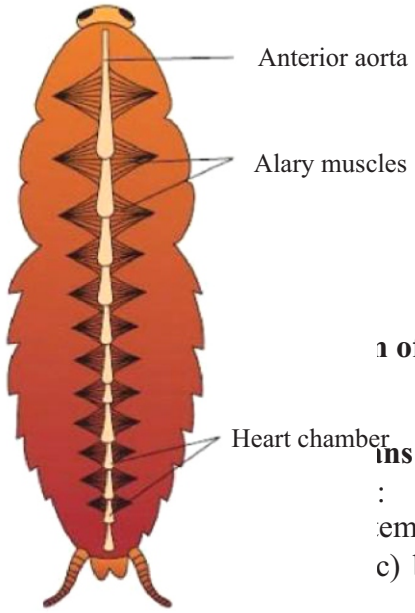



**Fig.8.12 Open Circulatory system of cockroach**

**8.9.4 Circulatory system in Earthworm :** The circulatory system in earthworm is of closed type i.e. blood circulation is confined to blood vessels. In earthworm, there are two main blood vessels - the dorsal blood vessel (towards upper side) and the ventral blood vessel (below the alimentary canal). In the dorsal blood vessel the blood is carried to the front of the earthworm's body while the ventral blood vessel carry the blood from the front to the back of the body. Near the anterior end these two blood vessels are connected to each other by means of five pairs of aortic arches which function like a heart and pumps the blood in both the major blood vessels. There are uni-directional valves in the heart and the dorsal vessel, which prevents the back flow of the blood. Thus the blood flows in the ventral vessel and returns to the heart via the dorsal vessel. In each segment there is a thin capillary that carries the blood from the ventral vessel to the dorsal vessel. It's cell wall is unicellular, therefore the nutrients and other substances diffuse and reach the cells through the tissue fluid, in each segment.

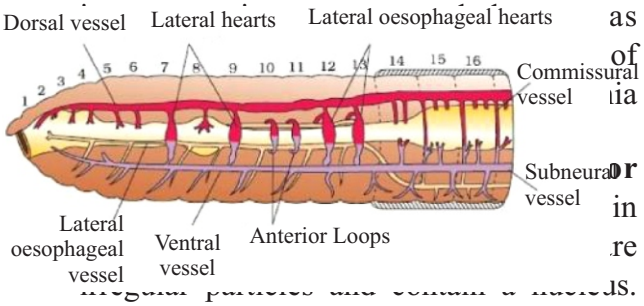
**(A) The Circulatory System :**

**(a) Blood :**

Blood is a fluid connective tissue having a fluid matter - **plasma** - in it. Plasma forms nearly 55% of the blood and is light yellow in color. 92% of the plasma is water and the remaining 8% are other substances. It contains many

organic substances like glucose, amino acid, fatty acid and oxygen and other dissolved gases. Apart from this the globulin antibody protein, fibrinogen and prothrombin which help in clotting etc. are also present in the plasma. Three types of blood cells are also present (i) Red Blood Corpuscles or RBC (ii) White Blood Corpuscles or WBC and (iii) Blood platelets or thrombocytes.

**(i) Red Blood Corpuscles or RBC :** These corpuscles are light yellow in color and are oval or round in shape. They appear red because they are present in large number and have oxyhaemoglobin. Their life span is about 120 days and they are enucleated i.e. they lack a nucleus. RBC contains an

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WBC do not contain haemoglobin therefore they are colorless. Many white blood corpuscles perform amoeboid movements along the walls of the blood vessel in a direction opposite to the blood flow. Whenever any bacteria or external toxic substance enters the body, these cells attack them and removes them after destroying. In this way they protect the body against various pathogens and develop our immunity system.

**(iii) Blood platelets :** These corpuscles are also known as the thrombocytes. They are smaller in shape, than the Red and the White Blood Corpuscles and their number is less than that of the red blood cells. Their main function is to form blood clot and block the route of bleeding. Nucleus is absent in these cells.

**(c) Heart a muscular organ :**

Human heart is an elongated, conical structure. It is located between the right and left lungs, slightly displaced towards the left, in the thoracic cavity. It is made up of four chambers. On the upper side are the left and the right atrium and towards lower side are the two ventricles: the left and the right ventricles. The oxygenated blood, from the lungs, enter the left atrium and the ventricle and the deoxygenated blood, from the body organs, is brought into the right hand chambers of the heart (right atrium and ventricle). As compared to the atrium the muscular wall of the ventricle is thicker. This is because it has to pump blood to the entire body. When the atrium or ventricle contracts, the valves ensure that the blood do not flow in the reverse direction. A septum is present between the two atria. It is known as the **inter auricular septum**. Similarly the **inter ventricular septum** is present between the two ventricles.

**Fig. 8.14 Structure of the human heart**

**8.9.6 Mechanism of Heart Action : The** function of the heart is to pump blood into various parts of the body. This is performed by the

contraction and relaxation of the heart. The oxygenated blood enters the left atrium from the lungs through the pulmonary veins. The deoxygenated blood from various parts of the body reaches the right atrium via the pulmonary artery. Now both the atria contract together so that the oxygenated blood is pumped into the left ventricle from the left atrium and the deoxygenated blood from the right atrium moves into the right ventricle. After this, the two ventricles contract together. Pressure is generated on the blood because of their contraction which results in the closing of the valves between the atrium and the ventricle and the blood cannot flow back into the atrium. The aortic valve of the aorta opens because of this pressure generated and the oxygenated blood is pushed into the aorta, from where it is distributed to various parts of the body by means of a network of arteries and capillaries. The blood flow to the lungs via pulmonary artery, on contraction of the right ventricle. In the lungs the carbon-di-oxide present in it is released and it gets oxygenated and then flows back to the left atrium. Thus the blood in human body circulates in two loops. This is known as **double circulation** or the double conduction.

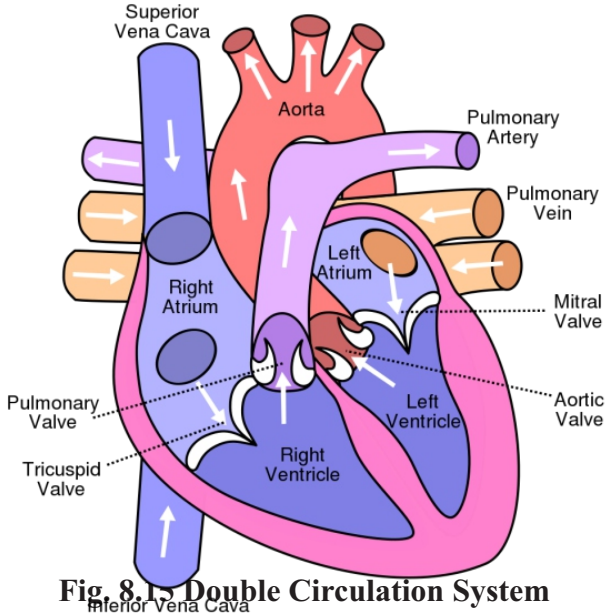
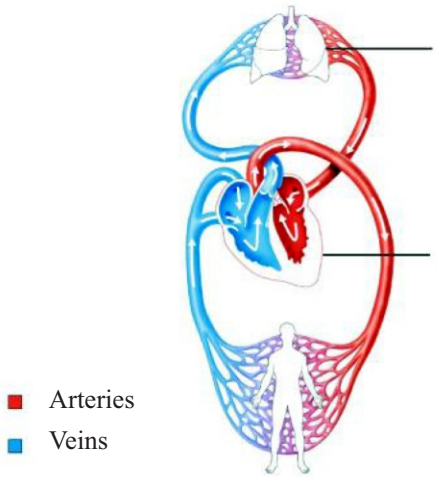



**Fig. 8.15 Double Circulation System**

**(d) Blood vessels :**

1. **Arteries :** The blood vessels which carry the blood from the heart to various body parts are known as the **arteries**. Their wall is thick and flexible because the blood flows in it under pressure. Normally, pure and oxygenated blood flows in the arteries. However, impure blood flows in the pulmonary artery.
2. **Veins :** The blood vessels which collect blood from various body parts and carry them back to heart are known as the **veins**. Their walls are thin and deflatable. The cavity of the vein is broad because the pressure of blood in it is less. Normally impure and deoxygenated blood flows in it. However, pure and oxygenated blood flows in the pulmonary vein.
3. **Capillaries :** These are the narrow blood vessels which connect the veins and the arteries.

**Blood pressure :** The pressure is more in arteries as compared to that in the veins. The heart is responsible for the flow of the blood into the arteries. The pressure of the blood in the arteries generated at the time of ventricle contraction is known as the **systolic pressure** and that generated

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immune system in human body. Lymph circulates in the interstices (i.e. the very small intervening spaces) of the body tissue and helps maintain fluid balance in the body. It is made up of lymph capillaries and the primary and secondary lymphoid organs.

## 8.10 Conduction in Plants :

Food substances are formed in green plants

by photosynthesis. For photosynthesis, the plants get energy from sun light, carbon-di-oxide from the atmosphere and water from soil by means of the roots. Let us study as to how the plants get all these substances? The major organ for photosynthesis is the leaf. So how these substances reach the leaves?

The plants present around us, whether herbs, shrubs or trees, may differ in their habit but their basic body plan is the same. All the flowering plants have root, stem, branches, leaves flowers, fruits and seed.

As compared to the animals, the number of organs in a plant are far less in number. The root, stem and leaves are the vegetative organs of the plant and perform the metabolic functions like photo-synthesis, conduction, food storage etc.

**8.10.1 Leaf :** The main functions of the leaf are photosynthesis and food storage. They are arranged on branches and stem in such a manner that they all are exposed to sun light. How the leaves perform photosynthesis can be better understood if we have an understanding of the internal structure of a leaf. Living parenchymatous cells are present below the upper epidermis of a leaf. These cells contain a pigment known as the chlorophyll. Intercellular spaces are present in between these cells which are interconnected with each other to facilitate the exchange of gases, like oxygen and carbon-di-oxide and the transpiration i.e. excretion of the water vapour and conduction of gases to all the cells of the leaves.

There is a network of veins in the leaves. The main tissue for conduction, are the xylem and phloem which are present in these veins. This tissue forms a web of tubules for the conduction of food material and water. The xylem and phloem present in the leaves is connected with the xylem and phloem of the stem. The main function of xylem is to carry water and minerals absorbed by the roots to every part of the plant. The phloem performs the function of carrying the organic food material formed in the leaves to all the plant parts including the roots.

Thus the conduction system, made up of xylem and phloem, extends in the entire plant body- from the root upto the leaves - in the form of tubules, which carry the water along with dissolved minerals and the prepared food, respectively.

Generally, minute pores called **stomata** are present on the lower epidermis. It is through these pores that the internal parenchymatous tissue remains in contact with the external environment. The pore is surrounded by two guard cells. These guard cells receive water from the neighbouring cells and become turgid, resulting in the opening of the stomatal pore. Air, carrying carbon-di-oixde, enters the leaf through these open pores. These guard cells lose water and become flaccid resulting in the closing of the stomatal pore.

Thus the main function of stomata is to exchange oxygen and carbon-di-oxide. The second important function performed by the leaf is to remove water from these pores in the form of water vapour.

**Transpiration :** Emission or removal of water, in the form of water vapour, through the pores present in the aerial green parts of a plant is known as transpiration.

Transpiration can be demonstrated by a simple experiment. We take a potted plant place it on a glass plate and cover it with a polythene. The set up is made air tight by applying vaseline on the tied end of the polythene. After some time water droplets are visible on the inner surface of the polythene. These droplets escape from the stomatal pores in the form of vapour and condense to form water droplets when they come in contact with the cool surface of the polythene.

In the absence of light, when the pores close, the rate of transpiration decreases. If the rate of transpiration increases in proportion to absorption of water from soil, the plant wilts.

The environment around the plant remains moist due to transpiration. it is because of this reason that during summer season we feel the coolness beneath a tree. Transportaion is helpful in the absorption of water from the soil.

**8.10.2 Stem :** Stem is the main route of conduction of water and mineral salts and the transpiration of food material to various parts of the plant body. Its conducting tissue are in continuity with the conduction tissue of the leaves.

**Xylem :** Xylem is a complex tissue. It has vessels and tracheid for the conduction of water and the dissoved salts. They are the long, dead cells with thickened cell walls. There are many pits on its cell wall through which water can move from one tracheidial element to another.

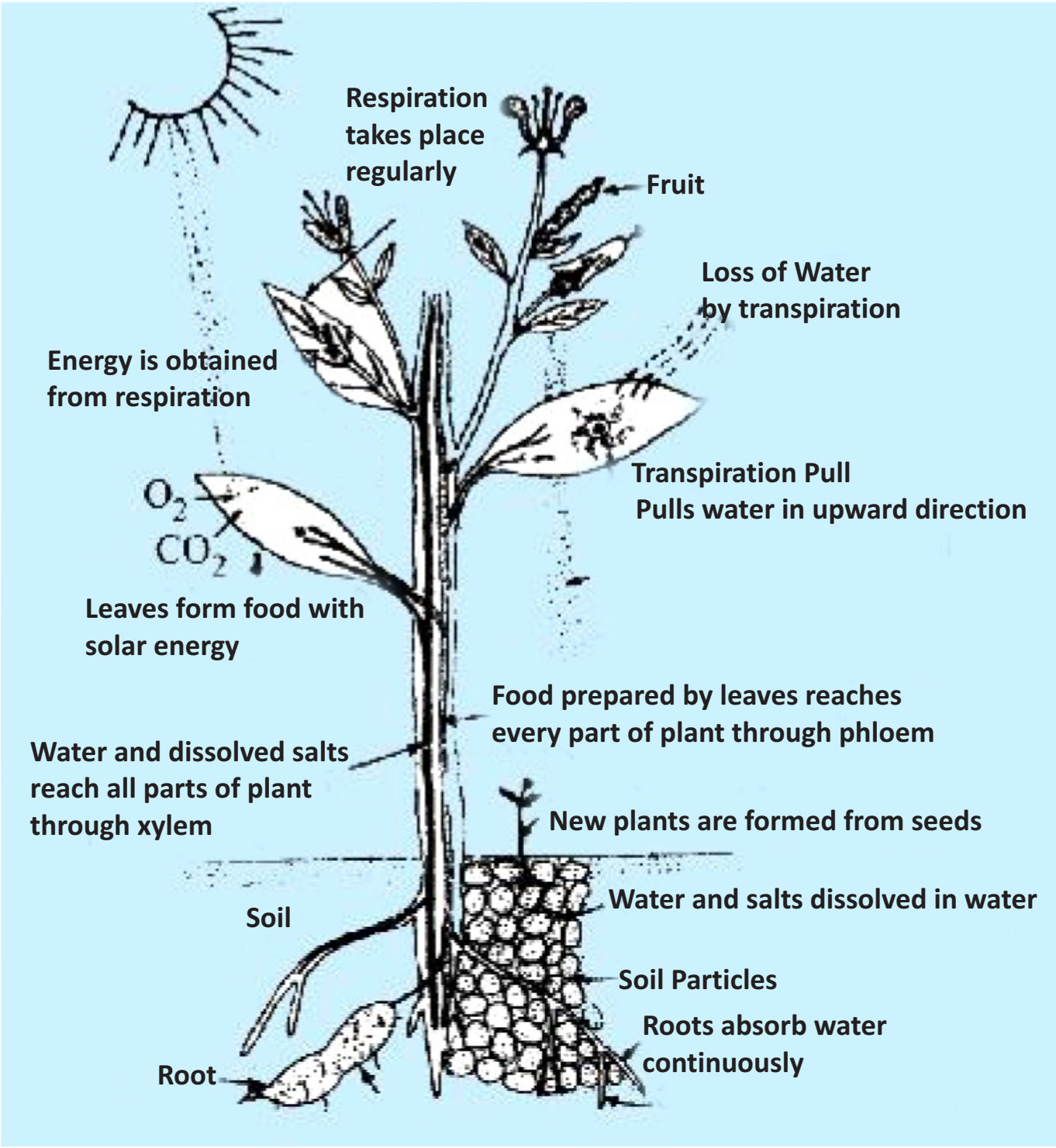



**Fig. 8.16 Major organs of a plant and their functions**

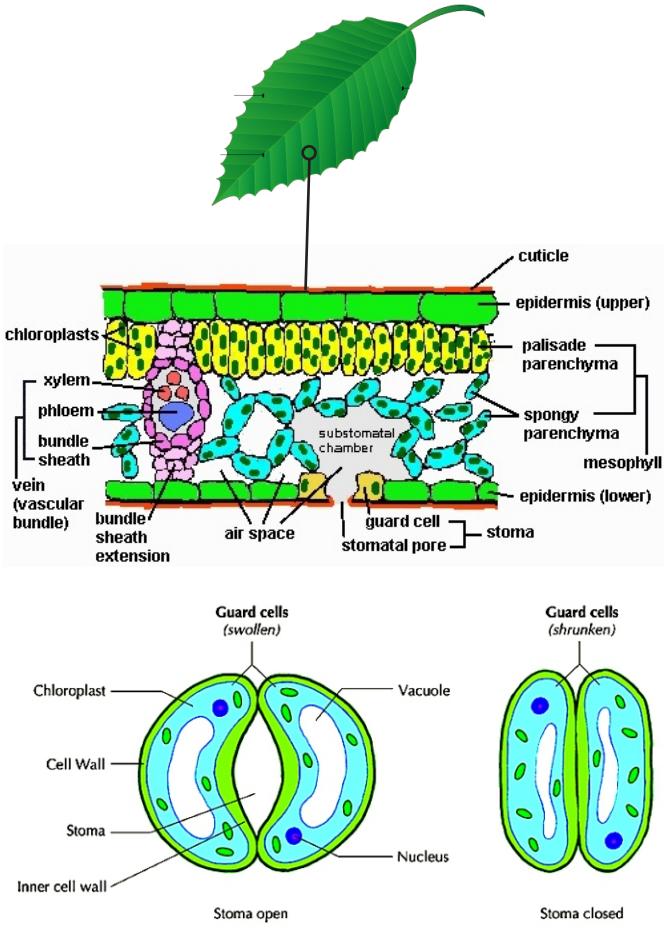



**Fig. 8.17 (a) Internal structure of the leaf The green parenchyma perform photosynthesis. See the pores present on the epidermis (b) open pore (c) closed pore**

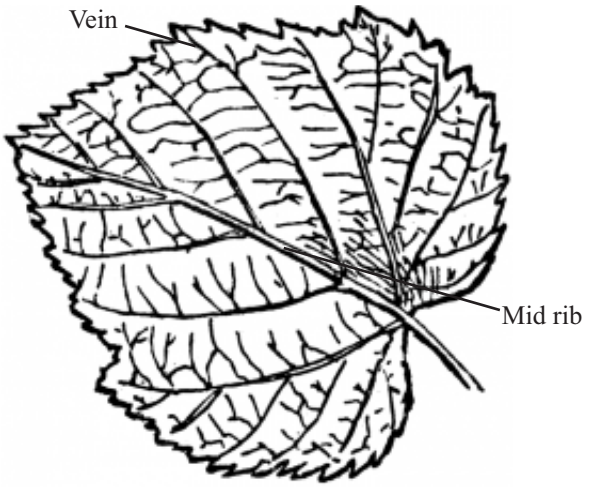



**Fig. 8.18 Web of veins in a leaf (Reticulate venation)**

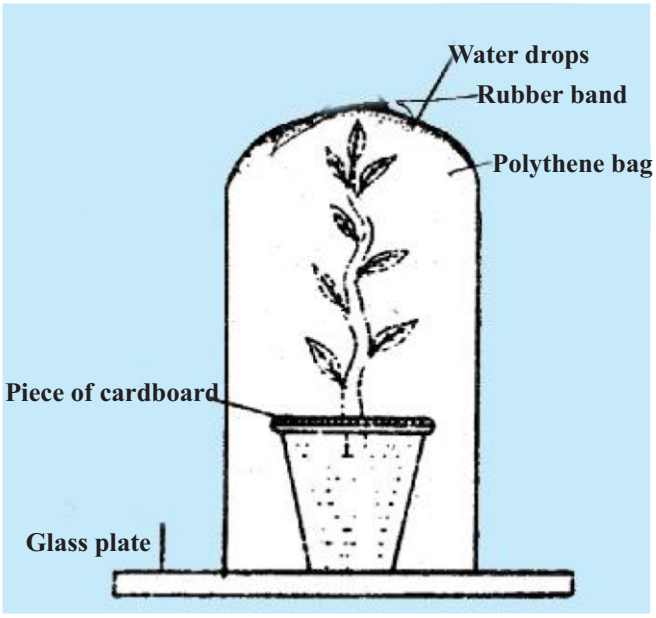



**Fig. 8.19 Demonstration of Transpiration**

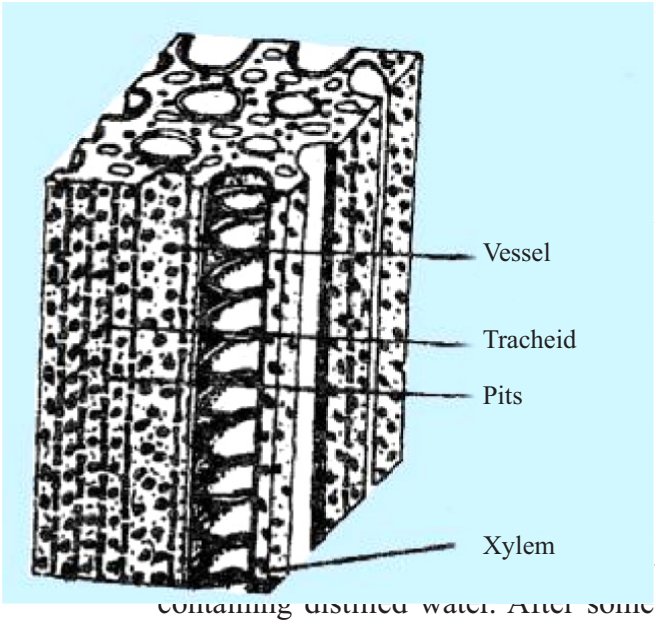
**Fig. 8.20 Structure of Xylem**

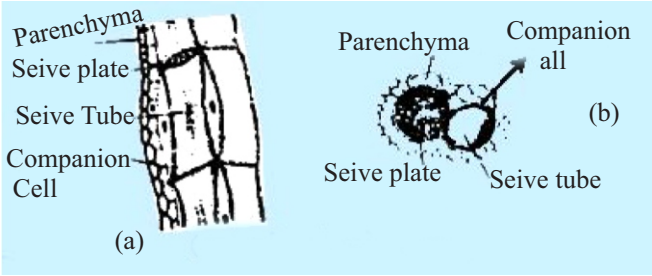
**Phloem :** The food synthesized during photosynthesis is conducted, in dissovled state, to various parts of the plant body through the phloem. There are specific sieve tubes for the purpose. The fluid food substances are transferred between the sieve elements by the minute pores present on their transverse walls. These cells lack a nucleus.

of water and dissolved minerals from the soil. Therefore the roots grow toward moisture and ground water in the soil.

The absorbed water reaches the conducting tissue of the stem and the leaves through the conducting system present in the roots.

We have studied that the liquid food substance formed during photosynthesis reaches various parts of the plant through the phloem. This is possible only when the cell membrane is selectively semipermeable. Substances in the form of solution are absorbed and conducted through the membranes by two processes : (i) Passive absorption and (ii) Active absorption. Many physical processes like diffusion, osmosis, capillarity, imbibition etc. are helpful in passive absorption.




containing distilled water. After some time you will observe that the bag swells.

This happens because the concentration of the water in the beaker is 100% while in the bag the concentration of water is 98% (2% is the sugar and remaining 98% is water). The bag will swell because water from the beaker will diffuse into the bag i.e. from a region of its high concentration to its low concentration. The water fills in the bag as a result of a pressure - the **osmotic pressure**.

Similarly, if we place raisins in a bowl having water, the raisins will swell because of osmosis.

Cell, absorbs water by osmosis. If a plant or animal cell is placed in distilled water, water molecules will enter the cells because the concentration of water in the cell sap is less as compared to the distilled water (in other words, the concentration of cell sap is more than that of the distilled water). This will result in stretching of the cell membrane and at the same time cell wall will exert pressure towards the inner side, in order to regain the original state. This is the wall pressure. Water will move into the cell because of the high osmotic pressure and the cell will continue to swell and will become turgid. Movement of water inside the

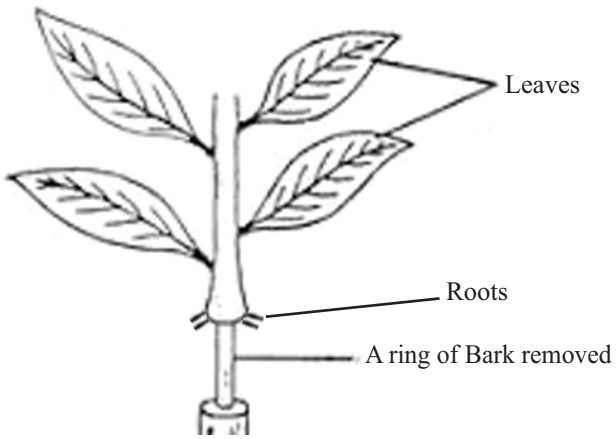
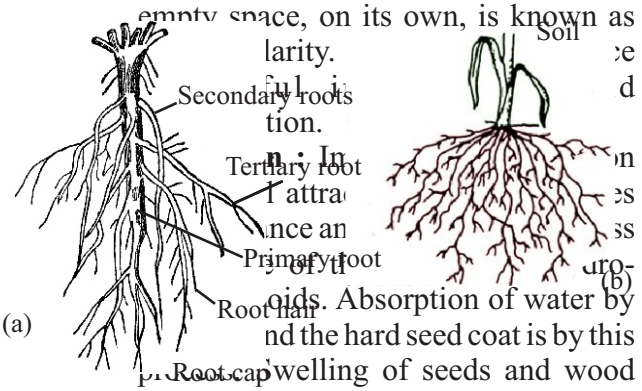



**Fig. 8.22 The liquid food is conducted by the phloem**

cell by osmosis is known as **endosmosis**.

The fully turgid state of the cell maintains the shape of the cell. The healthy nature of juicy fruits like mango and tomato and fleshy leaves is because of the turgidity of their cells.

**(iii) Capillarity :** If a thin glass tube is dipped in water from one of its end, water will rise in it for some distance. The tendency of a liquid to enter the empty space, on its own, is known as larity. ful i tion.



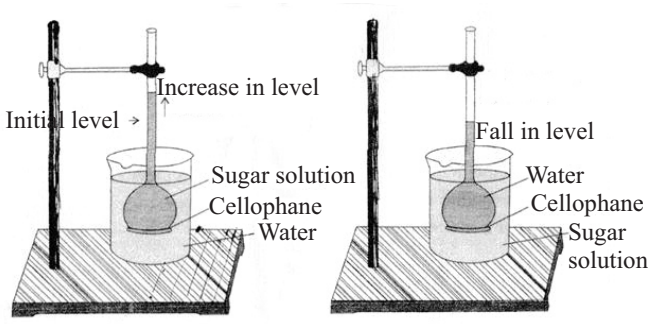

**n :** In attra nce an of th oids. Absorption of water by nd the hard seed coat is by this welling of seeds and wood when placed in water are examples of imbibition.

**Plasmolysis** : Now let us consider a condition in which a cell is placed in a solution having concentration more than that of the cell sap - then what will happen? The water from the cell sap will move out into the external solution and the cell will shrink. The cell wall will shrink only to a particular limit; then after the protoplast will separate from the cell wall and will ultimately appear as a shrunked round or oval mass on one side of the cell. This process of shrinking of the protoplast because of exosmosis is known as **plasmolysis**. **Exosmosis** is the movement of water out of the cell, by osmosis.

**Fig. 8.25 Plasmolysis in plant cell**

**Absorption of water from soil :**

In the space (pores) present in between the soil particles, air and water are present. The water present in these spaces is known as the capillary water. The roots of the plants absorb this water. Water is absorbed primarily by the root hair region of the roots. Mineral salts remain dissolved in the




capillary- water of the soil. Hence, it is a dilute solution. The concentration of cell sap is more than the concentration of this solution. Therefore the water from the soil enters the root hair cells by osmosis. The cell sap thus gets diluted as compared to the sap in the nearby cells and water moves to the next cell by osmosis. In this manner a pressure gradient is created from the xylem vessels to the cortical cells and root hairs. The water with the dissolved salts move up regularly from the root hairs to the root xylem because of this gradient.

If the osmotic pressure of root hairs is less than the osmotic pressure of the soil solution, according to the principle of osmosis, exosmosis should occur. Under such circumstances too, the root hair can absorb water. Energy is required for such absorption which is provided by the ATP molecules present in the cell. This type of absorption is known as the **active absorption.**

**Fig. 8.26 : Water path from the root hair to the xylem of the roots**

**Root Pressure :** The water from the soil reaches the xylem of the roots due to active water absorption. The cells of the root become turgid because of this water absorption and the water reaching the xylem rises, in the xylem, for some height. This positive pressure that is present in the roots is the **root pressure**. It is an active pressure

which propels water in the xylem of some of the herbaceous plants. It is a vital process.

**Fig. 8.27 Demonstration of root pressure**

We will perform a simple experiment to understand root pressure. We will take a potted healthy plant and will cut the stem 7-8 cm above the soil, transversely. Now we will connect a glass tube to this cut end with the help of a rubber tube. Fill some water in the glass tube and mark the water level on it. The experimental set up is made air tight with the help of wax. We will observe that after some time the water level in the glass tube starts increasing. This is because of the root pressure.

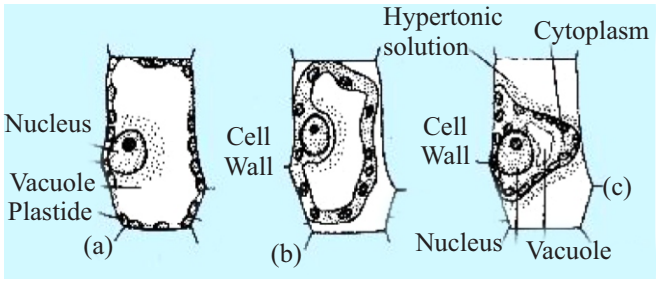
Root pressure is not enough to take up the water upto the leaves of 300 meter tall trees or trees taller than that. Now the question arises as to how the water reaches the leaves of these tall trees. This can be understood by the transpiration - cohesion tension theory.

**Transpiration- Cohesion-Tension theory:**

It is based on three main factors (1) Water is present in the xylem vessels in the form of a continuous regular column (2) The continuity of the column is maintained because of the strong force of attraction due to cohesion of the water molecules (3) the upper end of this water column is gradually removed to the atmosphere through leaves by transpiration. This exerts a pull or tension on the water column from the upper side and results in the upward movement of water molecules in this column.

## 8.11 Excretion :

The mechanism of eliminating waste and




toxic materials in living beings is known as excretion. The organs which participate in this excretory process are known as the excretory organs.

**8.11.1 Need for excretion :** Metabolic activity is observed in all the organisms. It may be catabolic or anabolic activity. Many waste products like urea, uric acid and ammonia are formed in the chemical reactions taking place during metabolism, which are harmful for the body. Excretion is essential for the removal of waste products formed during the protein metabolism in the body.

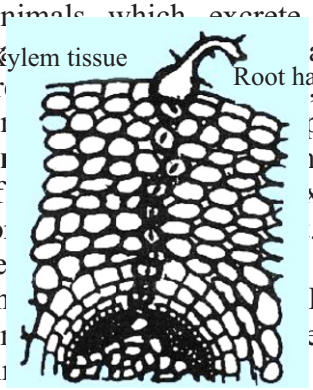
**8.11.2 Excretion in animals :**

On the basis of the nitrogenous excretory substance present in the urine, animals are of three types :

**(1) Aminotelic :** Some animals like *Unio*, Star-fish, *Pila* etc. excrete amino acid, directly.

**(2) Ammonotelic :** Ammonia is produced as a waste product during amino-acid metabolism. Ammonia is soluble and diffusable in water. The animals which secrete ammonia are known as Ammonotelic.

**(3) Ureotelic :** A waste product, urea, is formed in the liver by protein metabolism which dissolves in water. Animals which excrete nitrogenous w are known as ur , Fish, Snail, A otiles.

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**Excretion in Amoeba :**

Excretory organs are not present in amoeba

as it is a unicellular organism. Excretion of waste substances is by diffusion. Contractile vacuoles are present in amoeba, through which waste products are removed from the body.

**Excretion in Hydra :**

No excretory organ is present in Hydra. Ammonia and gases are excreted by diffusion.

**Excretion in Earthworm :**

In earthworm excretory process is carried by nephridia present in the body cavity. They excrete waste product[illegible] means of pores that open o[illegible] substance of earthworm is a[illegible]

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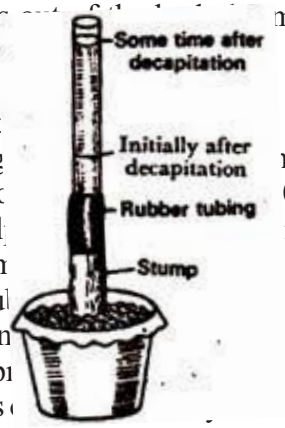
Malpig[illegible] nain excretory organs in cc[illegible] 0-90, yellow threadlike Mal[illegible] n the posterior part of the alin[illegible] ubules receive nitrogenous su[illegible] which reaches the proctodeun[illegible] these tubules. These waste pr[illegible] )ved from the body by means[illegible]




**Excretion in Humans :**

The excretory organs in human are - skin, liver, spleen, intestine, lungs, kidney etc. Sweat glands are present in the skin which expel water and urea. Kidney is the main excretory organ.

**Fig. 8.28 Excretory System in Human**

The main organs of the excretory system in humans are : (1) Kidney (2) Ureter (3) Urinary bladder

**(1) Kidney :** A pair of kidney is present in mammals. They are red in color and their shape is like a bean seed. They are situated below the diaphragm on each side of the vertebral column. Each kidney is 4-5 inch long, 2 inch broad and weighs about 140-150 grams.

**Fig. 8.29 Internal Structure of Kidney**

It is protected by lipid layers on all sides. The outer part of the kidney is the cortex and the inner part is the medula. Numerous thin tubules are present in the kidney which are known as Uriniferous tubules or **nephrons**. The two main parts of a nephron are Bowman's Capsule and the secretory portion. The secretory portion starts from behind the Bowman's capsule and has three parts (1) proximal convoluted tubule (2) Henle's loop (3) distal convoluted tubule.

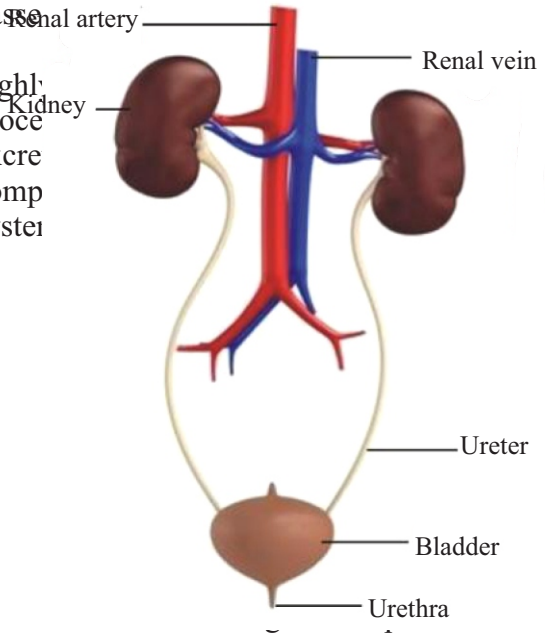
**(2) Ureter :** In each kidney a tube arises from the pelvis region and forms the ureter. It carries urine from the kidney to the urinary bladder.

**(3) Urinary bladder :** The sac like structure in the peritoneal cavity of human, present at the base of the pelvis

is the urinary bladder. Its outer covering is known as the peritoneum and it opens out by a tube called the urethra. Urethra opens out of the body by a pore or orfice.

**Urine Excretion :**

Urea is formed in liver. The impure blood from the liver reaches the kidney through the renal artery. The renal artery subdivides into numerous capillaries and provide blood to the glomerulus situated in the Bowman's capsule. The afferent arteriole supplies blood to the glomerulus while the efferent arteriole takes away the blood from glomerulus. The blood pressure in the glomerulus increases because the diameter of the afferent arteride is greater than that of the efferent arteriole. Because of this pressure generated, the water, glucose, urea, uric acid and some salts are released in the Bowman's capsule by Ultra filteration of blood from the afferent arterioles. Thus, fluid then enters the secretory substances. This fluid then enters the secretory portion of the nephron where, water, glucose and other useful salts are reabsorbed. The remaining fluid contains the waste products and is known as the **urine**. This urine ultimately enters the ureter which then opens into the urinary bladder. Urine collects in the urinary bladder which is then passe

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during protein metabolism in plants are used for the synthesis of novo-proteins.

4. The metabolism of plants mainly depends on the carbohydrates. The end products produced by carbohydrate metabolism are less toxic and harmful than the products of protein metabolism. Therefore the need of excretion in plants is very less than that in animals. Yet, excretion of certain metabolic waste products formed in plants or their storage, in a harmless form, is essential.
5. In aquatic plants some waste products diffuse out in the aquatic environment

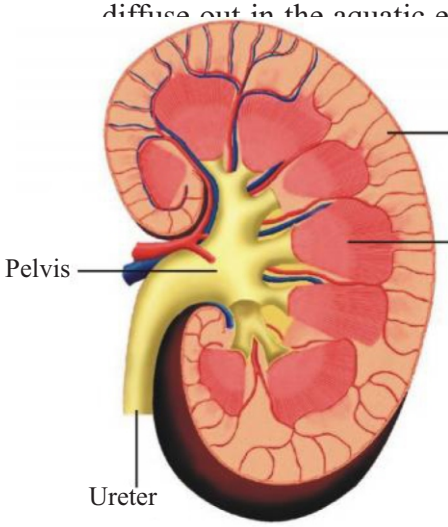


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**Fig. 8.31 Structure of a lenticel**

8. Many waste products are present in the vacuole in a dissolved form. These substances may be useless for the plants but they are very useful for us. They are used in many medicines. Even gum is a waste product.
9. Some of the useless substances are stored in the dead cells of the leaves or in the woody cells of the stem in the form of solid crystals. Mostly, these crystals are of calcium carbonate and calcium oxalate.

**Guttation :**

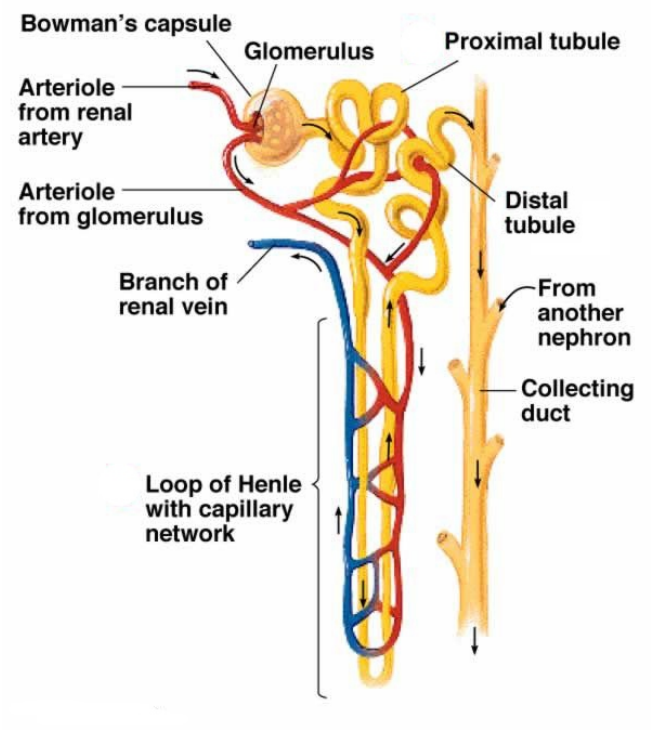



**Fig. 8.30 Ultrafilteration in Kidney**

If you stand beneath a peepal tree, early in the morning, you will feel minute water droplets falling on you. This is the water released by the leaves of this tree. Similar is the case with tomato, grass etc. where water oozes out at the margins or the apex of leaves, in the form of droplets. The exudation of water droplets, from leaves, is known as guttation. These plants have special pores, the **hydathodes**, for guttation. They are present at the end of veins of the leaves. Each minute pore opens in a small cavity which is lined by thin walled, soft parenchymatous cells.

Guttation is maximum in the state of more absorption and less transpiration. The water droplets contain some dissolved waste substances which deposit as a crust around the pores, on getting dry.

## 8.12 Reproduction :

**8.12.1 Meaning and need :** You must have seen numerous saplings beneath various trees and plants, like neem, babool etc., during rainy season. Similarly, you must also have observed babies of various birds like sparrow, pigeon, hen etc. which come out of the eggs. All these living beings gradually develop into adults. On attaining maturity, even they produce off-spring of their own type. Thus a continuity of the various species, is maintained in this universe.

The process of reproduction can be of two types :

(i) Asexual reproduction
(ii) Sexual reproduction

**Asexual reproduction :** Living beings originate from living beings. If the off-spring originate from one cell obtained from one parent only or from some specific vegetative structure, then this type of reproduction is known as the asexual reproduction.

**Sexual reproduction :** This process is accomplished by the male and female reproductive organs. Zygote is formed by the fusion of gametes produced by the male and female reproductive organs. The living being originates from the development of this zygote. This is known as the sexual reproduction.

The new organism formed by the fusion of two different gametes have variations which form the basis of evolution. From evolutionary point of view, sexual reproduction is more meaningful.

**8.12.2 Reproduction in Animals :** Reproduction is a natural characteristics of animals. All the living beings maintain their species in nature by means of this process. This production of off springs is known as **reproduction**. The number of animals increase by reproduction. In animals, reproduction is of two types :

(1) Asexual reproduction
(2) Sexual reproduction

1. **Asexual reproduction :** If the off-spring originates from cell obtained from done parent only or from any part of the biological body or from a vegetative organ, then this type of reproduction is called asexual reproduction. In this type of reproduction, male and female gametes are not formed. Asexual reproduction is of many types in invertebrate animals :
   **(i) Binary fission :** In unicellular organisms, similar organisms originate from cell division or fragmentation. In this, the animal divides into two similar types by

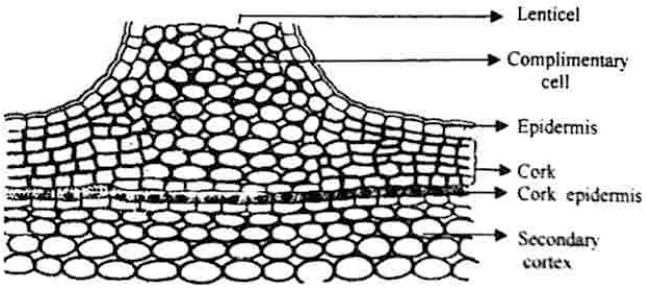



**Fig. 8.33 : Different types of Binary fission in animals of the division protozoa - (a) Irregular (Amoeba) (b) longitudinal (Euglena) (c) lateral (Paramecium)**

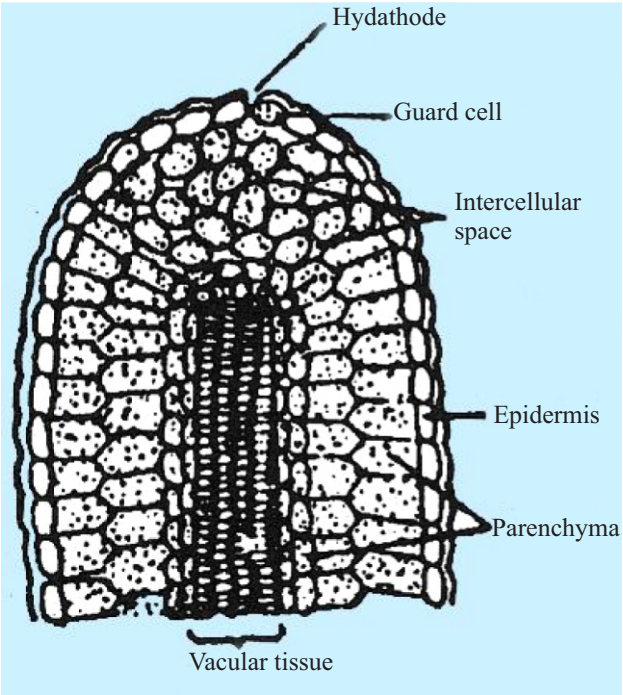



**Fig. 8.32 Hydathodes**

**(ii) Multiple fission :** Prior to this type of division, the nucleus of the individual divides many times resulting in the formation of many daughter nuclei. Later on the cytoplasm divides. New generation is obtained by the accumulation of cytoplasm around each individual nuclei. Thus the individuals of next generation are produced from the parent. Example : *Plasmodium* etc.

**Fig. 8.34 : Multiple fission in Plasmodium**

**(iii) Regeneration :** In some animals, there exists a remarkable capability of forming new organisms, of their type, by division of their vegetative parts. The animal divides into some fragments and each fragment then gives rise to an individual. Process of reorganization of the organism is known as regeneration. Example : *Planeria*, *Hydra*, Star-fish etc.

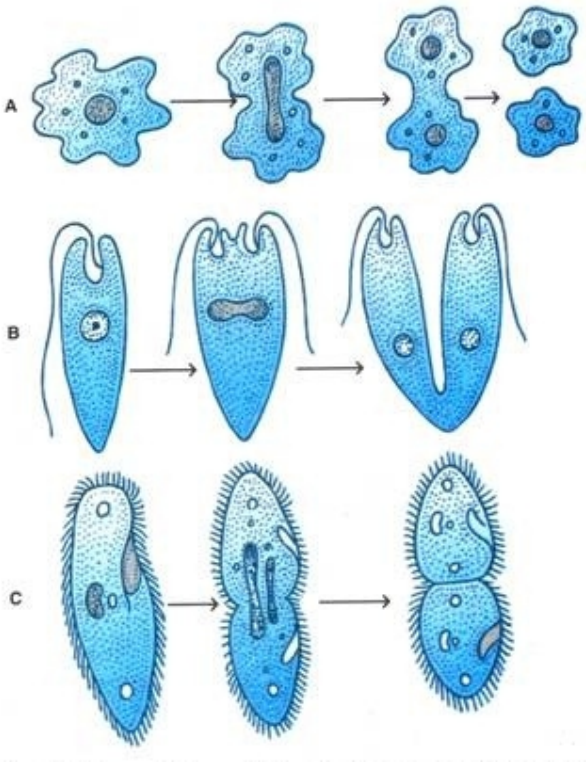
**(iv) Budding :** In some animals there exist cells having the capacity to reproduce a bud on the animal body i.e. an outgrowth, which develops into an individual. The new organism, thus formed, seperate from the parent organism only when mature. This method is known as budding. Example : Hydra

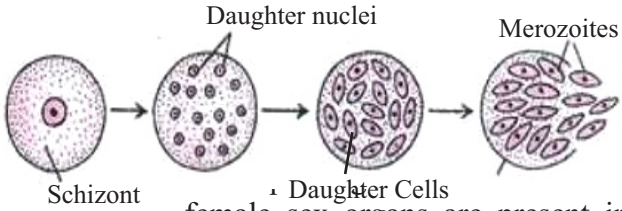
**Fig. 8.36 : Budding in Hydra**

2. **Sexual reproduction :** In this type of reproduction, there is participation of two individuals for the production of new generation. Production of a new organism, similar to the parents, by fusion of male and female gametes (sperm and egg) in known as sexual reproduction. Sexual reproduction takes place in higher invertebrates and vertebrates.

   **(i) Sexual reproduction in Hydra :** The male and female organs, testes and ovary respectively, are formed on the body of Hydra in the form of swellings. Zygote is produced by the fusion of male and female gametes. This zygote then develops to form hydra.

**(ii) Sexual reproduction in**




female sex organs are present in two separate individuals. The male reproductive cell is known as the male gamete or sperm, which is motile. The reproductive cell, present in female is known as the female gamete or the ovum, which is bigger than the male gamete and is non-motile.

The human reproductive system is more advanced than that of other evolved organisms. It is activated at a particular age, which is known as the puberty. In boys, puberty is at the age of 13-14 years while in girls it is at the age of 10-12 years. Human reproductive system can be studied in two parts :

**(a) Male reproductive system :** The organs that produce the

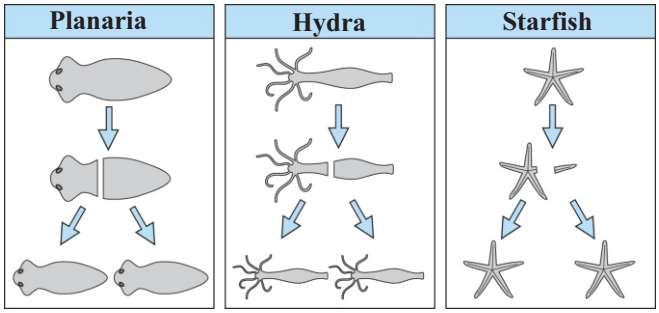
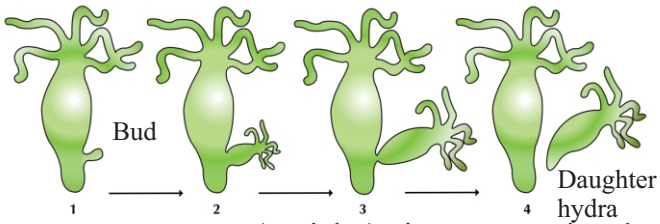


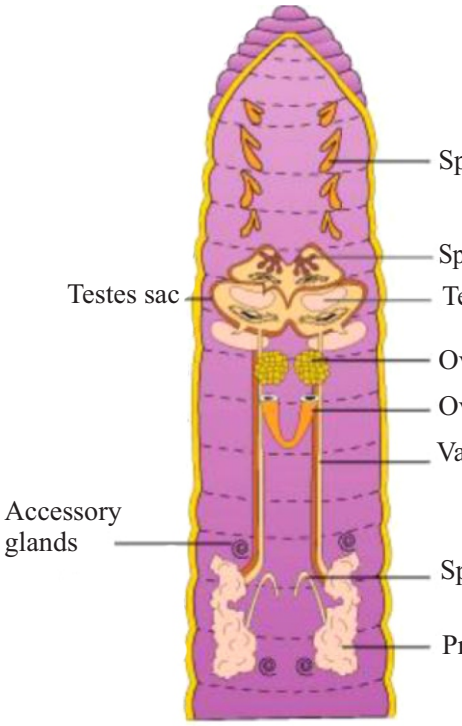

**Fig. 8.35 Regeneration in various organisms**

reproductive cells and the organs which carry them to the site of fertilization of the reproductive cells, together forms the male reproductive




(testicles) is present in the scrotum situated outside the abdominal cavity. This is because sperm-development requires a lower temperature than that of the body. Testes is made up of numerous seminiferous tubules. These coiled structures open into the epididymis. The distal end of the epididymis opens in the vas deferens which stores and nourishes mature sperms and move them to the ejaculatory duct. The ejaculatory duct connects the vas deferens to the urinary tract (urethra). The urethra is surrounded by a muscular organ, the penis and opens out by means of a pore. Both urine and the seminal fluid are passed out from this common opening. The prostate glands situated near vas deference secrete a milky fluid. Testosterone regulates the formation of sperms and the sexual characters visible during adulthood among boys. The motile sperms mainly comprise of the genetic material and a long tail which helps the sperm to swim upto the female gamete.

**Fig. 8.38 : Male reproductive system in humans**

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ovary is a funnel shaped structure which opens into the fallopian tube. The fallopian tubes of both sides join together to form a bag like structure the uterus. The uterus leads to the vagina via a cervix.

During mating sperms reach the fallopian tubes through the vagina and fertilizes the egg. The fertilized egg then establishes in the uterus and gradually develops into an embryo. A cord like structure, the placenta, is responsible for the nourishment of and excretion from the developing embryo. The female hormones, progesterone and oestrogen are responsible for the sexual symptoms of the female body.

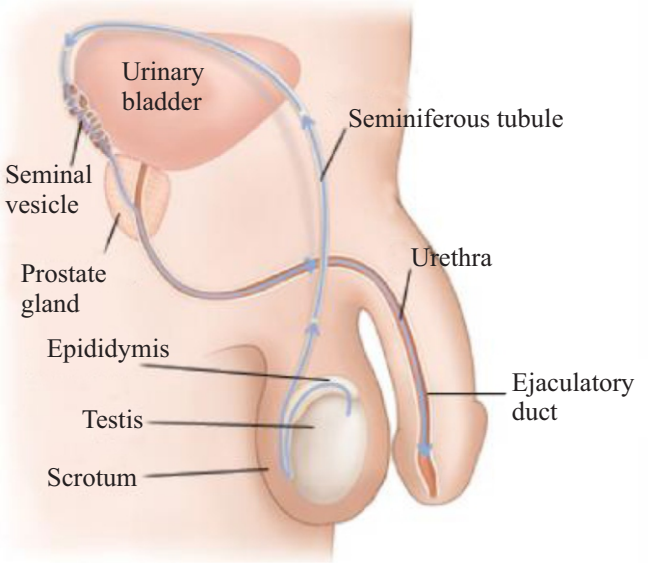



**Fig. 8.39 Female reproductive system in Human beings**

In the mammalian females there are two types of ovarian cycles :

**(i) Menstrual cycle :** If not fertilized, the egg cell remains alive only for a day, after ovulation. Then after, the internal wall of the uterus along with the blood vessels break down and passes out in the form of blood flow which is known as menstruation. It lasts for a duration of 4-7 days. In women, it is a regular process which occurs after a gap of 28-30 days. This is known as the menstrual cycle. The initialization of menstrual cycle at the time of puberty in females is known as menarche which indicates the beginning of the reproductive phase in women.

**(ii) Estrous cycle :** In most mammals, the reproductive period is in a particular season which is known as the estrous cycle or the reproductive phase. During the reproductive phase, after ovulation there is an intense desire for mating, in females and they reproduce , i.e. produce off-spring. This cycle occurs in all the female mammals like dogs, cat, cow etc.

**8.12.3 Reproduction in plants :** In plants, reproduction takes place by both asexual and sexual methods. Following are the major methods of reproduction in plants.

**Asexual Reproduction in plants :** In this method, a new plant develop from the cells obtained from only one parent or from some special vegetative structures. Following are the commonly occurring methods of asexual reproduction in plants:

**(a) Budding :** Asexual reproduction in yeast, which is used for bread formation, takes place by budding. In this method a small spherical outgrowth develops from the surface of the yeast cell. This is known as the bud. Now the nucleus present in the cell divides by mitosis to form two daughter nuclei. One of these nuclei moves to the bud while the other remains in the parent cell. After some time the bud takes the form of a mature cell and separates from the parent cell to form a new yeast.

**Fig. 8.40 Budding in Yeast**

Sometimes in a yeast cell many buds

develop one above the other forming a chain of buds. Thus, the asexual reproduction by budding occurs.

**(b) Sporogenesis :** This is the most common method of asexual reproduction in fungi. In this method a structure - the sporangium - develops in the mycelia. The nucleus of the sporangium divides many times resulting in the formation of numerous

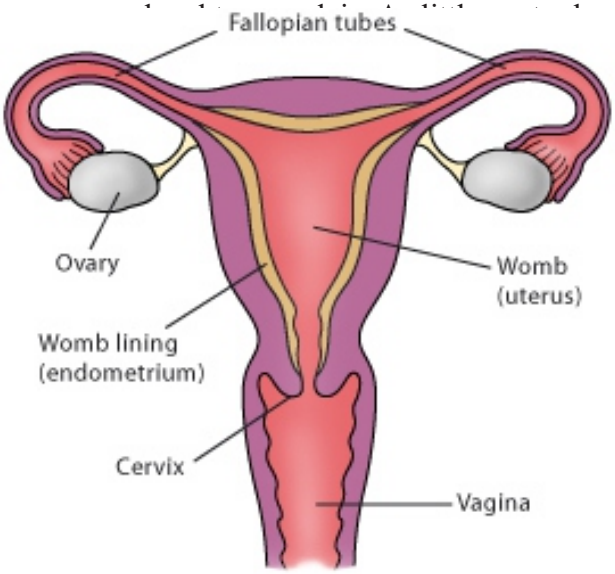



**Fig. 8.41 Sporogenesis in Rhizopus**

**Vegetative Reproduction :**

You must have observed plants like wheat jau, gram, bajra etc. developing from the germinating seeds. Have you observed seed production in plants like banana, rose, sugar-cane etc.? You will observe that seed production does not occur in them because of various reasons. However their vegetative parts have reproductive capability. New plants develop from the roots of banana; rose, mogra stem; and bryophyllum leaves. Dormant buds are present on the roots of sweet-potato and on potato tuber which develops into new plant by vegetative propagation. Thus development of new plants, from the vegetative organs of the plant, like - root stem or leaves, is known as vegetative propagation (The word 'asexual reproduction is not used in case of higher plants). In lower plants like *Spirogyra*, *Oscillatoria* etc. vegetative reproduction is by fragmentation.

Making use of the vegetatively reproducing capabilities of various plants, human beings have developed some methods of vegetative propagation for developing multiple plants at a fast rate, in lesser time, without any change in characteristics of plants of improved varieties having desired characters. Using these methods we can make our home, fields and gardens more ornamental and economically beneficial. These are the artificial vegetative propagation methods.

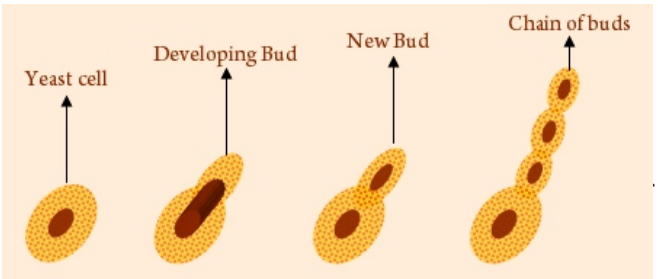



**Fig. 8.42 : Vegetative reproduction by leaf**

**Artificial Vegetative reproduction :** Following are the methods of vegetative reproduction developed by man :

**(a) Cutting :** A healthy, completely developed part of the root, stem or leaf

two plants together, is known as bud grafting or grafting. In this method the stem of two different plants is joined in

such a manner that they combine together in the form of a single plant.

**Fig. 8.43 Method of Grafting**

The plant with well developed root system is known as the stock and the plant stem having better quality characters which is to be established on this root system is known as the scion. A healthy branch of the stock and a scion of similar diameter is cut and the scion is tied to the stock in such a manner that their vascular region are in contact with each other. Within a few days the tissues of the stock and scion combine with each other and develop in the form of a single plant.

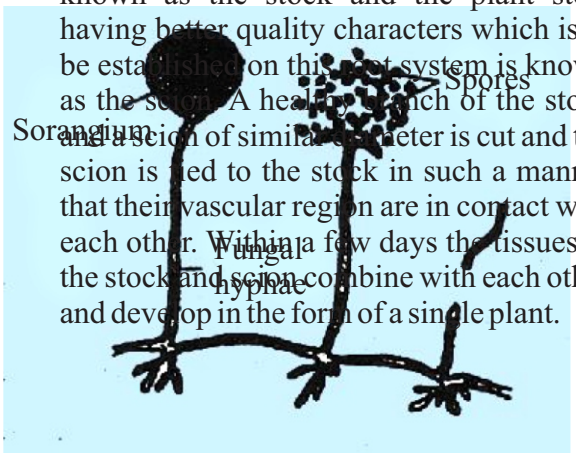



**Fig. 8.44 Different stages of grafting : (a) prepared scion (b) rooted stock (c) Scion inserted in the stock (d) Graft showing growth.**

Different varieties can be grafted on a single stock. This method is widely used to improve the varieties of various flowering and fruiting trees. Example : lemon, orange etc.

**(c) Layering :** This is the suitable method of vegetative reproduction in plants having long flexible branches, like mogra, litchi, pomegranate etc. In this method, rooting is done before separating the branch from the parent plant. In this method, rooting, on the branches, is done by two methods :

**(1) Mound (stool) layering method :** This is the simple method of layering in which branch is bent and buried or the soil is mounded over to the lower new branches on the stem. The soil is kept moist by watering at an interval of 2-4 days. In about 15-20 days, roots originate from the buried parts of the stem. Now, it is separated from the

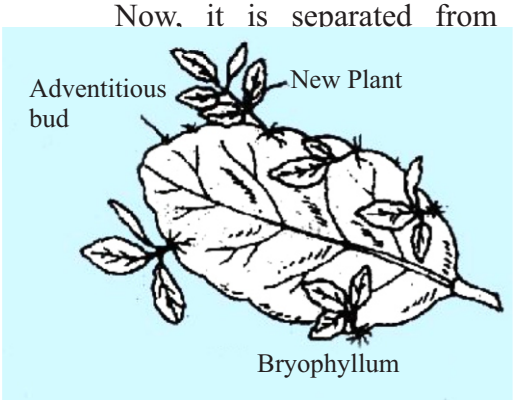
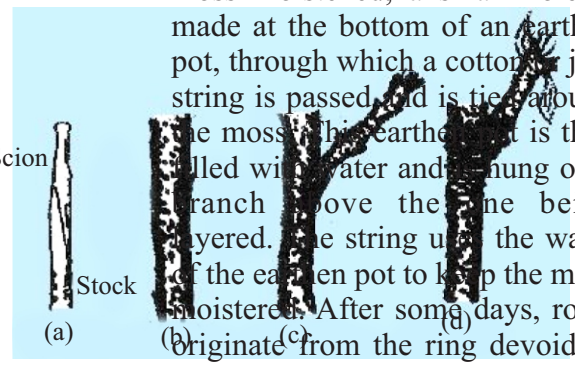



**Fig. 8.45 : Technique of Layering**

**(2) Air layering of 'gutti-method' :** The branches in woody trees like pomegranate, litchi etc. are very high from the soil. For layering in such plants, a groove is made by removing a ring of the bark of 1-2 year old branch, using a sharp knife. Moist moss is then tied around this groove using a piece of

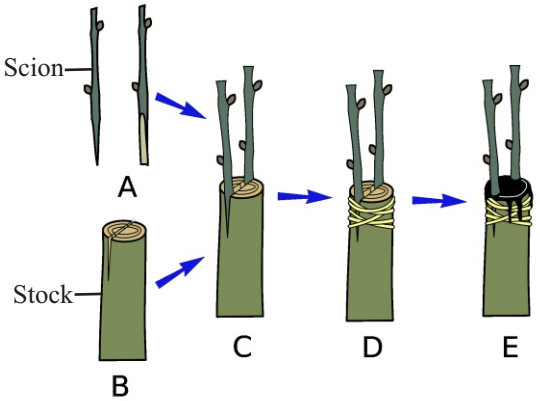
jute or a polythene. For keeping the moss moistened, a small hole is made at the bottom of an earthen pot, through which a cotton or jute string is passed and is tied around the moss. This earthen pot is then filled with water and hung on a branch above the one being layered. The string uses the water of the earthen pot to keep the moss moistened. After some days, roots originate from the ring devoid of the bark. This branch is then cut apart from the parent plant, below the gutti and thus a new plant is obtained. This method is known as air layering or gutti-method.




**Significance of vegetative reproduction :**

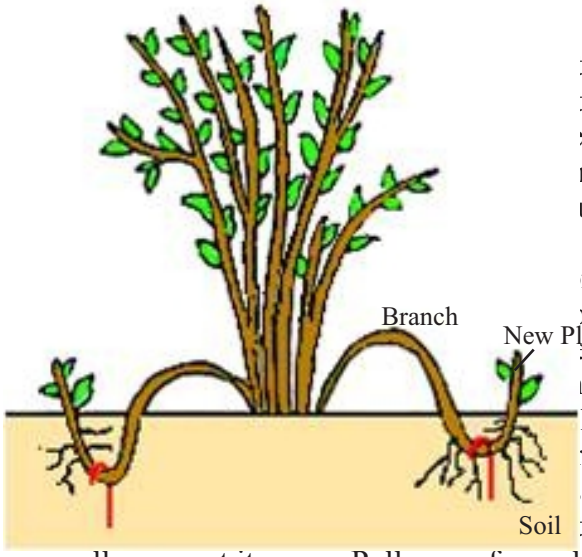
(1) Vegetative reproduction is the only method to maintain the variety of plants like banana, orange, grapes etc. in which either seeds are not formed naturally or the rate of germination is less and to ensure their availability at commercial level.

(2) In many plants which develop from seed, it takes a long time to obtain fruits




maintained from generation to generation whereas variations occur in plants that are developed from the seeds.

**Sexual Reproduction in Plants :** The flowering plants form the most highly evolved group in the plant world. Flowers bear the sex organs of the plant. In some plants both male and female reproductive parts are borne on the same plant. Such plants are known as bisexual. In others, the male and female reproductive parts are situated on separate plants. They are known as unisexual plants. We can understand sexual reproduction in plants using mustard or datura flowers.




pollen sac, at its apex. Pollen are formed in the pollen sac. Two male gametes are formed in each pollen grain. The carpel is divisible into three part - ovary, style and stigma. The swollen part at the base is the **ovary**, which contains the ovules. In each ovule there is a female gamete- the egg. A long tube-like structure develops from the upper part of the ovary. This is the **style** whose flattened apex is known as the stigma.

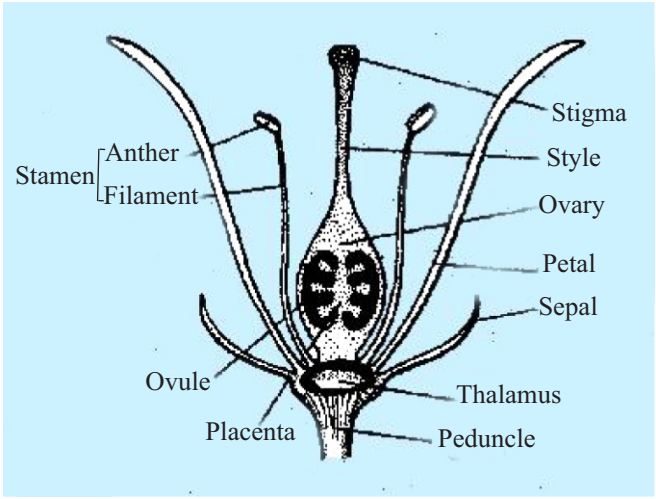
**Pollination :**

The transfer of pollen grains to the stigma of

the flower of the same species, is known as pollination. The female and the male gametes fuse after pollination. Pollination may take place by insects, air, water or by spontaneous dehiscence. The pollination of a flower by the pollen-grains from the same flower or from another flower situated on the same plant is known as **self-pollination**, while when the pollen-grains of a different flowering plant of the same species pollinate the stigma, it is known as cross pollination.

**Fig. 8.47 Fertilisation in flowering plant**

**Fertilization and embryo development :** The pollen grains reach the stigma of a flower by pollination. Here the pollen-grains germinate and forms a tube - **the pollen tube**. This tube enters the stigma and reaches the ovary. In the ovary, it enters the ovule through the micropyle. The two male gametes thus reach the embryo-sac situated in the ovule. Here, one of the male gamete fuses with the egg cell forming the zygote which develops into an embryo. This is true fertilization. The other male gamete fuses with the two polar nuclei, in the embryo sac. This is known as triple fusion. Thus during fertilization in angiosperms, there are two separate fusions within the embryosac - the fusion of the two gametes (egg and male gamete) and the fusion of the three nuclei (one male gamete and two polar nuclei). This is known as **Double fertilization**. After fertilization, ovule develops into the seed and the ovary into a fruit. Thus the sexual reproduction is accomplished in a flower.



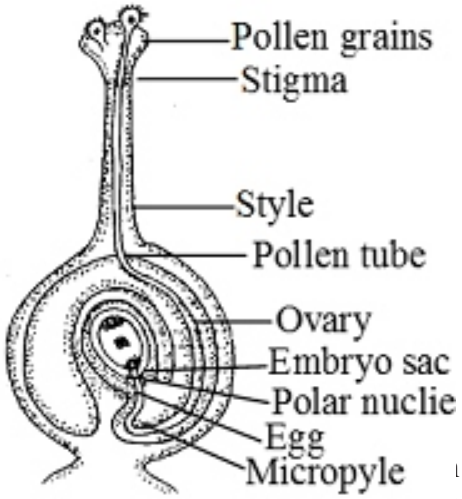

## 8.13 Regulation :

**8.13.1 Sensitivity :** Animals exhibit response to its environment and also to the changes in the environment. This process is known as sensitivity. All the living beings whether amoeba or human beings, exhibit sensitivity. In all of them the mode of responding may differ. If we prick a needle to the pseudopodia of amoeba, it retracts them and forms a ball-like structure. In higher animals the body is regulated by the nervous system and the endocrine system. In non-chordata and other less developed animals sensory cells are present instead of the complete nervous system which show sensitivity towards changes in their environment. The information received by the sensory organs reach the control center-brain, spinal cord, ganglions etc. through the nerves. This is known as the conduction of the impulse. These impulses are analyzed by the control centers and the reaction is carried to the affected organ or sense organ, accordingly. In animals the function of regulation is performed by the nerves at a fast pace.

**8.13.2 Nervous system :** The function of control and co-ordination of sensations in animals, is performed by the nerves and the muscle tissue. Every organism lives

normally in its environment and reacts to any sudden change in situations, like touching to a hot substance, pricking of a nail in the foot, touching of a person etc., by means of the nervous system.

The nervous system is made up of many nerve cells or neurons. There are three parts of a nerve cell - Cell body, axon and dendrite.

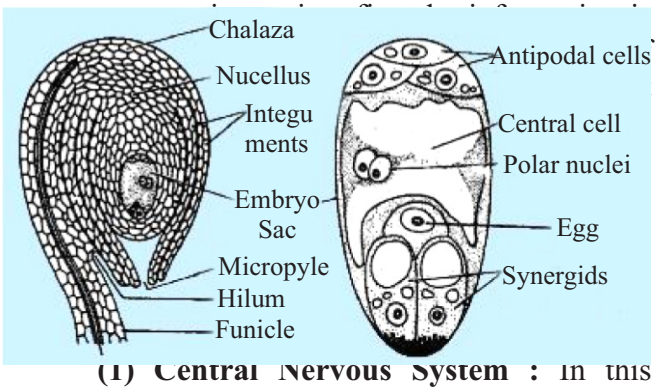



the nucleus, other organelles, Nissl body and neurofibrils are present in this part of the neuron.

**(ii) Axon :** A long cylindrical projection is present on one side of the cell body which is known as the axon. Cytoplasm is present in axon. It is covered with a layer of lipid which is known as the myelin sheath. It is an insulating sheath. There are many branches on the other end of the axon which terminates into button-shaped structures.

**(iii) Dendrites :** Many branched dendrite are present on the cell body which spread in all directions except in the direction of the axon.

An electric impulse is generated by a chemical reaction when information is received from the dendritic end of the neuron. This impulse is carried to the cell body by the dendrites and then it passes through the axon and reaches its other end. At the end of axon some chemicals are released by this electric impulse which travel across the void space or synapses and induces similar impulse in the dendrites of the adjoining neurons. This process




**(1) Central Nervous System :** In this system the brain and the spinal cord are the control centers.

**(a) Brain :** This is the most soft and a very important organ of the body. It is present in the cranium region of the skull which covers it and thus protects it from the external shocks. The brain has three main parts - Fore-brain, Mid-brain and Hind-brain. The weight of a normal human brain is 1350 gram and its volume is 1300 cc.

(i) **Fore brain :** This is the center of the main sensations in the brain. Different areas of this part of the brain has centers for hearing, smelling, viewing etc. Various sensory information are received at different points in the forebrain. This part of the brain controls voluntary actions like thought, recognition, memory, contemplation, will power etc. Various body processes like hunger, thirst etc. are also controlled and coordinated by the fore brain.

**(ii) Mid brain :** The centers of most of the involuntary actions are present in the mid-brain. For example : Watering of mouth on seeing food, contraction of the pupil in

bright light, reflex actions etc.

**(iii) Hind-brain :** It controls all the involuntary actions of the body like blood-pressure, vomiting, heart beat, digestion, excretion, circulation etc. The regulation of muscular movement of the hands and legs and other body parts is

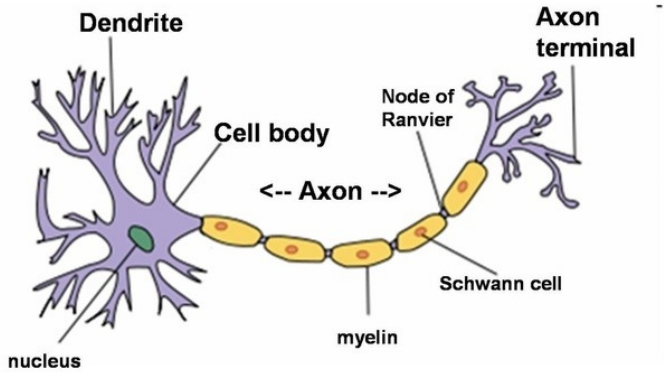



**Fig. 8.50 Human Brain**

**(b) The spinal cord :** It is long and cylindrical. It remains protected in our vertebral column. Its anterior end is connected to the medulla oblongata of the brain and the posterior end terminates in the form of a thin thread in the vertebral column. 31 pairs of nerves come out from the spinal cord which are known as the spinal nerves. Its main function is to regulate the reflex actions. In this process it carries the sensations to the brain and then sends back the communications and instructions received from the brain to the affected organs.

**(2) Peripheral Nervous System :** The various nerves coming out of the central nervous system comprises the peripheral nervous system. It connects the rest of the body with the central nervous system. In humans 12 pairs of cranial nerves come out from the brain which reaches to organs like eyes, nose, ear etc. and regulates them.

**(3) Autonomic Nervous System :** Various involuntary activities of our body, like the heart beat, peristalsis, digestion etc. are regulated by this nervous system. There are two parts of this system sympathetic nervous system and the parasympathetic nervous system.

**Reflex action and reflex arch :**

Reflex actions are involuntary i.e. they are not affected by our will power. They are controlled by the spinal cord. There are two roots of every spinal nerve - dorsal root and ventral root. The dorsal root is made up of the sensory nerve filaments. The ventral root is made up of the motor nerve filaments. The sensory cells present in the skin gets excited when a thorn is pricked in the leg. This stimulus from the sensory cells is carried to the dorsal root via the sensory nerves in the form of an impulse. In dorsal root this impulse reaches the gray-matter of the spinal cord. This information is analyzed in the spinal cord and the essential instructions are forwarded to the ventral root via the motor filaments. The motor nerves then carry these instructions to the affected organ, as a result of which we withdraw our leg immediately. The rate of reflex action is very high. In this process the entire path from the sense organ to the muscles of the affected organ is known as the reflex arch. Reflex actions occur very quickly thus protecting the organism from the harmful sensations instantly. The spinal cord controls the reflex action so the brain gets enough opportunity for other important body

functions.

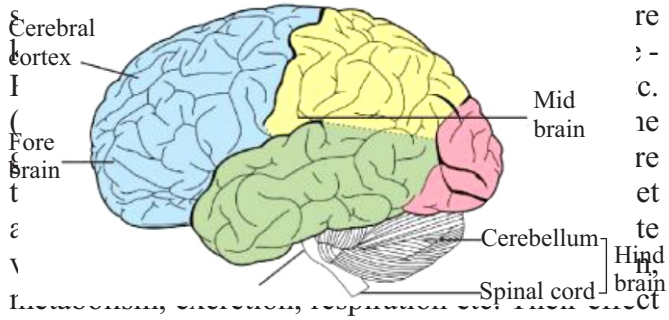



**Fig. 8.51 : Diagram of the reflex arch.**

**8.13.3 Endocrine System :** In human body there are ductless glands which directly release their s re l - I c. ( ne f re t et a te v n, metabolism, excretion, respiration etc. Their effect is very slow and they are secreted in very minute quantity.

Pitutary gland is situated in the fore brain and secretes growth hormones. Pitutary gland is also known as the 'master gland' because it regulates many other endocrine glands of the body. The Pitutary gland is controlled by the hypothalamus. Therefore it is also known as the 'master of master gland'. Imbalance in the growth hormone results in either very tall or a dwarf individual. **Thyroxine** hormone is secreted by the thyroid gland. This gland is present on either of the lateral side of the wind pipe near the voice box, in the anterior part of the lower neck. Unbalanced secretion of hormone (i.e. either too much thyroid hormone or not enough) causes enlargement of the thyroid gland. This is known as **goiter**. The goiter disease appears as a swelling in the neck. Thyroxine hormone is responsible for the proper metabolism of carbohydrates, proteins, fats etc. in our body which is essential for the proper functioning of our body. Iodine is very essential for thyroxine hormone. Iodine deficiency in the body disturbs the balance of thyroxine hormone in the body and this leads to the goiter.

**Thymosin** hormone is secreted by the thymus gland which is located in the chest. The main function of this hormone is to develop the immune system which enables our body to counter the pathogens. The overactivation of this gland results in enlargement of the tonsils and leads to the disease tonsillitis.

Pancreas are located near the duodenum. **Insulin** hormone is secreted by the pancreatic glands. This hormone regulates the blood sugar. If this hormone is not secreted in proper quantity the blood sugar level increases or decreases which results in a disease named diabetes.

Adrenal gland is located above the kidneys and secrete the hormone **adrenalin**. This hormone is secreted directly into the blood and is then carried by it to the target organs Adrenalin helps the body to face stressful situations. When under stress our heart beat increases which in turn increase the supply of oxygen in our muscles. This enhanced blood supply is managed by decreasing the amount of blood flow in some other organs. Even the rate of respiration increases.

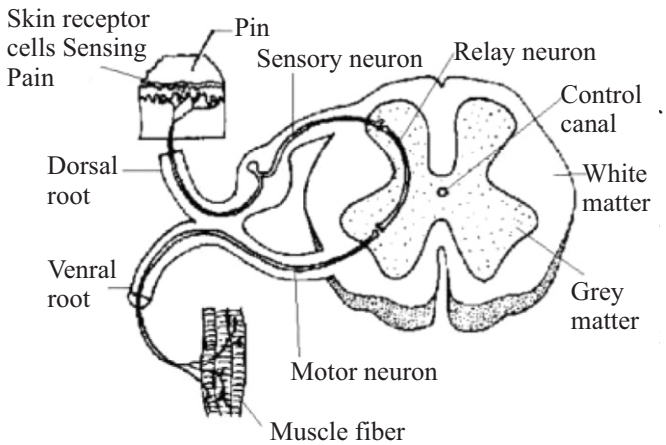
In males, the male reproductive glands are present which secretes **testosterone** at puberty. Testosterone is responsible for the development of the secondary sex characters during adolescence and development of male sex organs before birth.

Female reproductive glands are present in females, which secretes **estrogen**. Estrogen is responsible for the development of secondary sex characters in girls.

**8.13.4 Regulation in Plants by Hormones:** It is the general belief that the plant growth depends on the minerals present in the soil and the environmental factors. Now, it is a proven fact, that some chemical substances also influence the plant growth. These substances are generally produced in one part of the plant body and are then translocated to other parts where they influence the growth of that part. These chemicals which regulates and control the growth of various plant parts are known as the **plant hormones**.

**Uses of plant hormones in agriculture :**

Plant hormones are used in agriculture on a




are not present while they are present in animals.

2. In plants there are no specialized tissues for conduction of information but animals do have such tissues.
3. The process of change of shape of cells in plants is entirely different from that of animals.

**Famous Indian Scientists :**

**Biography of Dr. Sir Jagdish Chandra Bose :** Dr. Sir Jagdish Chandra Bose was born on 30th November 1858 at a place named Mymensingh in East Bengal (Now Bangladesh). His father, Bhagaban Chandra Bose was a leader of the Brahma-samaj and was the Deputy Magistrate at various places like Faridpur, Vardhaman etc. Sir J.C. Bose received his basic education in a school at his village, upto the age of 11 years. His father had a firm belief that a good knowledge of the mother tongue is essential prior to learning english, so his education started at a Bangla school. Dr. Bose in 1915 quoted at a conference at Vikrampur "In those days, educating children in an english medium school was a status symbol. In the Bangla school, I studied at, on my right hand side sat the son of one of my father's muslim servant while on the left hand side sat the son of a fisherman. They were my playmates. I used to listen to their stories about birds, animals and aquatic animals with interest. Probably these stories induced my interest in research on the composition of nature." After completing the primary education Bose was sent to Calcutta to learn English and got his further education at St. Xavier's school where he graduated in physical science. It was here that Prof. Father Lafont inspired him to study Physics. Jagdish Chandra Bose was very much interested in Biology. At the age of 22 years he went to London to study medical science but because of his bad health he abandoned the thought of becoming a doctor and got admission in the Christ College at Cambridge for his B.Sc. Degree.

He returned to his motherland in 1885 and taught physics at the Presidency College upto 1915. During those days Indian teachers were paid just one third the amount paid to the foreigners. As a protest Jagdish Chandra Bose continued teaching without drawing a single penny as salary for the initial three years. This resulted in the deterioration of his economic conditions, with debts piling high, he even had to sell out his ancetral land. In the fourth year, Jagdish Chandra was ultimately paid full salary from the date he joined the college. Bose was a famous teacher and in the class used scientific demonstrations on a large scale while teaching. Some of Bose's students like Satyendra Nath Bose became famous physicist.

Jagdish Chandra Bose was the first famous scientist of our country who had an indepth knowledge of physics, biology, botany and paleontology. He was a leading scientist who worked on the optics of radio and microwaves.

He conducted many important researches in Botany. It is worth mentioning that he was the first Bhartiya resercher and scientist to obtain an American patent. He is considered to be the 'father of radio science' He wrote science fictions also and is considered to be the 'father of the Bengali science fiction' also.

In November 1894, Bose used microwaves of one millimeter range to ignite dynamite placed at a distance and also to ring a bell, in a public display at Kolkata. In a Bengali essay "Invisible Light" (Adrashya Aalok) that "Invisible light can easily enter brick walls and buildings etc. and hence can be used to communicate messages without the use of wires."

Jagdish Chandra Bose made important contributions in the sphere of Biophysics also. By analyzing the changes in plant cells in different situations he concluded that plants are sensitive and have feelings. They can experience pain and love. Bose invented an instrument named 'Crescograph' and studied the response of plants towards various stimulants.

In 1917 the title of "Knight" was awarded to

Jagdish Chandra Bose and in 1920, Royal Society, London selected him as the Fellow of Royal Society (FRS) for his researches in Physics and Biology. The main point to be noted regarding his researches is that he accomplished everything without any costly apparatus and in a very simple laboratory. He was thinking about establishing a laboratory equipped with various advanced apparatus. The Bose Institute (Bose Science Temple) is the result of his aforesaid thinking. It is a famous center of research in science and is located at Calcutta.

Dr. Jagdish Chandra Bose died on 23 November in 1937 at Giridih (Bengal Presidency). His life and work is a source of inspiration for our youth. The lesson to be learnt from Dr. Bose's biography is that if there is talent and dedication in a person then high quality research can be conducted even in simple laboratory with limited means. The ideal personality and scientific attitude of Dr. Sir Jagdish Chandra Bose will remain a source of inspiration for the youth.

## Important Points

1. Xylem and Phloem are found in the veins of leaves.
2. The main function of xylem is conduction of water to every part of the plant and the main function of phloem is to translocate the food material prepared in the leaves to all the parts of plant.
3. Stomata are present on the lower epidermis of a dorsi-ventral leaf. Gaseous exchange takes place through these stomata.
4. Conduction of water and minerals to various parts of a plant is through the stem.
5. Plasmolysis occurs in plant cells.
6. Water moves up in the plant due to transpiration- Cohesion - Tension.
7. The food consumed by animals is broken down into minute simple forms by specific organs, with the help of various digestive juices. The specific organs for the purpose are known as the digestive organs.
8. Stomach digests the food. The hydrochloric acid of the stomach makes the food acidic and kills the accompanying bacteria and other micro organisms.
9. Haemoglobin is the respiratory pigment present in the Red Blood Corpuscles (RBC).
10. The pressure applied against the walls of the blood vessels is known as the blood-pressure.
11. The process of translocating the absorbed nutritive substances, water and waste products from one part of the body to another, is known as circulation. The system related to it is the circulatory system.
12. Male reproductive cells i.e. sperms are produced in the testis. Female reproductive cell, the egg, is formed in the ovary.
13. Asexual reproduction in filamentous algae like *Spirogyra, Oscillatoria* etc. takes place by fragmentation.
14. Dormant buds are present on the roots of sweet potato and potato tuber which produce new plants by vegetative reproduction.
15. Man has developed some methods of vegetative reproduction by using the capability of reproducing vegetatively of various plants. Many plants can be produced by these methods in less time and at a faster rate.
16. The swollen part on the tip of a pedicle is known as the thallamus. The four whorls of a flower - Calyx, Corolla, Androecium and Gynoecium are situated on the thallamus. Androecium and gynoecium are the reproductive whorls and Calyx and Corolla are the accessory whorls of a flower.
17. Waste products are formed as a result of various metabolic processes and the process of removing them from the body is known as excretion.
18. No specific excretory organs are present in the plants because most of the waste products formed are used by the plant itself.
19. Guttation takes place by special pores, the hydathodes.

## Questions

**Objective type :**

1. In plants water condition takes place through :
   (a) Phloem (b) Xylem
   (c) Seive tubes (d) Epidermis
2. The water available in soil for plant use is :
   (a) Hygroscopic water
   (b) Gravitational water

(c) Water obtained from guttation
(d) Capillary water

3. Exchange through stomata, takes place of :
(a) Water vapour and gases
(b) Oxygen and Hydrogen
(c) Oxygen and Carbohydrates
(d) Nitrogen and Water vapour
4. Food material is conducted through :
(a) Xylem (b) Phloem
(c) Stomata (d) Epidermis
5. Repiratory pigment is :
(a) Red Blood Corpuscles
(b) White Blood Corpuscles
(c) Haemoglobin
(d) None of the above
6. The systolic pressure of a normal body is :
(a) 120 nm (b) 90 nm
(c) 140 nm (d) 180 nm
7. Which of the following is not a function of the stomach :
(a) Storage of food
(b) Absorption
(c) Digestion
(d) Complete digestion of fats
8. Main example of fragmentation is :
(a) Spirogyna (b) Bryophyllum
(c) Yeast (d) Amoeba
9. The main method of reproduction in Rhizopus is :
(a) Binary fission (b) Budding
(c) Sporogenesis (d) Multiple fission
10. Ovules are located in :
(a) Ovary (b) Style
(c) Anther (d) Embryosac
11. In plant the metobolic process are mainly based on :
(a) Protein (b) Fats
(c) Carbohydrates (d) Vitamins
12. Hydathodes are present on :
(a) Roots (b) Stem
(c) Leaves (d) Flowers
13. Guttation can be observed when :
(a) Respiration is more
(b) More absorption and less transpiration
(c) Photosynthesis is more
(d) Diffusion is more
14. Ureotolic excretion occurs in :
(a) Amoeba and Frog
(b) Birds and fishes
(c) Fishes and snakes
(d) Man and frog

**Very short answer type questions :**

1. Excretion in aquatic plants occur by which method?
2. What is the function of the guard cells?
3. What is uricotelic excretion?
4. Name the two main parts of a plant.
5. Which conducting tissue is responsible for conduction of water from the roots to the leaves?
6. What is the function of Phloem?
7. Define plasmolysis.
8. What is respiration?
9. What is Binary fission?
10. What is a Thallamus?
11. Give examples of air-layering technique.
12. What is the need of reproduction in organism?

**Short answer type questions :**

13. Write the difference between the tap root and the adventitious roots.
14. Differentiate between the xylem and phloem tissue.
15. Define the following terms :
Diffusion, Osmosis, Plasmolysis, endosmosis
16. According to which theory does the water reach the leaves from the roots? Explain it.
17. Describe the functions of stomata.
18. How many types of circulatory systems are present in animals? Explain giving examples.
19. What are the anabolic and catabolic reactions?
20. Why special excretory organs are not present in plant? Explain.
21. What is budding?
22. Explain reflex action with example.

**Essay type answer questions :**

23. What is guttation? Explain with the help of example.
24. Explain the internal structure of a leaf?
25. Explain Root Pressure with the help of an experiment.
26. Give an illustrated account of the respiratory system in human.

27. Explain the method of grafting.
28. What is double fertilization? Elucidate.
29. Write a note on pollination.
30. Describe the reproductive system of human with the help of welllabelled diagrams.

## Answer Keys

1. (b) 2. (d) 3. (a) 4. (b) 5. (c)
6. (a) 7. (d) 8. (a) 9. (c) 10. (a)
11. (c) 12. (c) 13. (b) 14. (d)