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CHAPTER -5

LIFE PROCESSES

WHAT ARE LIFE PROCESSES?

The basic functions performed by living organisms to maintain their life on this earth are called life processes. The basic life processes common to all the living organisms are : Nutrition and Respiration; Transport and Excretion; Control and Coordination ; Growth; Movement and Reproduction. The process of nutrition involves the taking of food inside the body and converting it into smaller molecules which can be absorbed by the body. Respiration is the process which releases energy from the food absorbed by the body. Transport is the process in which a substance absorbed or made in one part of the body is moved to other parts of the body. Excretion is the process in which the waste materials produced in the cells of the body are removed from the body. Control and coordination is a process which helps the living organisms to survive in the changing environment around them.

In movement, the organism either moves from one place to another or moves its body parts while remaining at the same place. The process of reproduction involves the making of more organisms from the existing ones, so that organisms could live on this earth for ever.

NUTRITION

A nutrient is an organic or inorganic substance required for the maintenance of life and survival of a living organism. In most simple terms, a nutrient can be said to be a particular type of food. A nutrient can be defined as a substance which an organism obtains from its surroundings and uses it as a source of energy or for the biosynthesis of its body constituents.

How do living things get their food?

All the organisms do not obtain their food in the same way. Different organisms have different methods of procuring food or obtaining food.

In other words, organisms differ in their modes of nutrition. Depending on the mode (or method) of obtaining food, all the organisms can be classified into two groups: autotrophic and heterotrophic. Thus : There are mainly two modes of nutrition : Autotrophic, and Heterotrophic

Autotrophic Nutrition

Autotrophic nutrition is that mode of nutrition in which an organism makes (or synthesizes) its own food from the simple inorganic materials like carbon dioxide and water present in the surroundings (with the help of sunlight energy). The green plants have an autotrophic mode of nutrition. The autotrophic bacteria also obtain their food by the autotrophic mode of nutrition (though most bacteria are not autotrophic). The organisms having autotrophic mode of nutrition are called autotrophic organisms or just autotrophs. The autotrophic organisms (or autotrophs) contain the green pigment called chlorophyll which is capable of trapping sunlight energy. This trapped sunlight energy is utilised by the autotrophs to make food by combining inorganic materials like carbon dioxide and water present in the environment by the process of photosynthesis. Thus, autotrophs make their own food by photosynthesis. So, autotrophs are the producers of food. The food produced by autotrophs (green plants) is also used by human beings and many, many other animals.

The process by which green plants make their own food (like glucose) from carbon dioxide and water by using sunlight energy in the presence of chlorophyll, is called photosynthesis. Oxygen gas is released during photosynthesis. The process of photosynthesis takes place in the green leaves of a plant. The green leaves of a plant make the food by combining carbon dioxide and water in the presence of sunlight and chlorophyll. The carbon dioxide gas required for making

food is taken by the plant leaves from the air. This carbon dioxide enters the leaves through tiny pores in them called stomata. Water required for making food is taken from the soil. This water is transported to the leaves from the soil through the roots and stem. The sunlight provides energy required to carry out the chemical reactions involved in the preparation of food. The green pigment called chlorophyll present in green leaves helps in absorbing energy from sunlight.

Oxygen gas is produced as a by-product during the preparation of food by photosynthesis. This oxygen gas goes into the air. The photosynthesis takes place in the following three steps: Absorption of sunlight energy by chlorophyll. Conversion of light energy into chemical energy, and splitting of water into hydrogen and oxygen by light energy. Reduction of carbon dioxide by hydrogen to form carbohydrate like glucose by utilising the chemical energy .

How the Plants Obtain Carbon Dioxide

There are a large number of tiny pores called stomata on the surface of the leaves of plants. The green plants take carbon dioxide from air for photosynthesis. The carbon dioxide gas enters the leaves of the plant through the stomata present on their surface. Each stomatal pore is surrounded by a pair of guard cells. The opening and closing of stomatal pores is controlled by the guard cells. When water flows into the guard cells, they swell, become curved and cause the pore to open. On the other hand, when the guard cells lose water, they shrink, become straight and close the stomatal pore. A large amount of water is also lost from the cells of the plant leaves through open stomatal pores. So, when the plant does not need carbon dioxide and wants to conserve water, the stomatal pores are closed. The oxygen gas produced during photosynthesis also goes out through the stomatal pores of the leaves. Please note that in addition to leaves, the stomata

are also present in the green stems of a plant. So, the green stems of a plant also carry out photosynthesis. It is clear from the above discussion that stomata allow the movement of gases in and out of plant cells. In other words, the gaseous exchange in plants takes place through the stomata in leaves. in most broad-leaved plants, the stomata occur only in the lower surface of the leaf but in narrow-leaved plants, the stomata are equally distributed on both the sides of the leaf. Another point to be noted is that the aquatic plants use the carbon dioxide gas dissolved in water for carrying out photosynthesis.

Heterotrophic Nutrition

In heterotrophic nutrition, the organism cannot make (or synthesize) its own food from the inorganic raw materials like carbon dioxide and water, and uses the food made by autotrophic organisms directly or indirectly. A heterotrophic organism is a consumer which derives its nutrition from other organisms. That is, a heterotrophic organism has to eat other organisms for its nutrition. All the animals have a heterotrophic mode of nutrition. Most bacteria and fungi also have heterotrophic mode of nutrition. The organisms having heterotrophic mode of nutrition are called heterotrophic organisms or just heterotrophs.

A heterotrophic organism (or heterotroph) can obtain its food from other organisms in three ways. So, the heterotrophic mode of nutrition is of three types : 1. Saprotrophic nutrition, 2. Parasitic nutrition, and 3. Holozoic nutrition.

Saprotrophic nutrition is that nutrition in which an organism obtains its food from decaying organic matter of dead plants, dead animals and rotten bread, etc. The parasitic nutrition is that nutrition in which an organism derives its food from the body of another living organism

without killing it. The holozoic nutrition is that nutrition in which an organism takes the complex organic food materials into its body by the process of ingestion, the ingested food is digested and then absorbed into the body cells of the organism.

How do Organisms obtain their Nutrition?

Since the food and the way it is obtained differ, the digestive system is different in various organisms. In single-celled organisms, the food may be taken in by the entire surface. But as the complexity of the organism increases, different parts become specialised to perform different functions.

NUTRITION IN AMOEBA

Amoeba is a unicellular animal. Amoeba eats tiny (microscopic) plants and animals as food which float in water in which it lives. The mode of nutrition in Amoeba is holozoic. The process of obtaining food by Amoeba is called phagocytosis.

Amoeba has no mouth or a fixed place for the ingestion of food . Amoeba ingests food by using its pseudopodia. When a food particle comes near Amoeba, then Amoeba ingests this food particle by forming temporary finger-like projections called pseudopodia around it. The food is engulfed with a little surrounding water to form a food vacuole inside the Amoeba. This food vacuole can be considered to be a 'temporary stomach' of Amoeba. In Amoeba, food is digested in the food vacuole by digestive enzymes. The enzymes from surrounding cytoplasm enter into the food vacuole and break down the food into small and soluble molecules by chemical reactions . Thus, digestion in Amoeba takes place inside the food vacuole due to which the food dissolves. The digested food present in the food vacuole of Amoeba is absorbed directly into the cytoplasm of Amoeba cell by diffusion.

Since Amoeba consists of only one small cell, it does not require blood system to carry the digested food. The digested food just spreads out from the food vacuole into the whole of Amoeba cell. After absorption of food, the food vacuole disappears. A part of the food absorbed in Amoeba cell is used to obtain energy through respiration. The remaining part of absorbed food is used to make the parts of Amoeba cell which lead to the growth of Amoeba. Amoeba has no fixed place (like anus) for removing the undigested part of food. When a considerable amount of undigested food collects inside Amoeba, then its cell membrane suddenly ruptures at any place and the undigested food is thrown out of the body of Amoeba.

Nutrition in Human Beings

The human digestive system consists of the alimentary canal and its associated glands. The various organs of the human digestive system in sequence are : Mouth, Oesophagus , Stomach, Small intestine and Large intestine. The glands which are associated with the human digestive system and form a part of the human digestive system are : Salivary glands, Liver and Pancreas.

The mouth cavity (or buccal cavity) contains teeth, tongue, and salivary glands. The teeth cut the food into small pieces, chew and grind it. So, the teeth help in physical digestion. The salivary glands in our mouth produce saliva. Our tongue helps in mixing this saliva with food. The salivary glands help in chemical digestion by secreting enzymes. The human saliva contains an enzyme called salivary amylase which digests the starch present in food into sugar.

The walls of food pipe have muscles which can contract and expand alternately. When the slightly digested food enters the food pipe, the walls of food pipe start contraction and expansion movements. The contraction and expansion movement of the walls of food pipe is called peristaltic movement. This peristaltic movement of food pipe (or oesophagus) pushes the slightly digested food into the stomach.

the food breaks down into still smaller pieces and forms a semi-solid paste. The stomach wall contains three tubular glands in its walls. The glands present in the walls of the stomach secrete gastric juice. The gastric juice contains three substances : hydrochloric acid, the enzyme pepsin and mucus. Due to the presence of hydrochloric acid, the gastric juice is acidic in nature. In the acidic medium, the enzyme pepsin begins the digestion of proteins present in food to form smaller molecules. Thus, the protein digestion begins in the stomach.

The partially digested food then goes from the stomach into the small intestine. The exit of food from stomach is regulated by a 'sphincter muscle' which releases it in small amounts into the small intestine. The small intestine is the largest part of the alimentary canal. It is about 6.5 metres long in an adult man. Though the small intestine is very long, it is called small intestine because it is very narrow. The small intestine is arranged in the form of a coil in our belly.

The small intestine receives the secretions of two glands : liver and pancreas. Liver secretes bile. Bile is a greenish yellow liquid made in the liver which is normally stored in the gall bladder. Bile is alkaline, and contains salts which help to emulsify or break the fats (or lipids) present in the food. Thus, bile performs two functions : makes the acidic food coming from the stomach alkaline so that pancreatic enzymes can act on it, and bile salts break the fats present in the food into small globules making it easy for the enzymes to act and digest them. Pancreas is a large gland which lies parallel to and beneath the stomach. Pancreas secretes pancreatic juice which contains digestive enzymes like pancreatic amylase, trypsin and lipase. The enzyme amylase breaks down the starch, the enzyme trypsin digests the proteins and the enzyme lipase breaks down the emulsified fats.

The walls of small intestine contain glands which secrete intestinal juice. The intestinal juice contains a number of enzymes which complete the digestion of complex carbohydrates into glucose, proteins into amino acids and fats into fatty acids and glycerol. Glucose, amino acids, fatty acids and glycerol are small, water-soluble molecules. In this way, the process of digestion converts the large and insoluble food molecules into small, water-soluble molecules. The chemical digestion of food is brought about by biological catalysts called enzymes.

The inner surface of small intestine has millions of tiny, finger-like projections called villi. The presence of villi gives the inner walls of the small intestine a very large surface area. And the large surface area of small intestine helps in the rapid absorption of digested food. The digested food which is absorbed through the walls of the small intestine, goes into our blood.

the undigested food passes from the small intestine into a wider tube called large intestine. The walls of large intestine absorb most of the water from the undigested food. Due to this, the undigested part of food becomes almost solid. The last part of the large intestine called 'rectum' stores this undigested food for some time. The act of expelling the faeces is called egestion or defecation. The exit of faeces is controlled by the anal sphincter.