Life Processes

- **Autotrophic Nutrition**
  - Synthesis of food by photosynthesis, Photosynthesis equation

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$$

  - Leaves are the sites for the synthesis of food.
  - The green pigment called chlorophyll is present in leaves.
  - Chlorophyll traps solar energy, which is used to prepare food from CO_2 and water. Sun is the ultimate source of energy.
  - Green plants absorb CO_2 from atmosphere through tiny pores called stomata.
  - Stomata are present on the surface of leaves.
  - Water and minerals are absorbed from soil and are transported to leaves via tiny vessel-like structures present in roots.
  - Chlorophyll, sunlight, CO_2, and water are essential raw materials for photosynthesis.
  - Carbohydrates such as starch and oxygen are the product of photosynthesis.
  - All green plants including green algae show autotrophic nutrition.
  - Since the autotrophs manufacture their own food, they are called producers.
  - They form the first link in the food chain and all organisms on the earth obtain the energy directly or indirectly from them.

- **Heterotrophic Nutrition**

  - Generally derive energy from plants and animal sources.
  - The heterotrophs that derive their energy directly from plants are called herbivores and those who derive their energy indirectly i.e. by eating herbivores are called carnivores.
  - **Omnivores**- feed on both plants and animals e.g. bear, rat, man etc.
  - **Decomposers**- obtain nutrients by breaking down remains of dead plants and animals, includes some bacteria and fungi.
  - **Mainly of three types**—holozoic, parasitic, and saprophytic.
  - **Digestion**- mechanical and chemical reduction of ingested nutrients.
  - **Human digestive system**- consists of the long alimentary canal.
  - **Alimentary canal includes**- mouth, pharynx, oesophagus, stomach, small intestine, and large intestine
  - **Accessory organs**- pancreas, liver.

- Green plants prepare their food by the process of **photosynthesis.**
- Photosynthesis is the process of synthesizing food from CO_2 and water in the presence of sunlight.
- The equation for photosynthesis is

$$\text{Carbon dioxide} + \text{Water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Carbohydrate} + \text{Oxygen}$$

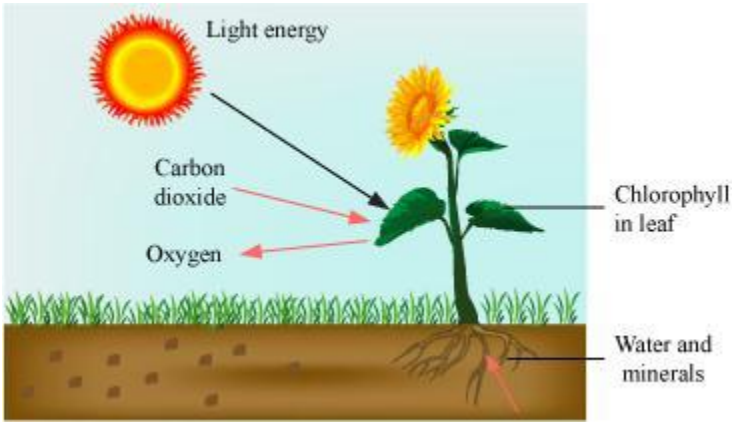
- Leaves are the sites for the synthesis of food.
- The green pigment called chlorophyll is present in leaves.
- Two phases of photosynthesis
  - Photochemical Phase
  - Biosynthetic Phase
- **Reactions involved in Photolysis:-**

(i) $NADP^+ + e^- + H^+ \xrightarrow{\text{enzyme}} NADPH$

(ii) $2O \rightarrow O_2$

(iii) $ADP + Phosphate \rightarrow ATP$ (Phosphorylation)

- **Biosynthetic Phase - The reactions that does not require light(happens during day time as well).**
- Chlorophyll traps solar energy that is used to prepare food from CO_2 and water. Thus, plants convert solar energy into chemical energy.
- Sun is the ultimate source of energy.
- Green plants absorb CO_2 from atmosphere through tiny pores called stomata.
- Stomata are present on the surface of leaves.
- Water and minerals are absorbed by roots from soil and are transported to leaves via tiny vessel-like structures present in roots, stems, the branches and the leaves.
- Chlorophyll, sunlight, CO_2 and water are essential raw materials for photosynthesis.
- Carbohydrates and oxygen are the end products of photosynthesis.
- The presence of starch in the leaves indicates the occurrence of photosynthesis.



Photosynthesis

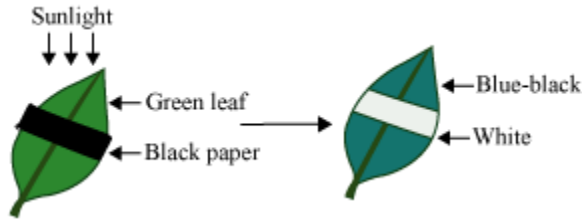
- **Algae** contain chlorophyll and prepare its own food by the process of photosynthesis.
- **End Results of Photosynthesis**
  - Glucose
  - Water

- Oxygen

1. Sunlight is essential for photosynthesis

Place a healthy green potted plant in a dark room for 1-2 days. This is done to ensure that the plant consumes all its reserve food and the leaves do not contain any starch. Then, cover a portion of a leaf of this plant on both sides with two uniform pieces of black paper, fixed in position with two paper clips.

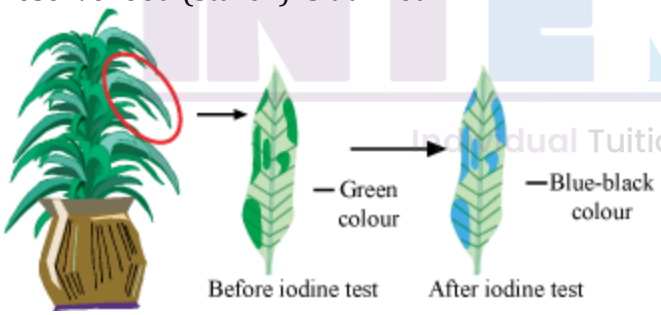
Now, expose this plant to bright light. After a few hours, remove the leaf and decolorized it with alcohol and test the presence of food (starch) with iodine solution.



You will observe that the portion of the leaf covered with black paper does not show any presence of starch (food).

2. Chlorophyll is essential for photosynthesis

Place a variegated plant (i.e. a plant which has both green and non-green areas, for e.g. croton or money plant) in a dark room for 2 – 3 days. This is done to ensure that all the reserve food (starch) is utilized.



Place this plant in sunlight for six hours to allow photosynthesis to take place.

Then, pluck a leaf from this plant and trace the green areas on a sheet of paper.

Now, decolourize the leaf using alcohol and dip it in a dilute solution of iodine for a few minutes. Wash this leaf with water and compare it with the tracings of the leaf done earlier.

It will be observed that only the green areas of the leaf could photosynthesize.

Nutrition in humans

- Mouth includes teeth, salivary glands, and tongue. Teeth break down the food. They are of four types – molars (6), premolars (4), canines (2), and incisors (4) in each jaw.
  - Molars and premolars are for chewing and grinding food.
  - Canines are for piercing and tearing food.
  - Incisors are for cutting and biting food.
- In total life span of humans, two sets of teeth grow – milk teeth and permanent teeth.
- Saliva is secreted by salivary glands located under the tongue. It contains a digestive enzyme salivary amylase, which breaks down starch into sugar.

- Tongue helps in chewing and swallowing of food.
- The food from mouth passes down the oesophagus to the stomach, through the movement of walls of oesophagus (peristalsis)
- **Stomach** mixes the food received from oesophagus with digestive juices.
- Inner lining of stomach secretes:
  - Mucus – protects the lining of stomach against the action of the acid.
  - Hydrochloric acid – creates an acidic medium and helps in digestion of proteins.
  - Digestive juices – break down protein into simple substance.
    - Pepsin breaks proteins into polypeptides
    - Rennin changes soluble milk proteins into curd which is insoluble.
- The food from stomach moves into the small intestine.
- **Digestion in small intestine**
  - It is the longest part (about 7.5 m long) of the alimentary canal.
  - It is the site where complete digestion of carbohydrates, proteins, and fats takes place.
  - All the digested food is absorbed by the walls of intestine. This process is known as **absorption**.
  - Inner lining of small intestine has tiny finger-like projections called **villi.**
  - **Villi** increase the surface area for more efficient food absorption.
  - The absorbed food is delivered to each and every cell of the body where they are used to produce complex substances such as proteins, etc. This process is known as **assimilation**.
  - It receives intestinal juice from two glands – liver and pancreas that help in further digestion of food.
  - **Liver** - It is the largest gland of the body and secretes bile juice. Bile juice is stored in gall bladder and plays an important role in the digestion of fats.
  - **Pancreas** - Pancreas contains enzymes that help in complete digestion of all food components.
    - Amylase breaks starch into maltose
    - Lipase breaks complex fats into simple fats.
  - The functions of enzymes secreted in small intestine are :
    - Maltase changes maltose to glucose
    - Sucrase changes sucrose to glucose
    - Lactase changes lactose to glucose
    - Peptidase changes polypeptides to amino acids
- **Digestion in large intestine**
  - The digested food from small intestine goes into blood stream and the undigested and unabsorbed material and water enters the large intestine.
  - The function of large intestine is absorption of water and some salts from undigested food.
  - From large intestine, the waste material is stored in rectum in the form of semi-solid faeces.
  - The undigested, stored waste is excreted out from the body as faeces via anus. This process is known as egestion.

- *Amoeba* is a single-celled organism which feeds on algae, rotifers, protozoans, and even other small *Amoeba*.
- *Amoeba* can constantly change its shape with the help of pseudopodia.
- Pseudopodia (also called false feet) are the finger-like projections that help *Amoeba* in moving and capturing food.

- When an *Amoeba* senses its prey, it pushes out its pseudopodia around it and engulfs it. The food thus eaten gets trapped in the food vacuole.
- Digestive juices such as amylase and protease are secreted inside the food vacuole in an *Amoeba.* These juices act on the food and break it down into smaller components.
- Amylase breaks down complex carbohydrates into simple sugars while protease breaks down proteins into simpler substances.
- The digested food is later absorbed by *Amoeba* for growth, maintenance, and multiplication.
- Undigested food is egested using pseudopodia.

Respiration

- **Respiration** is the process of taking in oxygen and releasing carbon dioxide. The process involves the consumption of oxygen and liberation of carbon dioxide and water.
- Two types- aerobic and anaerobic

Aerobic respiration

- Oxidation of food materials with the help of oxygen
- Yields 38 ATP

Steps in cellular respiration

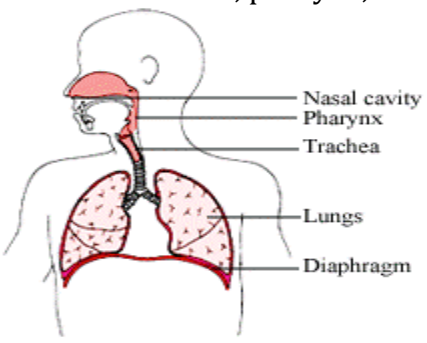
- **First step-** Breakdown of glucose (6C) into pyruvate (3C). It takes place in the cytoplasm
- **Second step-** Pyruvate is broken down into CO_2 and water. It takes place in mitochondria, energy is produced in the form of ATP.

Anaerobic respiration

- Oxidation of nutrients without utilizing molecular oxygen
- Yields 2 ATP
- **First step-** Glycolysis (occurs in the cytoplasm), 2 pyruvate produced
- **Second step-** Break down of pyruvic acid into ethanol and water and energy (in yeast) and lactic acid and energy (in muscle cells)

Human respiration

Includes the nose, pharynx, trachea, bronchi, bronchioles and alveoli



- Bronchioles divide to form many alveoli
- Alveoli are sites of gas exchange
- O_2 present in alveolar blood vessels transported to body cells
- Haemoglobin is the respiratory pigment present in blood is mainly responsible for the transport of carbon dioxide and oxygen.

- **Transportation** is a life process where substances synthesized or absorbed in one part of the body are carried to other parts of the body**.**

- **Transportation in plants**
  - The transportation system in plants moves the energy stored in leaves to different parts. It also helps in moving raw materials absorbed from the roots to various organs of the plant.
  - **Xylem** conducts water and minerals obtained from soil (via roots) to the rest of the plant. Transport of water occurs due to transpiration pull, root pressure and difference in pressure gradient.
  - **Phloem** transports food materials from the leaves to different parts of the plant body.
  - Transport of food (translocation) through phloem requires energy.

Transportation

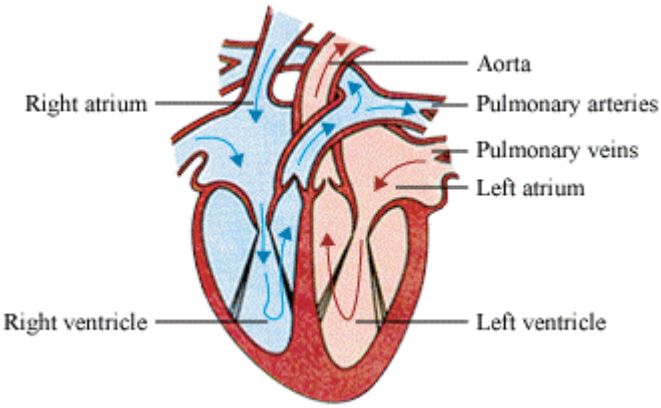
It is a life process where substances synthesised or absorbed in one part of the organism's body are carried to other parts of the body.

Translocation in plants

- The translocation system in plants moves the synthesised food from leaves to remaining plant parts. It also helps in moving raw materials absorbed from the roots to various organs of the plant.
- **Phloem** transports food materials from the leaves to different parts of the plant body.
- The phloem consists of companion cells, sieve tubes, phloem parenchyma, and fibres.
- Transport of food (translocation) through phloem requires energy, which is obtained from respiration in the form of ATP.

- **Transportation in humans**
  - The system that transports nutrients and collects waste materials for disposal in the body is the **circulatory system**.
  - The circulatory system consists of the central organ i.e., the heart, blood vessels, and circulating fluid i.e., blood.
  - Another system, called the **lymphatic system,** transports immune cells.
- **Circulation** in humans
  - Double circulation occurs in human i.e. the blood goes through the heart twice during each cardiac cycle.
  - Blood, lymph- involved in transportation
  - Components of blood- RBCs, WBCs, platelets, and plasma
  - Three types of blood vessels- arteries, veins and capillaries
  - Arteries carry oxygenated blood, except pulmonary artery
  - Veins carry deoxygenated blood, except pulmonary vein

- Human heart is divided into four chambers – right auricle, right ventricle, left auricle, and left ventricle



- Right side of the heart receives deoxygenated blood from all parts of the body
- Left side of the heart receives oxygenated blood from lungs.

Excretory system- The organ system that performs the function of excretion is known as the excretory system

- **Excretion** – It is the process of removing harmful waste products produced in the cells of living organisms.
- The excretory system in humans includes – a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

- **Kidney-** It is the main excretory organ of the human body. It plays an important role in the formation of urine. Human kidney produces about 1 – 1.8L of urine in a day. The urine consists of 95% water, 2.5% urea and 2.5% other waste products.
- It is divided into two layers - outer cortex and inner medulla.
- Nephrons are the basic filtering units of the kidneys.
- The main components of a nephron are the **glomerulus**, **Bowman's capsule,** and a long **renal tube**.
- **Ureter** carries urine to the bladder.
- **Urinary bladder** collects and stores urine.
- **Urethra** carries urine out of the body.

- **Dialysis-** The process of removing wastes using an artificial kidney is called dialysis.

Excretion in Plants

- Plants use a variety of techniques to remove waste materials.
- Oxygen, a by-product of photosynthesis is removed through stomata.
- The excess water absorbed from roots is also lost through stomata via **transpiration.**
- Cell vacuoles, gum, resin etc. are stored in old xylem tissues.
- Waste products may be stored in leaves that fall.
- Plant roots also sometimes excrete wastes materials.

Excretion in Plants

- Plants get rid of the excess of water by transpiration.
- Transpiration is the evaporation of water from plants.
- The water evaporates through stomata. Stomata help in gaseous exchange and evaporation of water.