

KENDRIYA VIDYALYA SANGATHAN

REGIONAL OFFICE AGRA

Life Processes

Class 10

Science

LESSON NOTES

Nutrition in Plants and Animals

- **Nutrition:** The process by which an organism takes food and utilizes it, is called nutrition.
- **Need for Nutrition:** Organisms need the energy to perform various activities. The energy is supplied by the nutrients. Organisms need various raw materials for growth and repair. These raw materials are provided by nutrients.
- **Nutrients:** Materials which provide nutrition to organisms are called nutrients. Carbohydrates, proteins and fats are the main nutrients and are called macronutrients. Minerals and vitamins are required in small amounts and hence are called micronutrients.
- **Modes of Nutrition**
 1. Autotrophic Nutrition.
 2. Heterotrophic Nutrition.

Autotrophic Nutrition – Life Processes Class 10 Notes

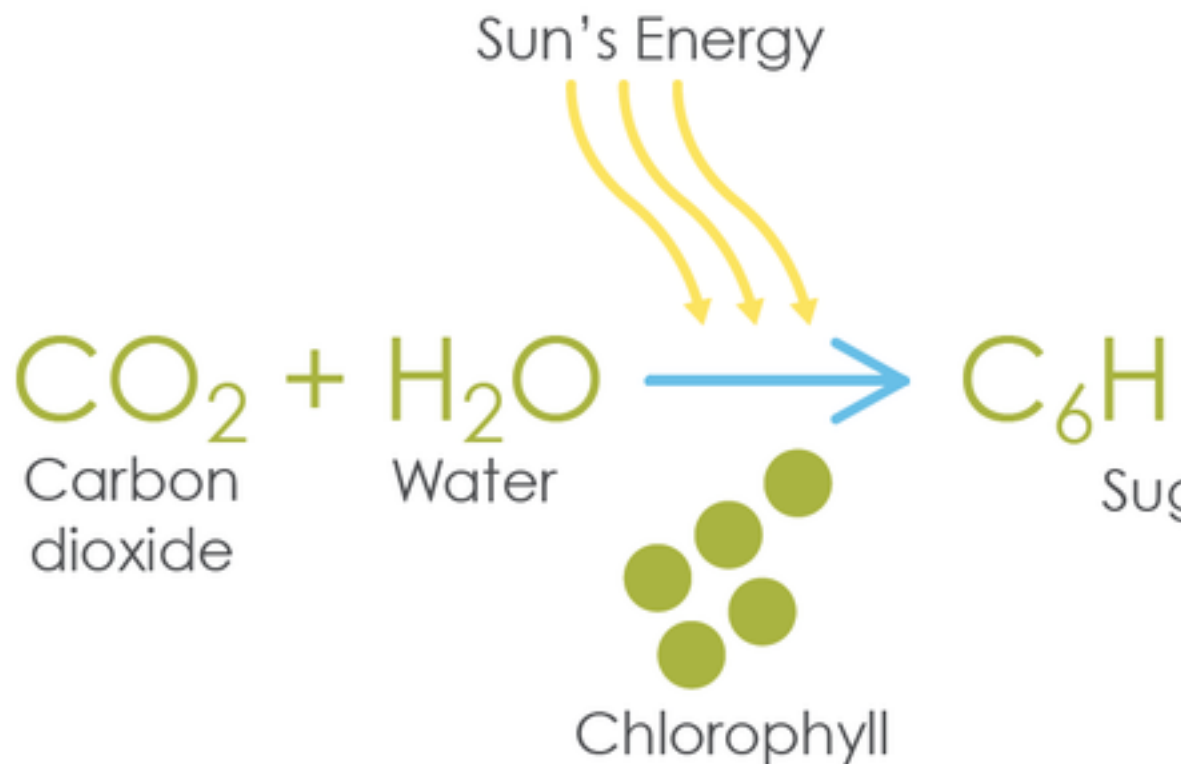
The mode of nutrition in which an organism prepares its own food is called autotrophic nutrition. Green plants and blue-green algae follow the autotrophic mode of nutrition.

- The organisms which carry out autotrophic nutrition are called autotrophs (green plants).

Autotrophs $\xrightarrow{\text{Use}}$ Simple inorganic material $\xrightarrow[\text{into}]{\text{Convert}}$ Complex molecules of

- Autotrophic nutrition is fulfilled by the process, by which autotrophs intake CO_2 and H_2O , and convert these into carbohydrates in the presence of chlorophyll, sunlight is called photosynthesis.

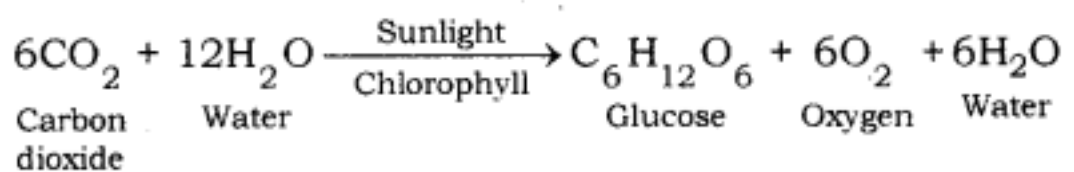
- Equation



Nutrition in Plants: Green plants prepare their own food. They make food in the presence of sunlight. Sunlight provides energy, carbon dioxide and water are the raw materials and chloroplast is the site where food is made.

Photosynthesis: The process by which green plants prepare food is called photosynthesis.

- During this process, the solar energy is converted into chemical energy and carbohydrates are formed.
- Green leaves are the main site of photosynthesis.
- The green portion of the plant contains a pigment chloroplast, chlorophyll (green pigment).
- The whole process of photosynthesis can be shown by the following equation:



Raw Materials for Photosynthesis:

- Sunlight
- Chlorophyll: Sunlight absorbed by chloroplast
- CO₂: Enters through stomata, and oxygen (O₂) is released as a byproduct through stomata on the leaf.
- Water: Water + dissolved minerals like nitrogen, phosphorous etc., are taken up by the roots from the soil.

How do raw materials for photosynthesis become available to the plant?

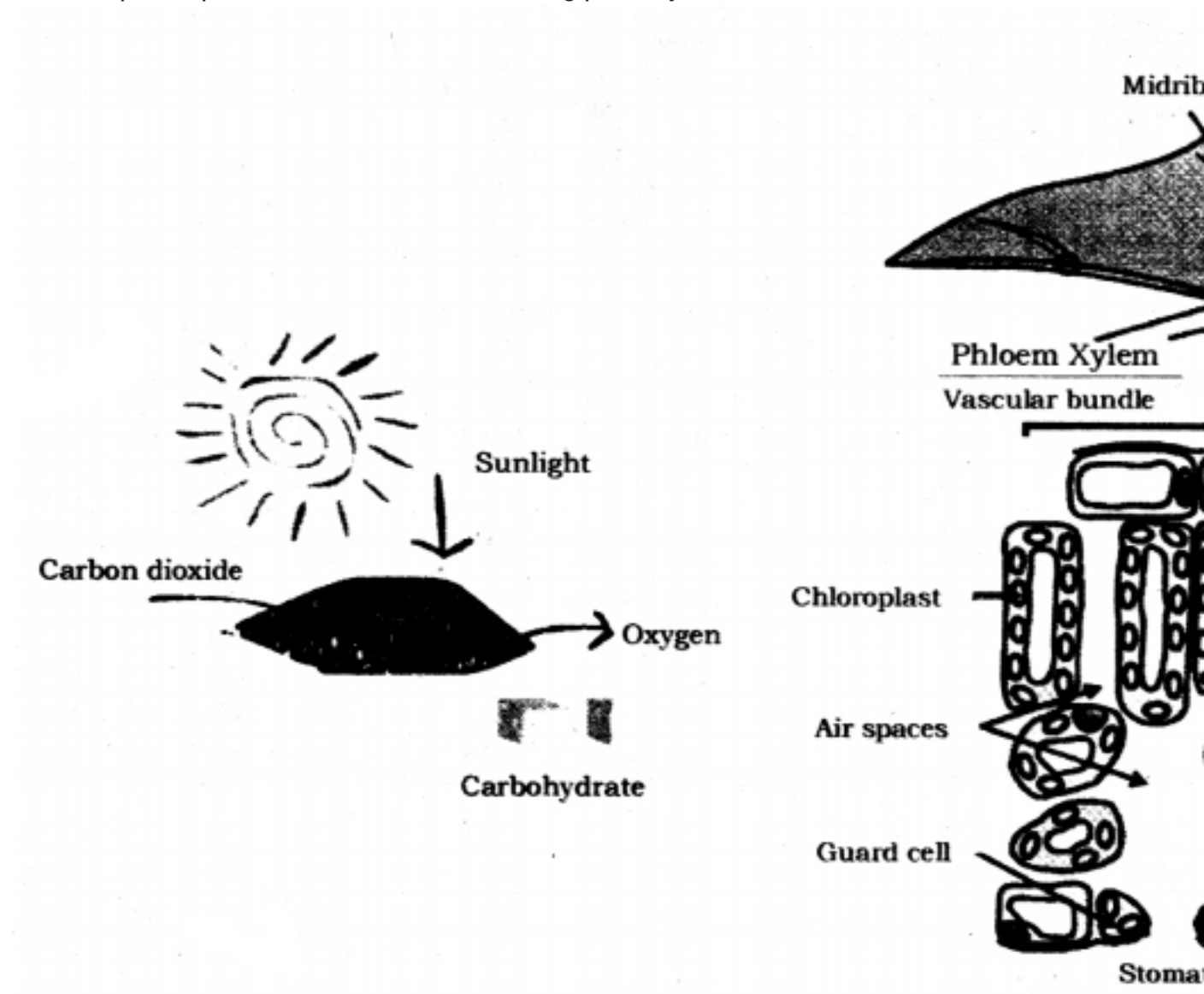
- Water comes from the soil, through the xylem tissue in roots and stems.
- Carbon dioxide comes in the leaves through stomata.

Site of Photosynthesis: Chloroplast in the leaf. Chloroplast contains chlorophyll (green pigment)

Main Events of Photosynthesis:

- Absorption of light energy by chlorophyll.
- Conversion of light energy into chemical energy + splitting (breaking) of water into hydrogen and oxygen.
- Reduction of CO₂ to carbohydrates.
- Sunlight activates chlorophyll, which leads to splitting of the water molecule.
- The hydrogen, released by the splitting of a water molecule is utilized for the reduction of carbon dioxide to produce carbohydrates.
- Oxygen is the by-product of photosynthesis.
- Carbohydrate is subsequently converted into starch and is stored in leaves and other storage parts.
- The splitting of water molecules is a part of the light reaction.

Other steps are part of the dark reaction during photosynthesis.



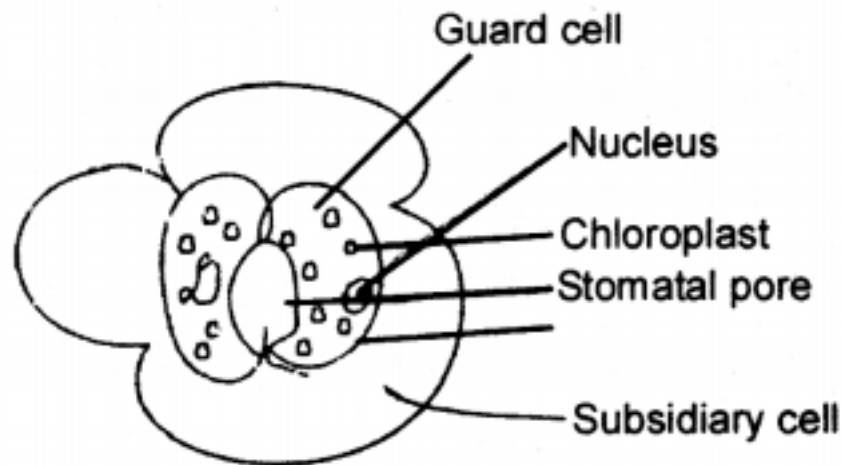
Stomata – Life Processes Class 10 Notes

- Stomata: These are tiny pores present in the epidermis of leaf or stem through which gaseous exchange and transpiration occur.

Functions of stomata

- Exchange of gases, O_2 and CO_2 .

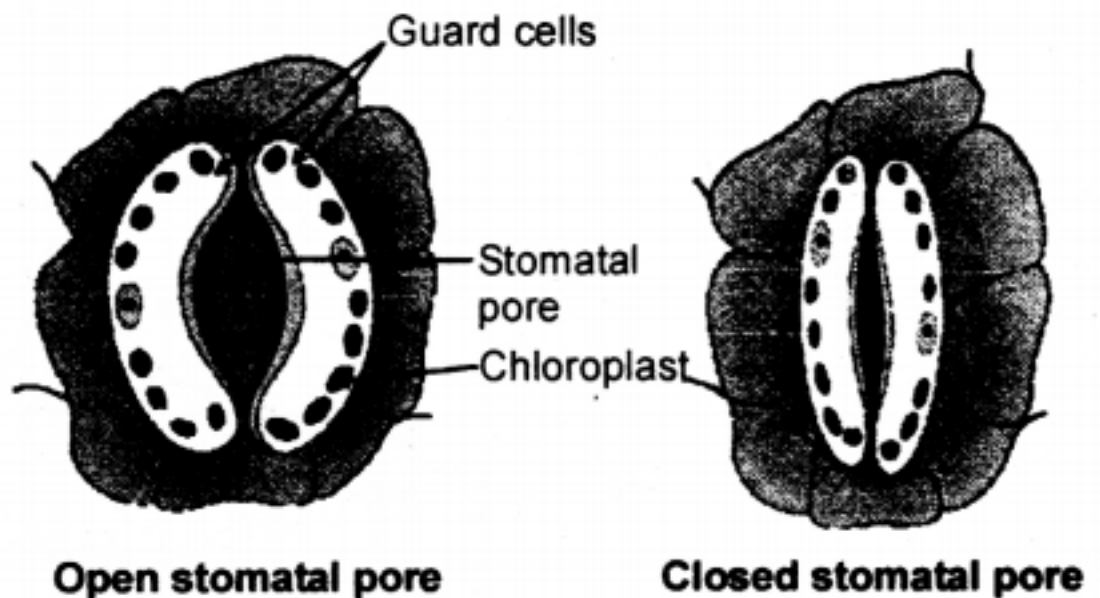
- Loses a large amount of water (water vapour) during transpiration.



Structure of stomata

Opening and closing of stomatal pores:

- The opening and closing of stomatal pores are controlled by the turgidity of guard cells.
- When guard cells uptake water from surrounding cells, they swell to become a turgid body, which enlarges the pore in between (Stomatal Opening).
- While, when water is released, they become flaccid shrinking to close the pore (Stomatal Closing).



Significance of Photosynthesis:

- Photosynthesis is the main way through which solar energy is made available for different living beings.

- Green plants are the main producers of food in the ecosystem. All other organisms directly or indirectly depend on green plants for food.
- The process of photosynthesis also helps in maintaining the balance of carbon dioxide and oxygen in the air.

Heterotrophic Nutrition – Life Processes Class 10 Notes

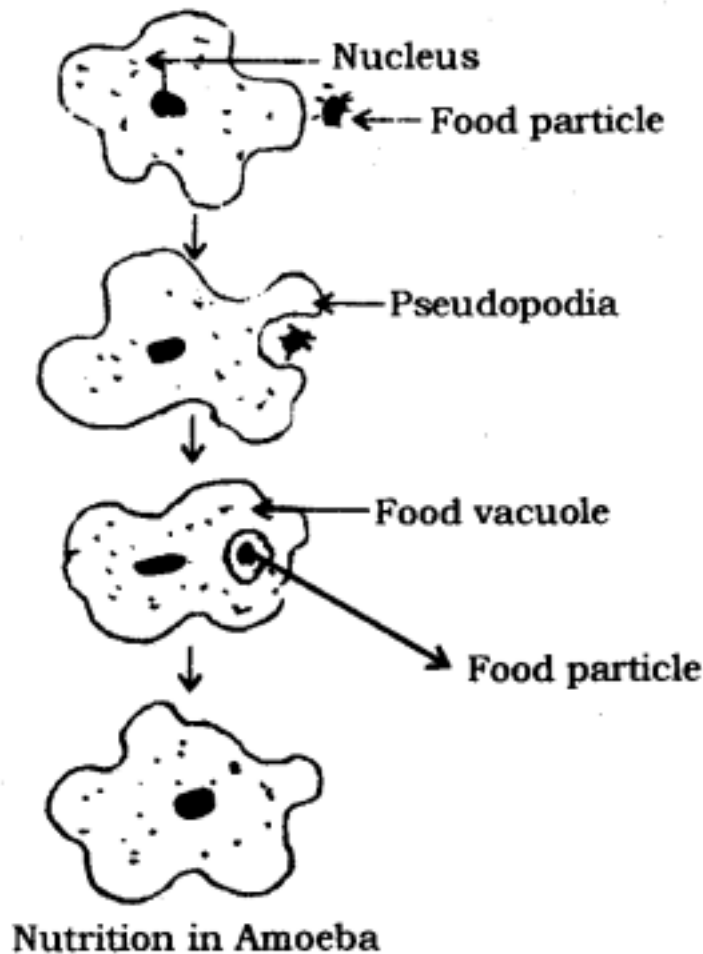
The mode of nutrition in which an organism takes food from another organism is called heterotrophic nutrition. Organisms, other than green plants and blue-green algae follow the heterotrophic mode of nutrition. Heterotrophic nutrition can be further divided into three types, viz. saprophytic nutrition, holozoic nutrition, and parasitic.

- **Saprophytic Nutrition:** In saprophytic nutrition, the organism secretes the digestive juices on the food. The food is digested while it is still to be ingested. The digested food is then ingested by the organism. All the decomposers follow saprophytic nutrition. Some insects, like houseflies, also follow this mode of nutrition.
- **Holozoic Nutrition:** In holozoic nutrition, the digestion happens inside the body of the organism. i.e., after the food is ingested. Most of the animals follow this mode of nutrition.
- **Parasitic Nutrition:** The organism which lives inside or outside another organism (host) and derives nutrition from it is known as parasites and this type of mode of nutrition is called parasitic nutrition. For example Cuscuta, tick etc.

Nutrition in Amoeba

- Amoeba is a unicellular animal which follows the holozoic mode of nutrition.
- In holozoic nutrition, the digestion of food follows after the ingestion of food. Thus, digestion takes place inside the body of the organism.

- Holozoic nutrition happens in five steps, viz. ingestion, digestion, absorption, assimilation and egestion.



Steps of Holozoic Nutrition:

- **Ingestion:** The process of taking in the food is called ingestion.
- **Digestion:** The process of breaking complex food substances into simple molecules is called digestion. Simple molecules, thus obtained, can be absorbed by the body.
- **Absorption:** The process of absorption of digested food is called absorption.
- **Assimilation:** The process of utilization of digested food, for energy and for growth and repair is called assimilation.
- **Egestion:** The process of removing undigested food from the body is called egestion.

Amoeba is a unicellular animal which follows the holozoic mode of nutrition. The cell membrane of amoeba keeps on protruding into pseudopodia. Amoeba surrounds a food particle with pseudopodia and makes a food vacuole. The food vacuole contains food particle and water. Digestive enzymes are secreted in the food vacuole and digestion takes place. After that, digested food is absorbed from the food

vacuole. Finally, the food vacuole moves near the cell membrane and undigested food is expelled out.

Nutrition in Human Beings

Human beings are complex animals, which have a complex digestive system. The human digestive system is composed of an alimentary canal and some accessory glands. The alimentary canal is divided into several parts, like oesophagus, stomach, small intestine, large intestine, rectum and anus. Salivary gland, liver and pancreas are the accessory glands which lie outside the alimentary canal.

Structure of the Human Digestive System:

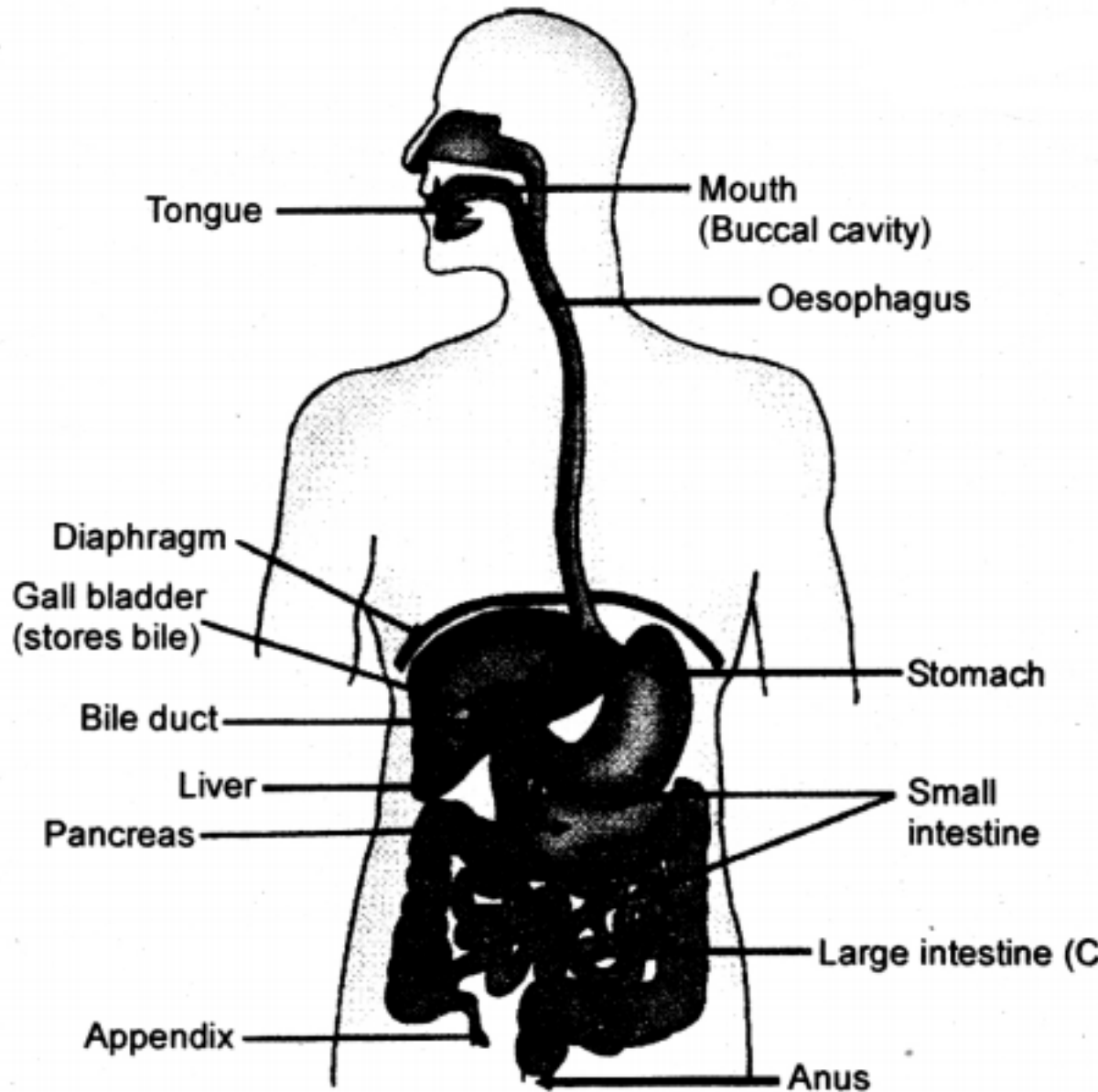
The human digestive system comprises of the alimentary canal and associated digestive glands.

- Alimentary Canal: It comprises of mouth, oesophagus, stomach, small intestine and large intestine.
- Associated Glands: Main associated glands are
 - Salivary gland
 - Gastric Glands
 - Liver
 - Pancreas

Mouth or Buccal Cavity:

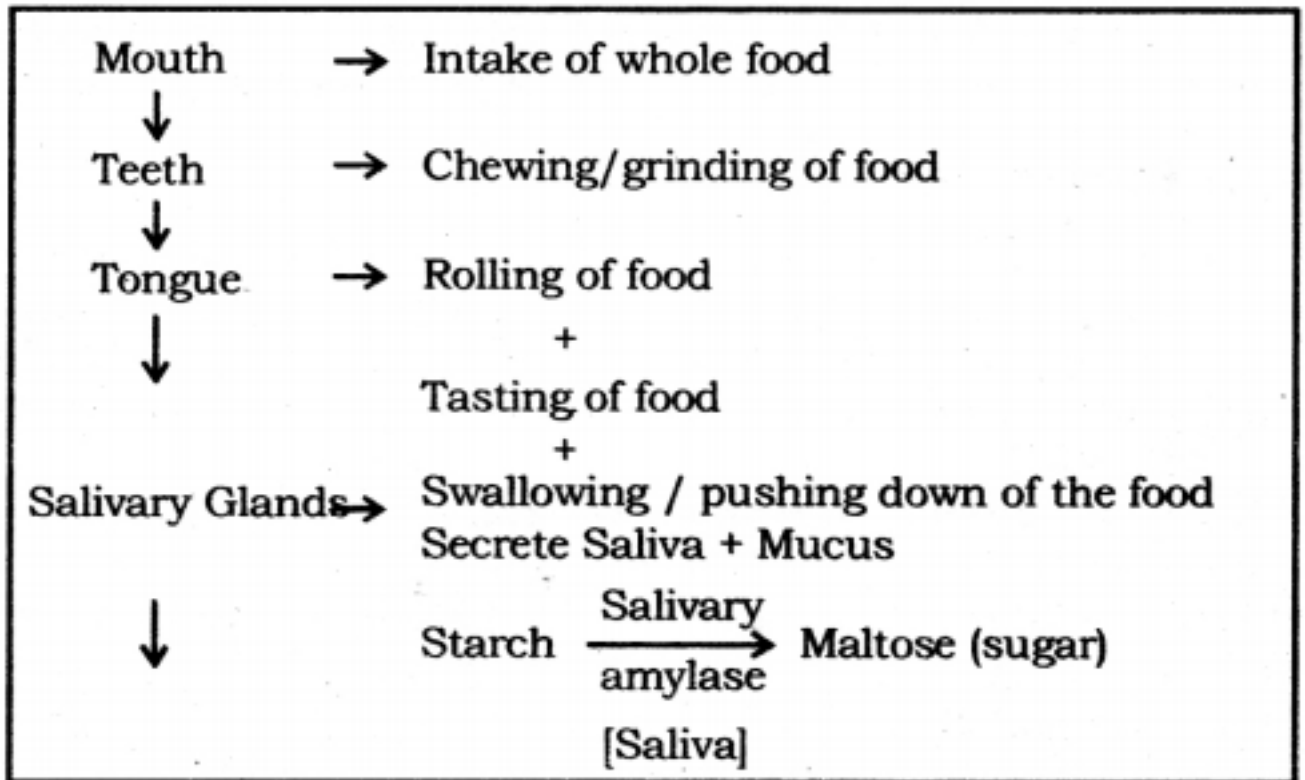
- The mouth has teeth and tongue. Salivary glands are also present in the mouth.
- The tongue has gustatory receptors which perceive the sense of taste.
- The tongue helps in turning over the food so that saliva can be properly mixed in it.
- Teeth help in breaking down the food into smaller particles so that, swallowing of food becomes easier.
- There are four types of teeth in human beings. The incisor teeth are used for cutting the food.
- The canine teeth are used for tearing the food and for cracking hard substances.

- The premolars are used for the coarse grinding of food. The molars are used for fine grinding of food.



Salivary glands secrete saliva: Saliva makes the food slippery which makes it easy to swallow the food. Saliva also contains the enzyme salivary amylase or ptyalin.

Salivary amylase digests starch and converts it into sucrose, (maltose).



Oesophagus: Taking food from mouth to stomach by Peristaltic movement.

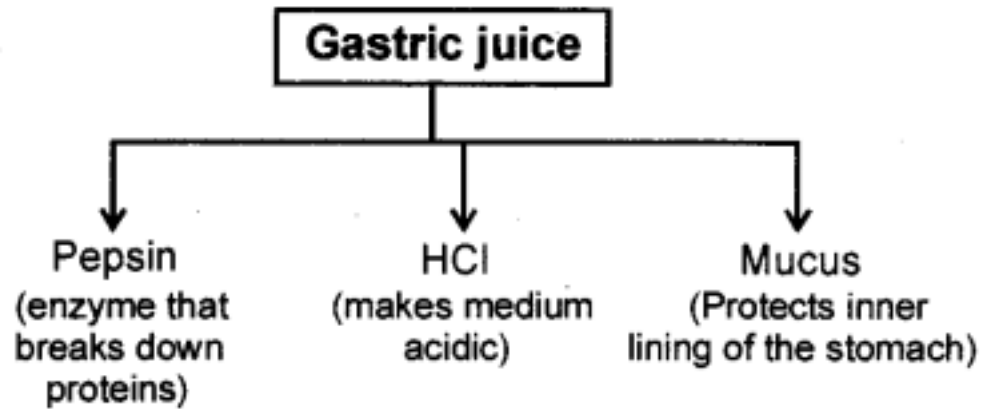
Peristaltic movement: Rhythmic contraction of muscles of the lining of the alimentary canal to push the food forward.

Stomach

- Stomach is a bag-like organ. Highly muscular walls of the stomach help in churning the food.
- The walls of the stomach secrete hydrochloric acid. Hydrochloric acid kills the germs which may be present in food.
- Moreover, it makes the medium inside the stomach as acidic. The acidic medium is necessary for gastric enzymes to work.
- The enzyme pepsin, secreted in the stomach, does partial digestion of protein.

- The mucus, secreted by the walls of the stomach saves the inner lining of the stomach from getting damaged from hydrochloric acid.

Stomach → Gastric glands secrete Gastric juice

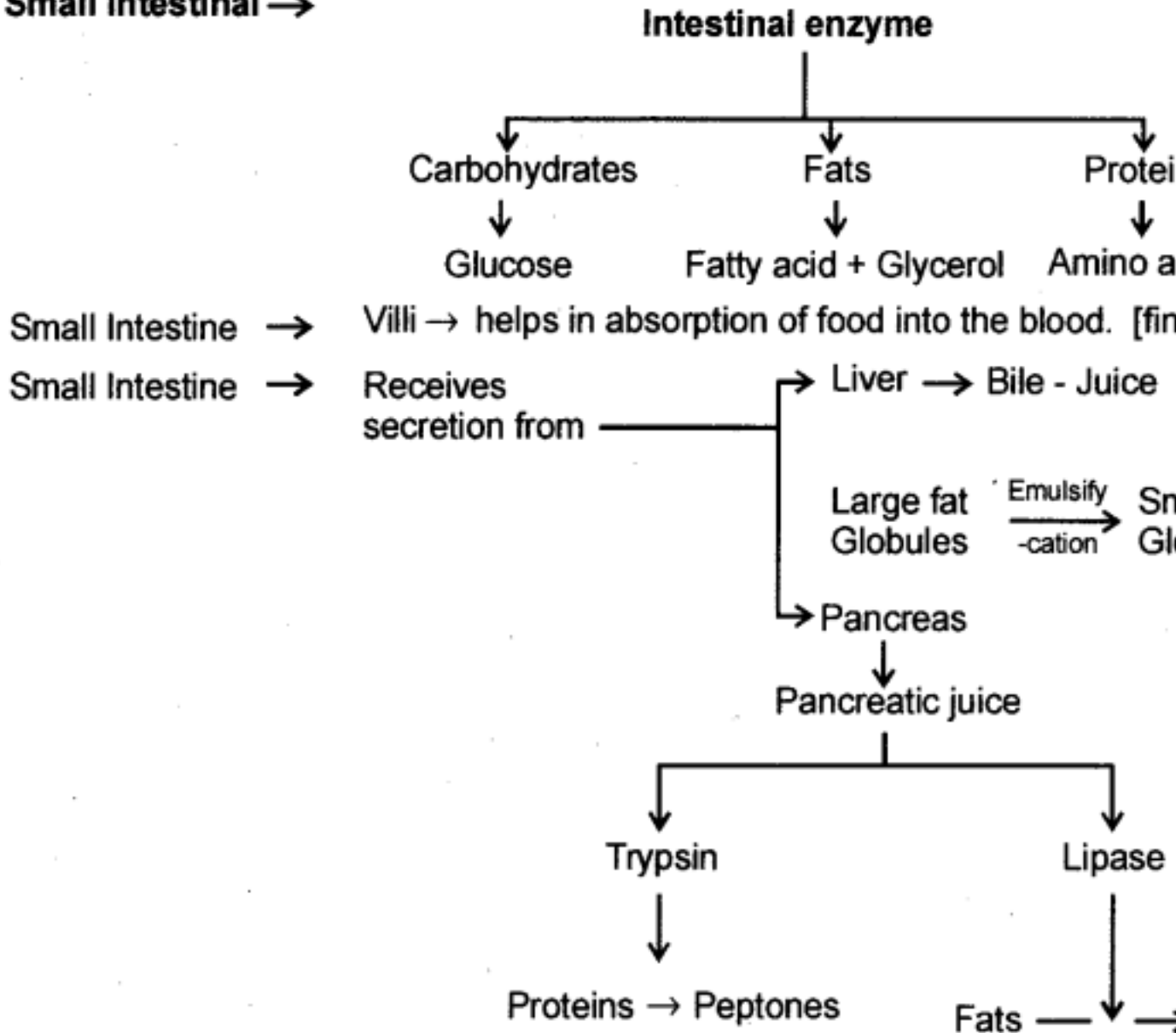


Small Intestine: It is a highly coiled tube-like structure. The small intestine is longer than the large intestine but its lumen is smaller than that of the large intestine. The small intestine is divided into three parts, like duodenum, jejunum and ileum.

Liver: Liver is the largest organ in the human body. The liver manufactures bile, which gets stored in the gall bladder. From the gall bladder, bile is released as and when required.

Pancreas: Pancreas is situated below the stomach. It secretes pancreatic juice which contains many digestive enzymes.

Small Intestinal →



Bile and pancreatic juice go to the duodenum through a hepatopancreatic duct. Bile breaks down fat into smaller particles. This process is called emulsification of fat. After that, the enzyme lipase digests fat into fatty acids and glycerol. Trypsin and chymotrypsin are enzymes which digest protein into amino acids. Complex carbohydrates are digested into glucose. The major part of digestion takes place in the duodenum.

No digestion takes place in the jejunum: The inner wall in the ileum is projected into numerous finger-like structures, called villi. Villi increase the surface area inside the ileum so that optimum absorption can take place. Moreover, villi also reduce the lumen of the ileum so that food can stay for a longer duration in it, for optimum absorption. Digested food is absorbed by villi.

Large Intestine:

- Large intestine is smaller than the small intestine.
- Undigested food goes into the large intestine.
- Some water and salt are absorbed by the walls of the large intestine. After that, the undigested food goes to the rectum, from where it is expelled out through the anus.
- Large Intestine absorb excess of water. The rest of the material is removed from the body via the anus. (Egestion).

Respiration –

Types of respiration, aerobic and anaerobic respiration, human respiratory system, respiration in plants.

Respiration: The process by which a living being utilises the food to get energy, is called respiration. Respiration is an oxidation reaction in which carbohydrate is oxidized to produce energy. Mitochondria is the site of respiration and the energy released is stored in the form of ATP (adenosine triphosphate). ATP is stored in mitochondria and is released as per need.

Steps of respiration:

- **Breaking down of glucose into pyruvate:** This step happens in the cytoplasm. Glucose molecule is broken down into pyruvic acid. Glucose molecule is composed of 6 carbon atoms, while pyruvic acid is composed of 3 carbon atoms.
- **Fate of Pyruvic Acid:** Further breaking down of pyruvic acid takes place in mitochondria and the molecules formed depend on the type of respiration in a particular organism. Respiration is of two types, viz. aerobic respiration and anaerobic respiration.
- **Respiration involves**
 - Gaseous exchange: Intake of oxygen from the atmosphere and release of CO_2 → Breathing.
 - Breakdown of simple food in order to release energy inside the cell → Cellular respiration

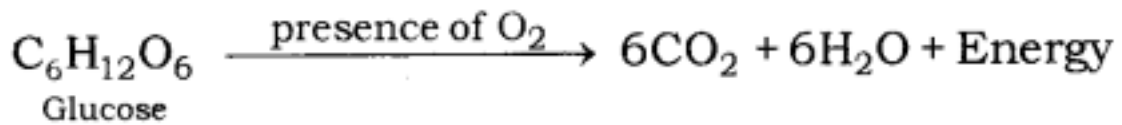
Types of Respiration –

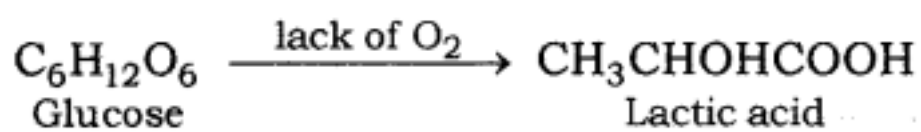
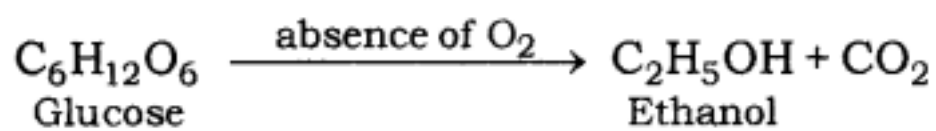
- **Aerobic respiration:** This type of respiration happens in the presence of oxygen. Pyruvic acid is converted into carbon dioxide. Energy is released and water molecule is also formed at the end of this process.
- **Anaerobic respiration:** This type of respiration happens in the absence of oxygen. Pyruvic acid is either converted into ethyl alcohol or lactic acid. Ethyl alcohol is usually formed in case of anaerobic respiration in

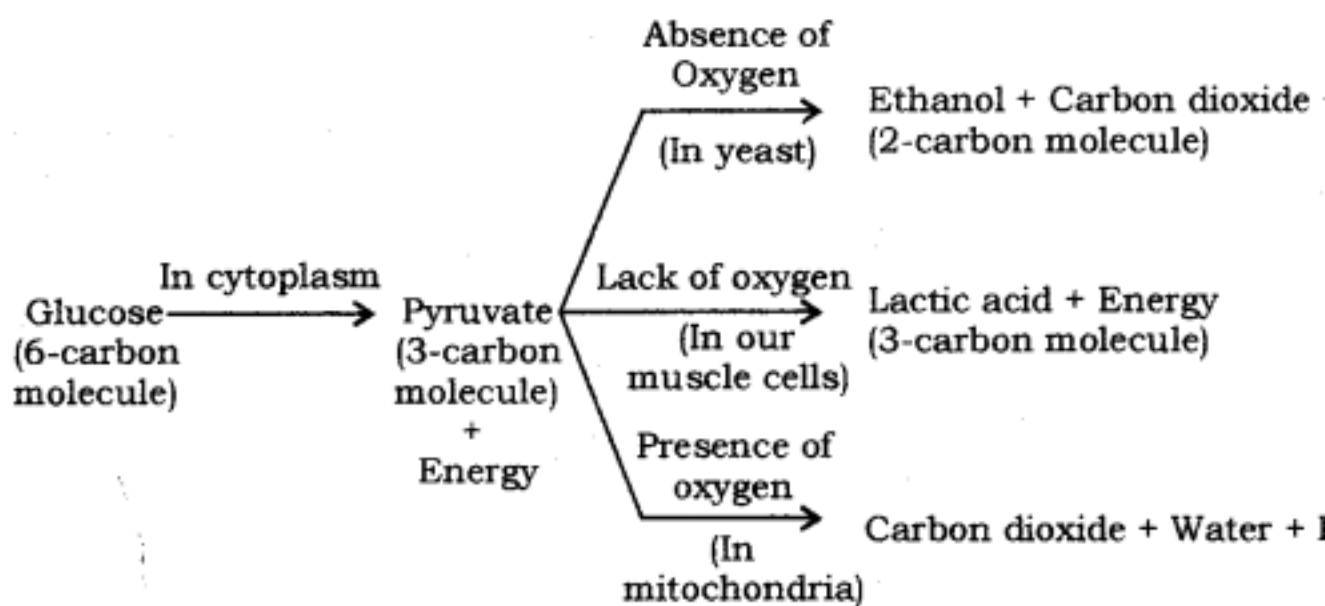
microbes, like yeast or bacteria. Lactic acid is formed in some microbes as well as in the muscle cells.

- o Glucose (6 carbon molecule) → Pyruvate (3 carbon molecules) + Energy
- o Pyruvate (In yeast, lack of O₂) → Ethyl alcohol + Carbon dioxide + Energy
- o Pyruvate (In muscles, lack of O₂) → Lactic Acid + Energy
- o Pyruvate (In mitochondria; the presence of O₂) → Carbon dioxide + Water + Energy

The equations for the above reactions can be written as follows:



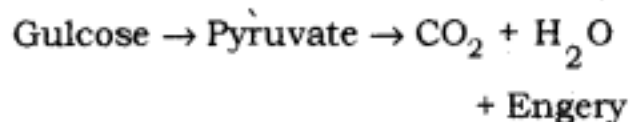




Respiration

Aerobic

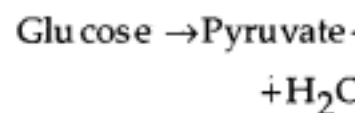
- Takes place in the presence of oxygen.
- Occurs in mitochondria.
- End products are CO_2 and H_2O .
- More amount of energy is released.
- Equation :



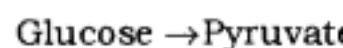
Anaerobic

- Takes place in the absence of oxygen.
- Occurs in cytoplasm.
- End products are alcohol and lactic acid.
- Less amount of energy is released.
- Equation :

In Yeast :



In Muscle Cell :



Pain in leg muscles while running:

- When someone runs too fast, he may experience throbbing pain in the leg muscles. This happens because of anaerobic respiration taking place in the muscles.
- During running, the energy demand from the muscle cells increases. This is compensated by anaerobic respiration and lactic acid is formed in the process.
- The deposition of lactic acid causes pain in the leg muscles. The pain subsides after taking rest for some time.

Exchange of gases:

- For aerobic respiration, organisms need a continuous supply of oxygen, and carbon dioxide produced during the process needs to be removed from the body.
- Different organisms use different methods for the intake of oxygen and expulsion of carbon dioxide.
- Diffusion is the method which is utilized by unicellular and some simple organisms for this purpose.
- In plants also, diffusion is utilized for exchange of gases.
- In complex animals, respiratory system does the job of exchange of gases.
- Gills are the respiratory organs for fishes. Fishes take in oxygen which is dissolved in water through gills.
- Since, availability of oxygen is less in the aquatic environment, so the breathing rate of aquatic organisms is faster.
- Insects have a system of spiracles and tracheae which is used for taking in oxygen.
- Terrestrial organisms have developed lungs for exchange of gases.
- Availability of oxygen is not a problem in the terrestrial environment so breathing rate is slower as compared to what it is in fishes.

Terrestrial organisms: Use atmospheric oxygen for respiration.

Aquatic organisms: Use dissolved oxygen for respiration.

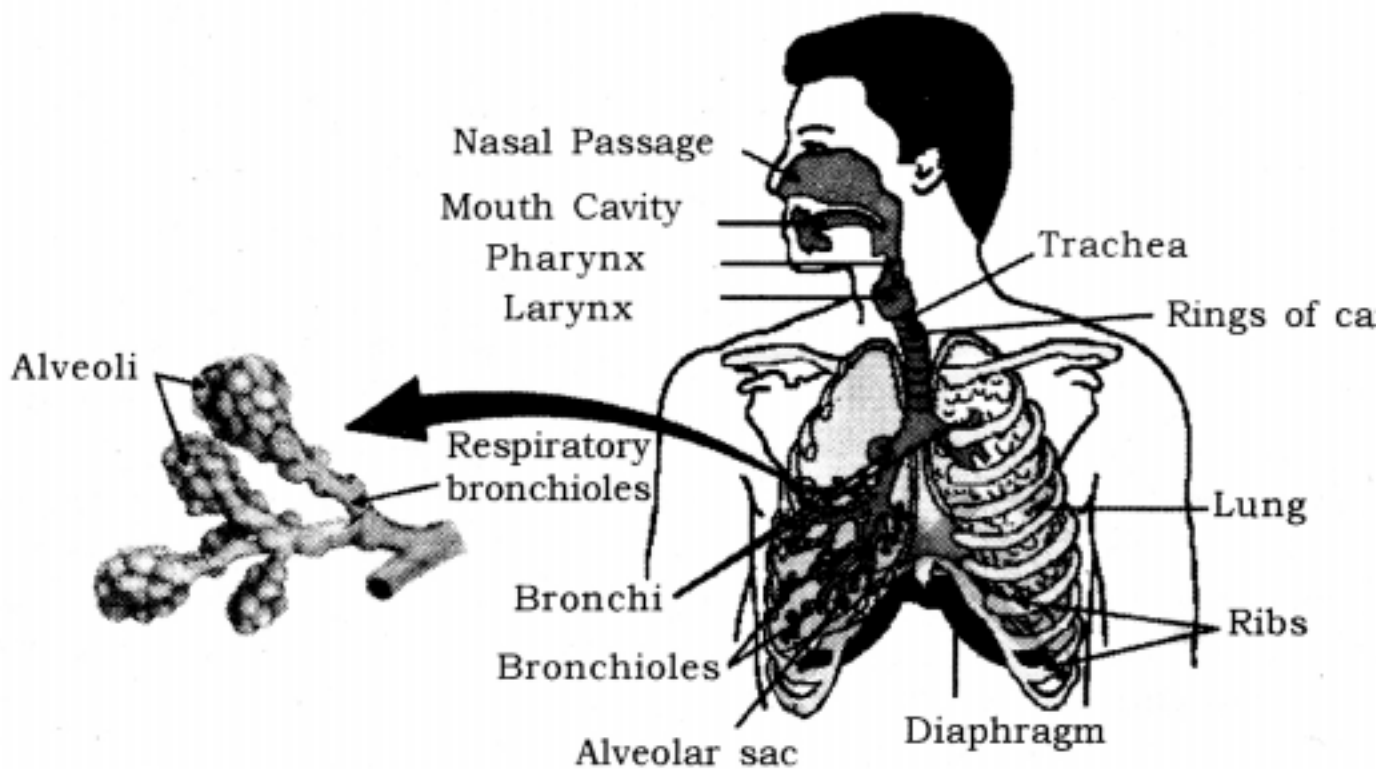
Human respiratory system

The human respiratory system is composed of a pair of lungs. These are attached to a system of tubes which open on the outside through the nostrils.

Following are the main structures in the human respiratory system:

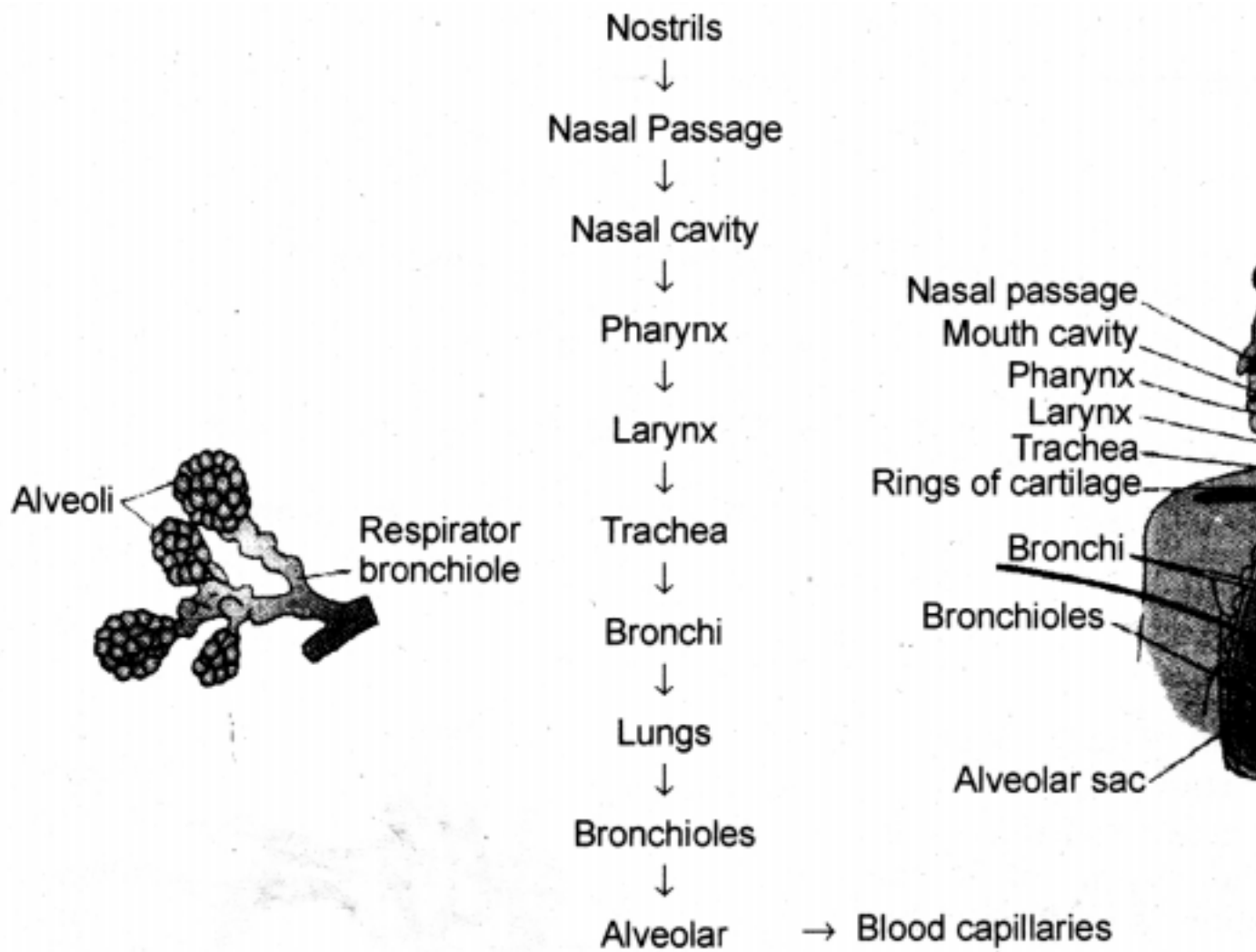
1. **Nostrils:** There are two nostrils which converge to form a nasal passage. The inner lining of the nostrils is lined by hair and remains wet due to mucus secretion. The mucus and the hair help in filtering the dust particles out from inhaled air. Further, air is warmed up when it enters the nasal passage.

2. Pharynx: It is a tube-like structure which continues after the nasal passage.
3. Larynx: This part comes after the pharynx. This is also called voice box.
4. Trachea: This is composed of rings of cartilage. Cartilaginous rings prevent the collapse of trachea in the absence of air.
5. Bronchi: A pair of bronchi comes out from the trachea, with one bronchus going to each lung.
6. Bronchioles: A bronchus divides into branches and sub-branches inside the lung.
7. Alveoli: These are air sacs at the end of bronchioles. The alveolus is composed of a very thin membrane and is the place where blood capillaries open. This is alveolus, where the oxygen mixes with the blood and carbon dioxide exits from the blood. The exchange of gases, in alveoli, takes place due to the pressure differential.



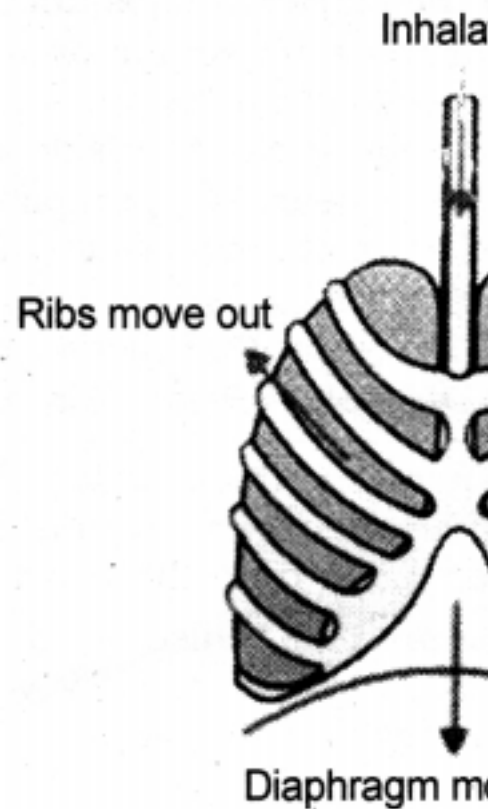
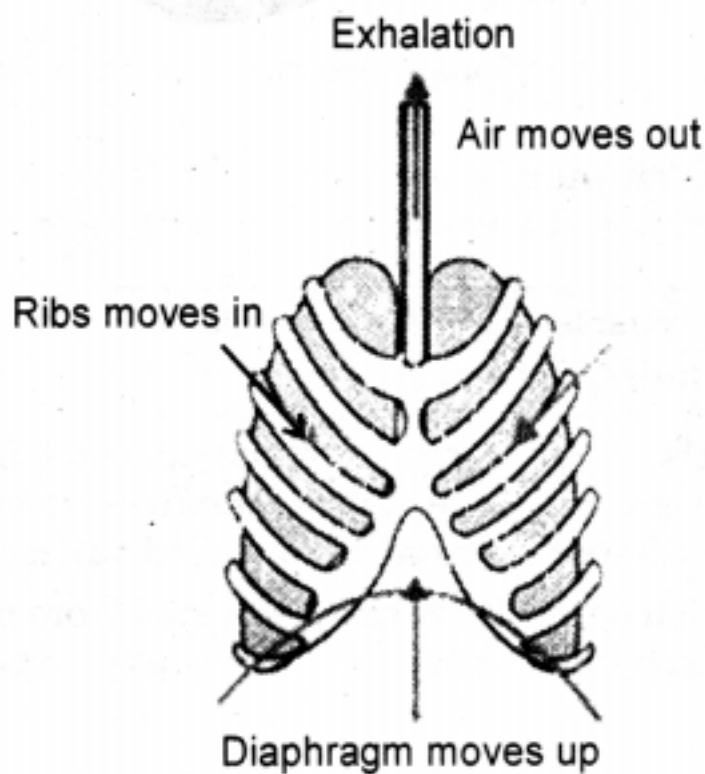
Human Respiratory System

Passage of air through the respiratory system in human beings:



Breathing Mechanism

- The breathing mechanism of lungs is controlled by the diaphragm and the intercostalis muscles.
- The diaphragm is a membrane which separates the thoracic chamber from the abdominal cavity.
- When the diaphragm moves down, the lungs expand and the air is inhaled.
- When the diaphragm moves up, the lungs contract and air are exhaled.



Mechanism of Breathing

Inhalation

- During inhalation, the thoracic cavity (chest cavity) expands
- Ribs lift upwards
- Diaphragm become flat in shape
- Volume of lungs increases and air enters the lungs

Exhalation

- Thoracic cavity contracts
- Ribs move downwards
- Diaphragm become dome
- Volume of lungs decrease and air exits from the lungs.

