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CHAPTER -5

LIFE PROCESSES

PART – II

RESPIRATION

Most living things need oxygen (of air) to obtain energy from food. This oxygen reacts with the food molecules (like glucose) present in the body cells and burns them slowly to release energy. The energy thus released is stored in ATP molecules in the cells.
The process of releasing energy from food is called respiration.
The process of respiration involves taking in oxygen (of air) into the cells, using it for releasing energy by burning food, and then eliminating the waste products (carbon dioxide and water) from the body. The process of respiration can be written in the form of a word equation as follows :

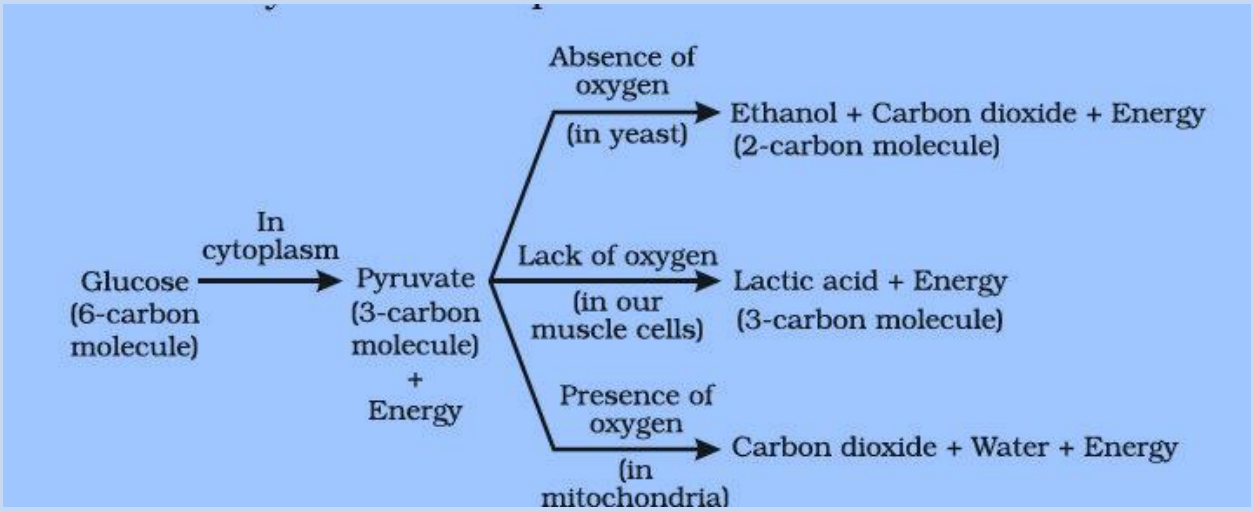
$$\text{Food} + \text{Oxygen} \longrightarrow \text{Carbon dioxide} + \text{Water} + \text{Energy}$$

TYPES OF RESPIRATION

Based on this, we have two types of respiration : aerobic respiration and anaerobic respiration.

1. Aerobic Respiration

The respiration which uses oxygen is called aerobic respiration. It is called aerobic respiration because it uses air which contains oxygen ('aerobic' means 'with air').
In aerobic respiration, the glucose food is completely broken down into carbon dioxide and water by oxidation.
Aerobic respiration produces a considerable amount of energy for use by the organism which gets stored in the ATP molecules. during aerobic respiration, 1 molecule of glucose (food) produces 38 energy-rich ATP molecules



2. Anaerobic Respiration

The respiration which takes place without oxygen is called anaerobic respiration. It is called anaerobic respiration because it takes place without air which contains oxygen .

RESPIRATION IN PLANTS

The leaves of a plant have tiny pores called stomata . The exchange of respiratory gases in the leaves takes place by the process of diffusion through stomata. Oxygen from air diffuses into a leaf through stomata and reaches all the cells where it is used in respiration. The carbon dioxide produced during respiration diffuses out from the leaf into the air through the same stomata.

At night time, when no photosynthesis occurs and hence no oxygen is produced, oxygen from air diffuses into leaves to carry out respiration. And carbon dioxide produced by respiration diffuses out into air. So, the net gas exchange in leaves at night is : O_2 diffuses in; CO_2 diffuses out.

RESPIRATION IN ANIMALS

Respiration in Fish

The fish has special organs of breathing called 'gills'.
When water passes over the gills, the gills extract dissolved oxygen from this water.
The water then goes out through the gill slits. Thus, the dissolved oxygen is extracted from water by the fish when it flows over the gills.
The carbon dioxide produced by respiration is brought back by the blood into the gills for expelling into the surrounding water. The fish has no lungs like us, the gaseous exchange in fish takes place in the gills. So, the respiratory surface of a fish is the surface of its gills.

RESPIRATORY SYSTEM IN HUMANS

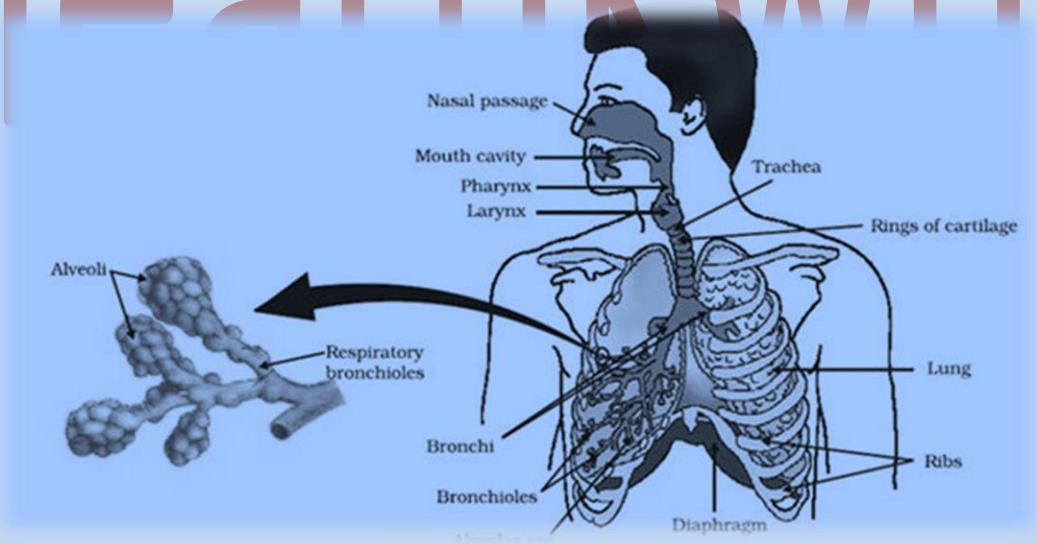
The main organs of human respiratory system are : Nose, Nasal passage (or Nasal cavity), Trachea, Bronchi, Lungs and Diaphragm.

The air for respiration is drawn into our body through the nostrils present in the nose. This air then goes into nasal passage. The nasal passage is separated from the mouth cavity The nasal passage is lined with fine hair and mucus.

The part of throat between the mouth and wind pipe is called pharynx. From the nasal passage, air enters into pharynx and then goes into the wind pipe

The trachea runs down the neck and divides into two smaller tubes called ‘bronchi’ at its lower end .

The two bronchi are connected to the two lungs. The lungs lie in the chest cavity or thoracic cavity which is separated from abdominal cavity by a muscular partition called diaphragm.



The pouch-like air-sacs at the ends of the smallest bronchioles are called ‘alveoli’ (singular alveolus). The walls of alveoli are very thin and they are surrounded by very thin blood capillaries.

During the breathing cycle, when air is taken in and let out, the lungs always contain a residual volume of air so that there is sufficient time for oxygen to be absorbed and for the carbon dioxide to be released.

TRANSPORT

Transport is a life process in which a substance absorbed (or made) in one part of the body of an organism is carried to other parts of its body.

TRANSPORT IN PLANTS

Plants do not move, and plant bodies have a large proportion of dead cells in many tissues. As a result, plants have low energy needs, and can use relatively slow transport systems.
The distances over which transport systems have to operate, however, can be very large in plants such as very tall trees. Plant transport systems will move energy stores from leaves and raw materials from roots.

These two pathways are constructed as independently organised conducting tubes. One, the xylem moves water and minerals obtained from the soil. The other, phloem transports products of photosynthesis from the leaves where they are synthesized

Transport of Water

In xylem tissue, vessels and tracheid's of the roots, stems and leaves are interconnected to form a continuous system of water-conducting channels reaching all parts of the plant. At the roots, cells in contact with the soil actively take up ions. This creates a difference in the concentration of these ions between the root and the soil. Water, therefore moves into the root from the soil to eliminate this difference. This means that there is steady movement of water into root xylem, creating a column of water that is steadily pushed upwards

the plant has an adequate supply of water, the water which is lost through the stomata is replaced by water from the xylem vessels in the leaf. In fact, evaporation of water molecules from the cells of a leaf creates a suction which pulls water from the xylem cells of roots. The loss of water in the form of vapour from the aerial parts of the plant is known as transpiration

transpiration helps in the absorption and upward movement of water and minerals dissolved in it from roots to the leaves. It also helps in temperature regulation. The effect of root pressure in transport of water is more important at night. During the day when the stomata are open, the transpiration pull becomes the major driving force in the movement of water in the xylem

Transport of Food and Other Substances

This transport of soluble products of photosynthesis is called translocation and it occurs in the part of the vascular tissue known as phloem.

Besides the products of photosynthesis, the phloem transports amino acids and other substances. These substances are especially delivered to the storage organs of roots, fruits and seeds and to growing organs.

The translocation of food and other substances takes place in the sieve tubes with the help of adjacent companion cells both in upward and downward directions.

Unlike transport in xylem which can be largely explained by simple physical forces, the translocation in phloem is achieved by utilising energy.

Material like sucrose is transferred into phloem tissue using energy from ATP. This increases the osmotic pressure of the tissue causing water to move into it.

Transport in Humans

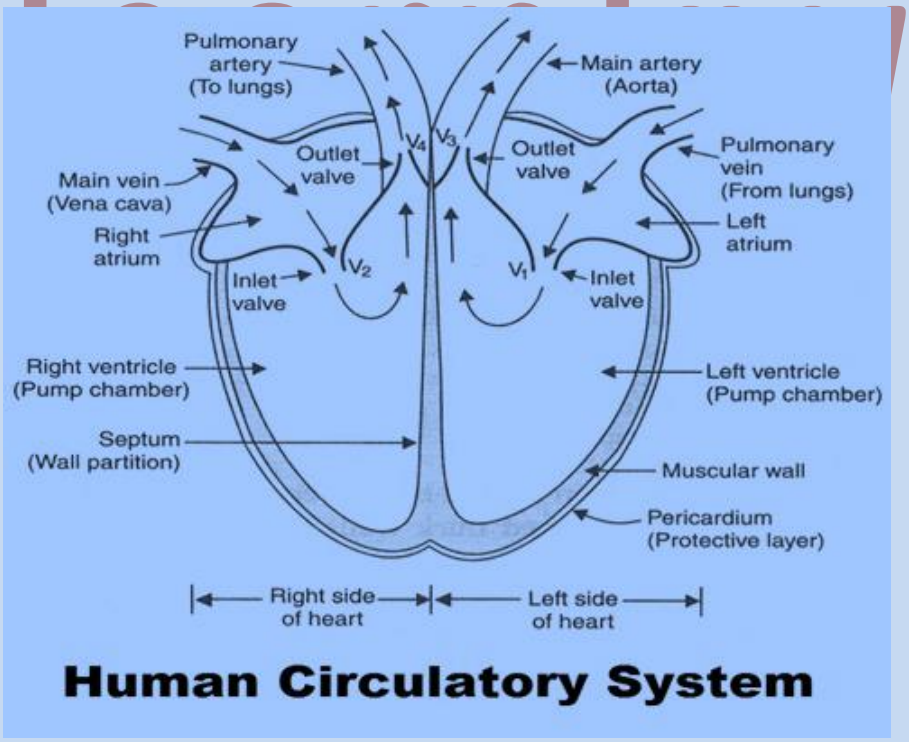
In the human circulatory system, blood carries oxygen, digested food and other chemicals like hormones and enzymes to all the parts of the body. It also takes away the waste product like carbon dioxide and urea produced in the body cells.

The human blood circulatory system consists of the heart (the organ which pumps and receives the blood) and the blood vessels (or tubes) through which the blood flows in the body.

HUMAN CIRCULATORY SYSTEM

The various organs of the circulatory system in humans are : Heart, Arteries, Veins and Capillaries. Blood is also considered a part of the circulatory system. heart acts as a pump to push out blood. The arteries, veins and capillaries act as pipes (or tubes) through which the blood flows.

Oxygen-rich blood from the lungs comes to the thin-walled upper chamber of the heart on the left, the left atrium. The left atrium relaxes when it is collecting this blood. It then contracts, while the next chamber, the left ventricle, relaxes, so that the blood is transferred to it. When the muscular left ventricle contracts in its turn, the blood is pumped out to the body. De-oxygenated blood comes from the body to the upper chamber on the right, the right atrium, as it relaxes. As the right atrium contracts, the corresponding lower chamber, the right ventricle, dilates. This transfers blood to the right ventricle, which in turn pumps it to the lungs for oxygenation. Since ventricles have to pump blood into various organs, they have thicker muscular walls than the atria do. Valves ensure that blood does not flow backwards when the atria or ventricles contract.



The tubes – blood vessels

Arteries are the vessels which carry blood away from the heart to various organs of the body. Since the blood emerges from the heart under high pressure, the arteries have thick, elastic walls. Veins collect the blood from

different organs and bring it back to the heart. They do not need thick walls because the blood is no longer under pressure, instead they have valves that ensure that the blood flows only in one direction. On reaching an organ or tissue, the artery divides into smaller and smaller vessels to bring the blood in contact with all the individual cells. The smallest vessels have walls which are one-cell thick and are called capillaries.

Blood Pressure

The force that blood exerts against the wall of a vessel is called blood pressure. This pressure is much greater in arteries than in veins. The pressure of blood inside the artery during ventricular systole (contraction) is called systolic pressure and pressure in artery during ventricular diastole (relaxation) is called diastolic pressure. The normal systolic pressure is about 120 mm of Hg and diastolic pressure is 80 mm of Hg

Lymph

There is another type of fluid also involved in transportation. This is called lymph or tissue fluid.
Through the pores present in the walls of capillaries some amount of plasma, proteins and blood cells escape into intercellular spaces in the tissues to form the tissue fluid or lymph.
It is similar to the plasma of blood but colourless and contains less protein.

Lymph drains into lymphatic capillaries from the intercellular spaces, which join to form large lymph vessels that finally open into larger veins.

Lymph carries digested and absorbed fat from intestine and drains excess fluid from extra cellular space back into the blood.

EXCRETION

EXCRETION IN PLANTS

(i) The plants get rid of gaseous waste products through stomata in leaves and lenticels in stems.
(ii) The plants get rid of stored solid and liquid wastes by the shedding of leaves, peeling of bark and felling of fruits.
(iii) The plants get rid of wastes by secreting them in the form of gums and resins.

(iv) Plants also excrete some waste substances into the soil around them.

EXCRETION IN HUMANS

The excretory system of human beings includes a pair of kidneys, a pair of ureters, a urinary bladder and a urethra. Kidneys are located in the abdomen, one on either side of the backbone. Urine produced in the kidneys passes through the ureters into the urinary bladder where it is stored until it is released through the urethra.

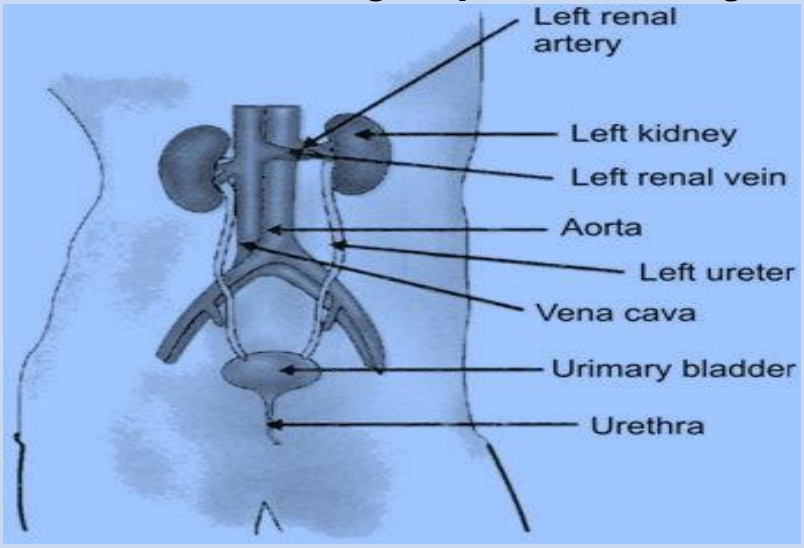
Each capillary cluster in the kidney is associated with the cup-shaped end of a coiled tube called Bowman's capsule that collects the filtrate.

Each kidney has large numbers of these filtration units called nephrons packed close together. Some substances in the initial filtrate, such as glucose, amino acids, salts and a major amount of water, are selectively re-absorbed as the urine flows along the tube.

The amount of water re-absorbed depends on how much excess water there is in the body, and on how much of dissolved waste there is to be excreted.

The urine forming in each kidney eventually enters a long tube, the ureter, which connects the kidneys with the urinary bladder.

Urine is stored in the urinary bladder until the pressure of the expanded bladder leads to the urge to pass it out through the urethra.



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