Unit 2 World Of Living

Chapter 5: Life Process

➡ What are life Processes ?

Life processes encompass a network of interrelated activities vital for an organism's upkeep and well-being. These fundamental processes, abbreviated as RENT (Respiration, Excretion, Nutrition and Transportation), collectively contribute to repair and maintain the organism's functionality.

Nutrition

The process by which organisms obtain and use food to provide energy for growth, maintenance and repair of cells.

Respiration

The process of exchanging gases between an organism and it environment, typically involving the intake of oxygen and the release of carbon dioxide.

Transportation

The movement of substances, such as nutrients, gases and wastes with in an organism's body to and from cells, usually facilitated by circulatory system.

Excretion

The removal of waste products, such as excess salts, toxins and metabolic byproducts from an organism's body to maintain internal balance and prevent harm to cells and tissues.

➡ Modes of Nutrition

(i) Autotrophic Nutrition (ii) Heterotrophic Nutrition.

(i) Autotrophic like green plants and certain bacteria, derive nutrition from inorganic sources like carbon dioxide and water

(ii) Heterotrophs depend on complex substances for nutrition, requiring them to be broken down into simplex forms for use in growth and maintenance. Enzymes serve as biological catalysts in this Process. Example - animal and fungi.

Autotrophic Nutrition

- Autotrophs perform photosynthesis, using sunlight and chlorophyll to convert carbon dioxide and water into carbohydrates, storing surplus as starch.
- In humans, a portion of food energy is stored as glycogen.

$$6CO_2 + 12H_2O \xrightarrow[\text{Sunlight}]{\text{chlorophyll}} \underset{\text{(Glucose)}}{C_6H_{12}O_6} + 6O_2 + 6H_2O$$

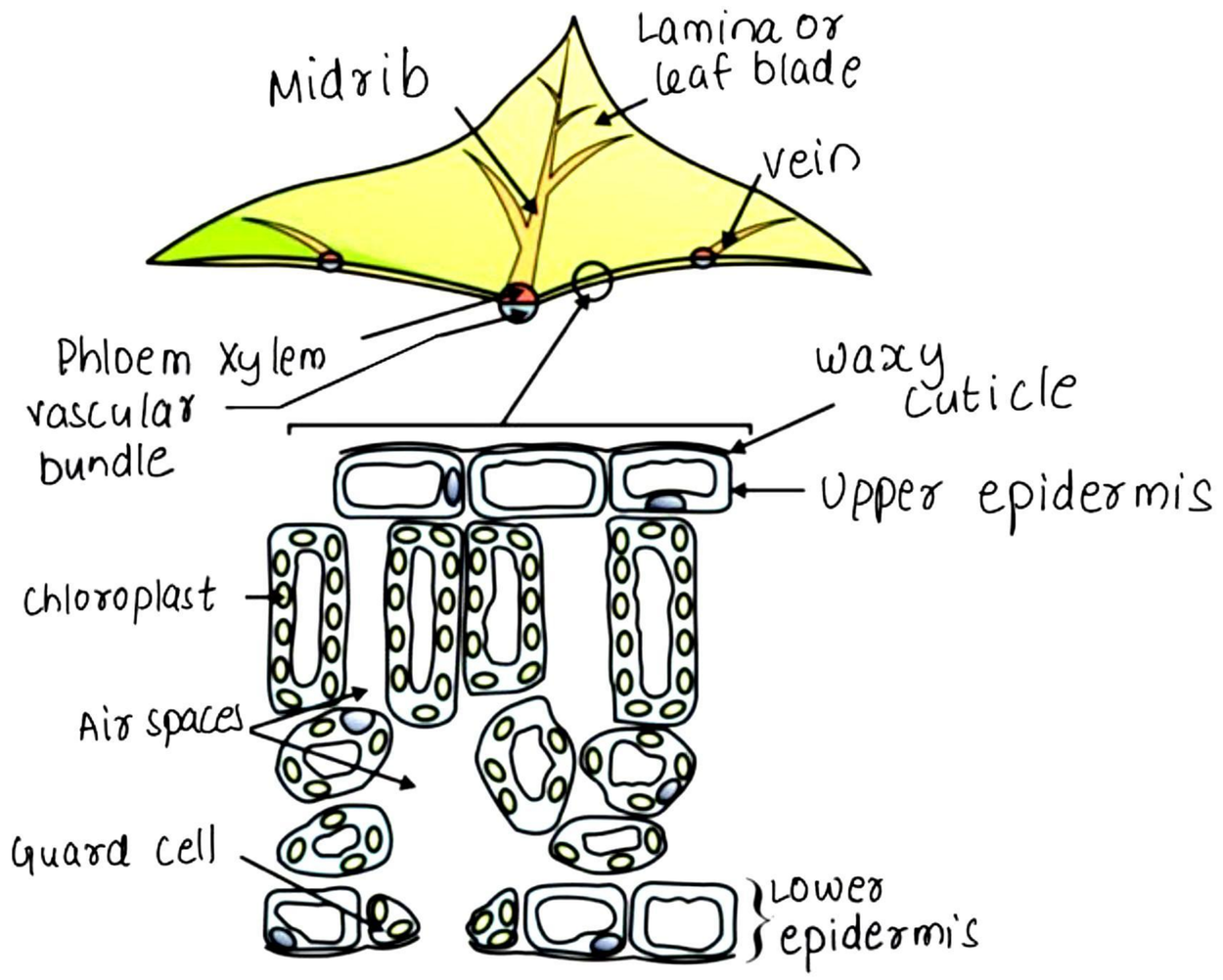
Photosynthesis steps

- Chlorophyll absorbs light energy
- Light energy splits water into hydrogen and oxygen
- Carbon dioxide is reduced to carbohydrates

steps may not occur immediately or sequentially, for instance, desert plants can take up carbon dioxide at night and process it with absorbed energy during the day

Photosynthesis

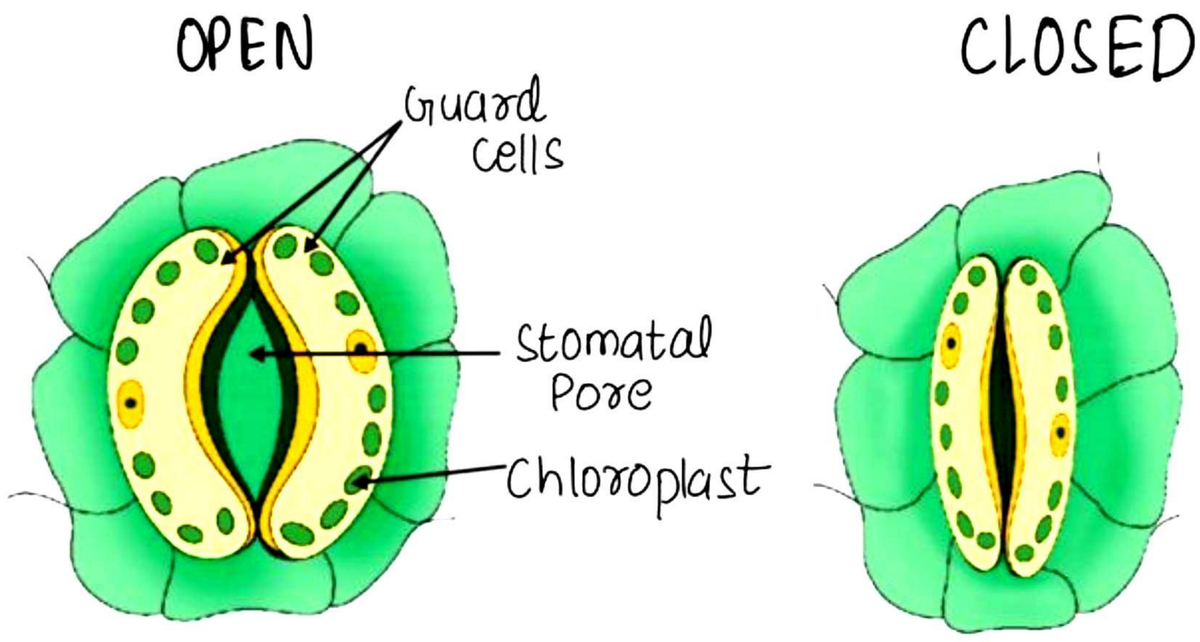
$6CO_2 + 6H2O \rightarrow C6H1206 + 602$ Plants use sunlight, water and chlorophyll to convert carbon dioxide and water into glucose and oxygen, supporting life on Earth.



Cross-Section of a leaf.

Stomata

Tiny leaf porse regulate gas exchange · Guard cells manage opening and closing, crucially influenced by water content · vital for plant respiration and photosynthesis ·



Open and Closed stomatal Pores

Heterotrophic Nutrition

Organisms consume other organisms for organic nutrients involving ingestion, digestion, absorption and assimilation · Vital for growth, development and energy production ·

Saprophytic Nutrition

Organisms feed on dead organic matter, partially digesting it externally, then absorbing nutrients · Fungi are a prime example of saprophytic behaviour ·

Parasitic Nutrition

Organisms consume resources from another organism, often harming it · Parasites live on or inside hosts, extracting nutrients directly · Examples - leeches, Ascaris and Cuscuta ·

Holozoic Nutrition

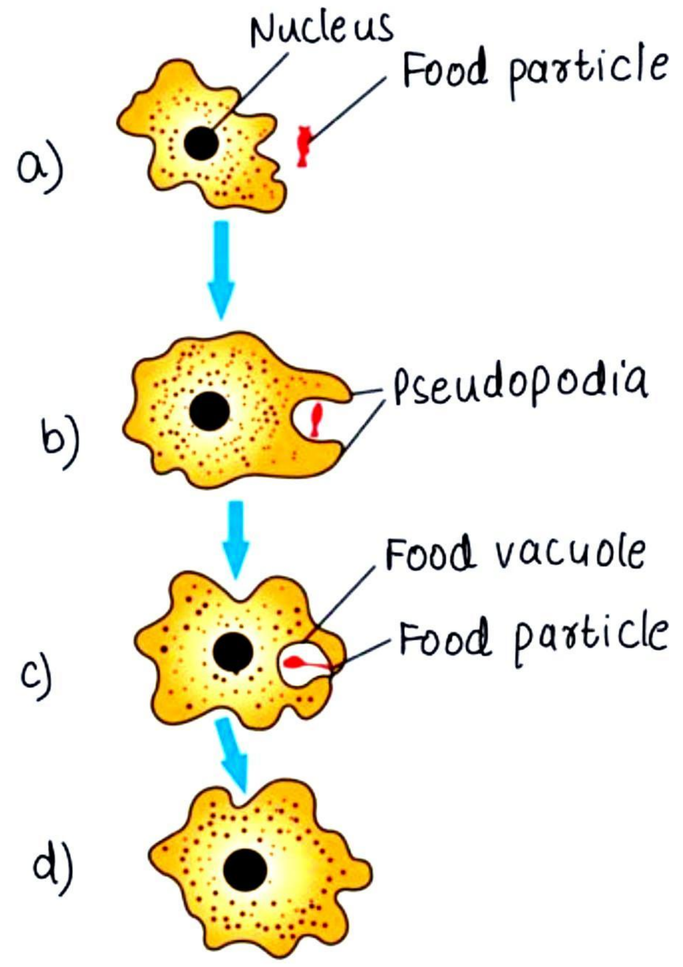
Holozoic Nutrition entails the internal digestion of food with in the organism's body occuring subsequent to ingestion · This mode of Nutrition is predominantly observed among animals ·

➡ How do organisms Obtain their Nutrition?

- Single - celled organisms absord food across their entire surface ·
- As organism become more complex, their digestive System Specialize

- Amoeba uses temporary extensions to engulf food, forming food vacuoles for digestion.

- Nutrients diffuse into the cytoplasm, while undigested material is expelled. Similarly, Paramoecium uses cilia for food intake at specific spots.



➡ Nutrition in Paramoecium

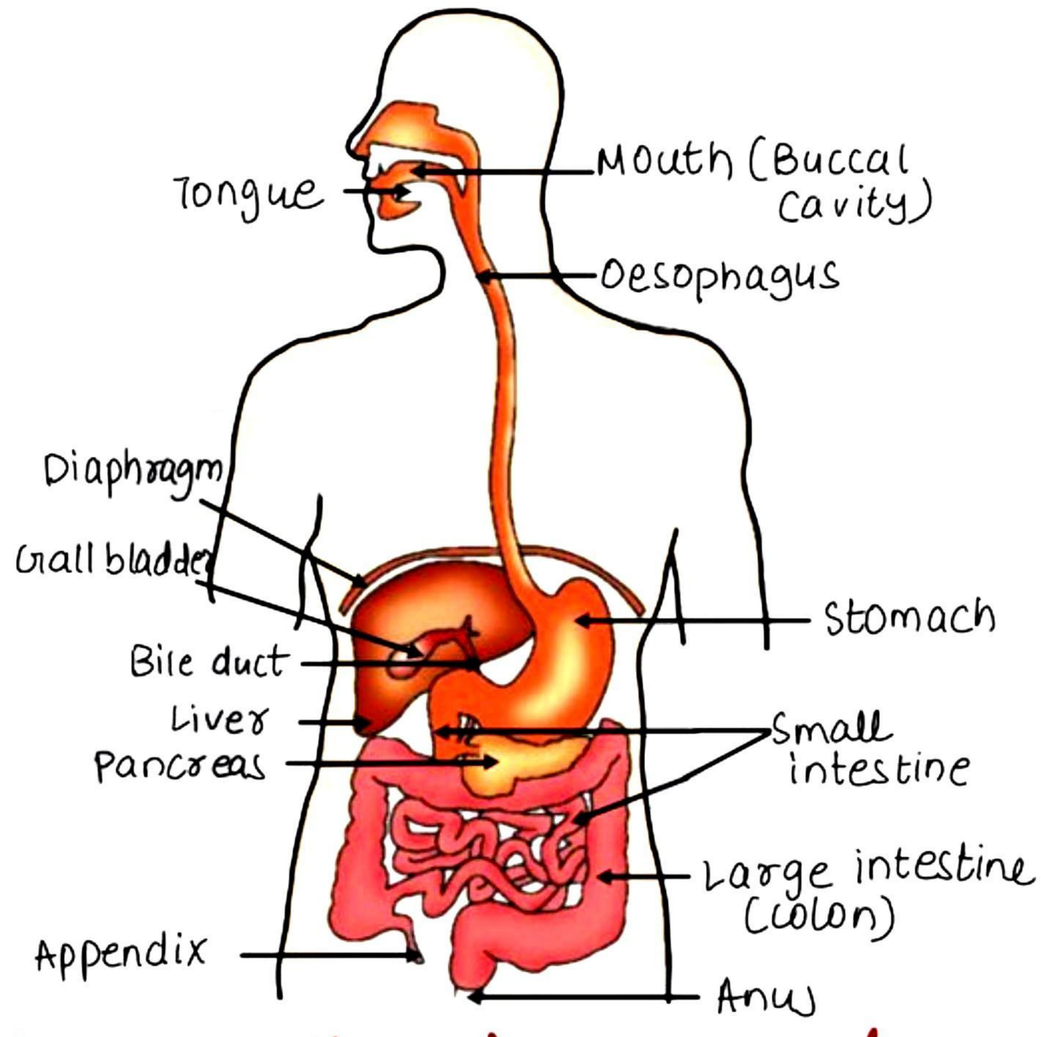
Uses cilia to ingest food through oral groove. Food vacuole forms, moves through cytoplasm for digestion and nutrient absorption. Undigested food expelled through anal pore.

➡ Nutrition In Human Beings

- The alimentary canal extends from the mouth to the anus, forming a lengthy tube.

- Salivary glands secrete saliva containing salivary amylase, which breaks down complex starch into simple sugars.

- Muscles linning the canal contract rhythmically to facilitate peristaltic movements, pushing food forward through digestive system.



Human alimentary canal

📌 Digestion In the Stomach

Gastric glands produce acid, pepsin and mucus. Acid activates pepsin for protein digestion. Mucus protects stomach linning. sphincter regulates food passage to small intestine.

📌 Dental Caries

Tooth Decay: Bacteria feed on sugars, producing acids that soften enamel, leading to decay, plaque buildup exacerbates acid effects. Regular brushing prevents decay and potential infections.

📌 Length of Small Intestine

Small Intestine: Varies by diet, herbivores have longer for cellulose digestion. Carnivores shorten. Crucial for carb. Protein, fat

digestion. Supported by liver and pancreas secretions.

Bile Juice from the liver

Bile, from the liver, contains bile salts that emulsify fats, aiding digestion. It alkalizes acidic food, optimizing pancreatic enzyme activity for efficient digestion.

Pancreatic Juice from the Pancreas

Pancreatic Juice : Contains trypsin for protein and lipase for fat digestion. Small intestine glands produce intestinal juice, breaking down proteins, carbs and fats. Villi in the intestine aid absorption.

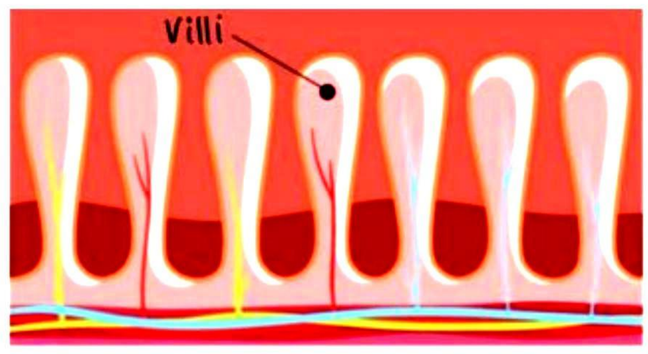
Digestive Glands

Digestive Glands : Salivary glands produce saliva for mouth digestion. Gastric glands secrete acid and pepsine in the stomach. Liver produces bile stored in gallbladder for fat digestion. Pancreas release juice with enzymes for digestion.

Dental Caries

The functions of villi include increasing the surface area for absorption. Abundant blood vessels with in villi aid in distributing absorbed nutrients throughout the body's cells. Any unabsorbed food is directed to the large intestine, where additional water is extracted from the material by its walls.

Functions of Villi



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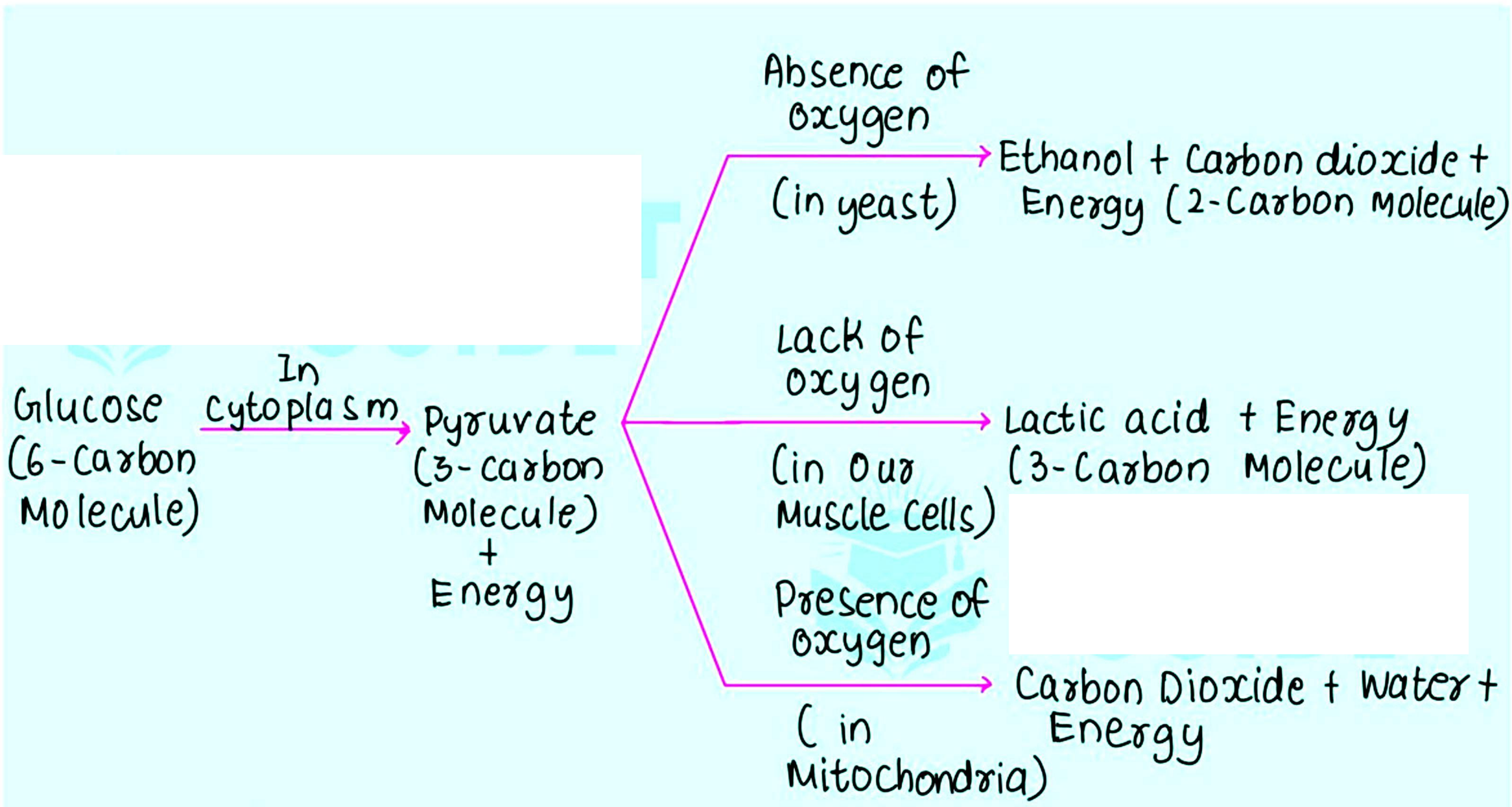
Respiration

Gas Exchange Methods: Diffusion for unicellular, ancient animals, and plants. Fish use gills in water for oxygen absorption, insects use spiracles and tracheae. Terrestrial animals rely on lungs.



Types of Respiration

Aerobic Respiration

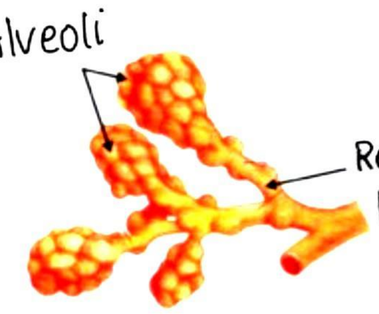
- Aerobic Respiration takes place in the presence of oxygen.
- Pyruvic Acid is converted into carbon dioxide, releasing energy, and ultimately resulting in the formation of water molecules.

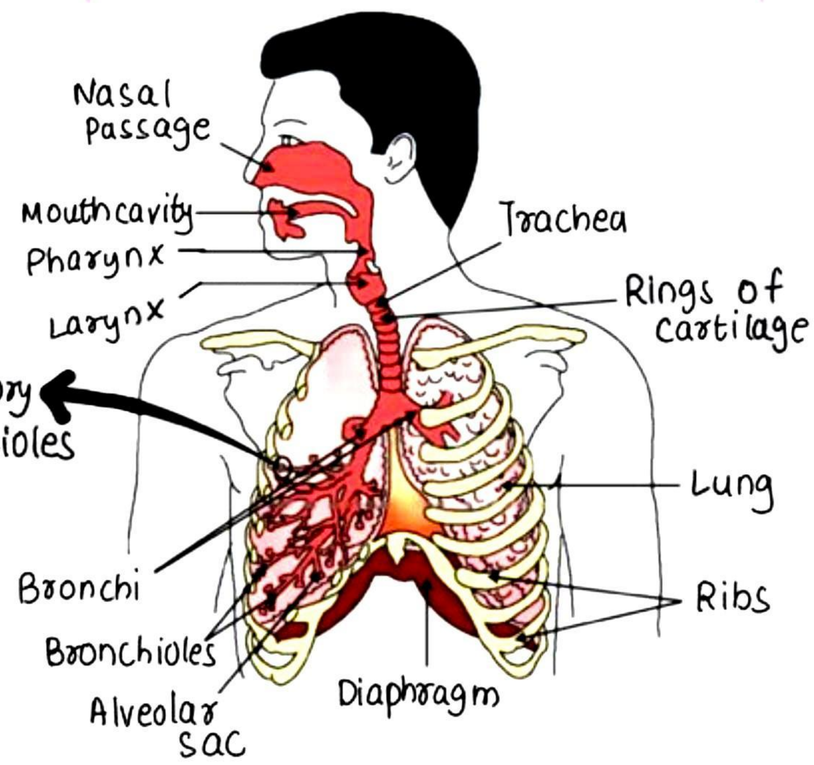
Anaerobic Respiration

- Anaerobic respiration occurs in the absence of oxygen.
- Pyruvic acid is converted into ethyl alcohol or lactic acid.
- Ethyl alcohol is typically produced by microbes like yeast or bacteria during anerobic respiration

Respiration In Humans

Human Respiratory System: Facilitates breathing, gas exchange and cellular respiration. Oxygen intake and carbon dioxide release during inhalation and exhalation. Lungs primarily





manage gas exchange , supporting cellular respiration in body cells.

⚠ NOTE - Diffusion involves the spontaneous movement of molecules from an area of high concentration to an area of low concentration , requiring no energy expenditure

ATP serves as the primary energy carrier for cellular functions with energy released during respiration utilized to convert ADP and inorganic phosphate into ATD molecules.

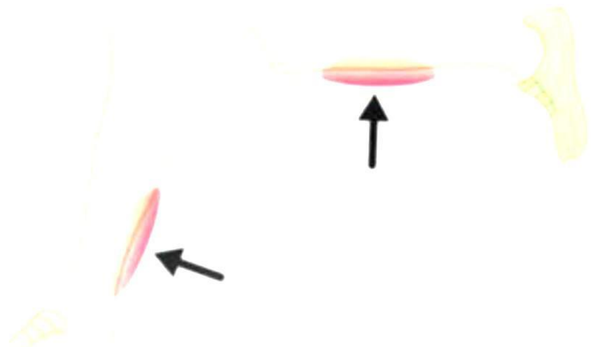
$$ADP + Ⓟ \xrightarrow{Energy} ADP \sim Ⓟ = ATP$$

Ⓟ: Phosphate

Endothermic cellular process utilize ATP to fuel reactions with the energy equivalent to 30.5 KJ/mol released when the terminal phosphate linkage is hydrolyzed using water. ATP functions akin to a versatile battery , providing energy for various cellular activities including muscle contraction, protein synthesis and transmission of nervous impulses among others.

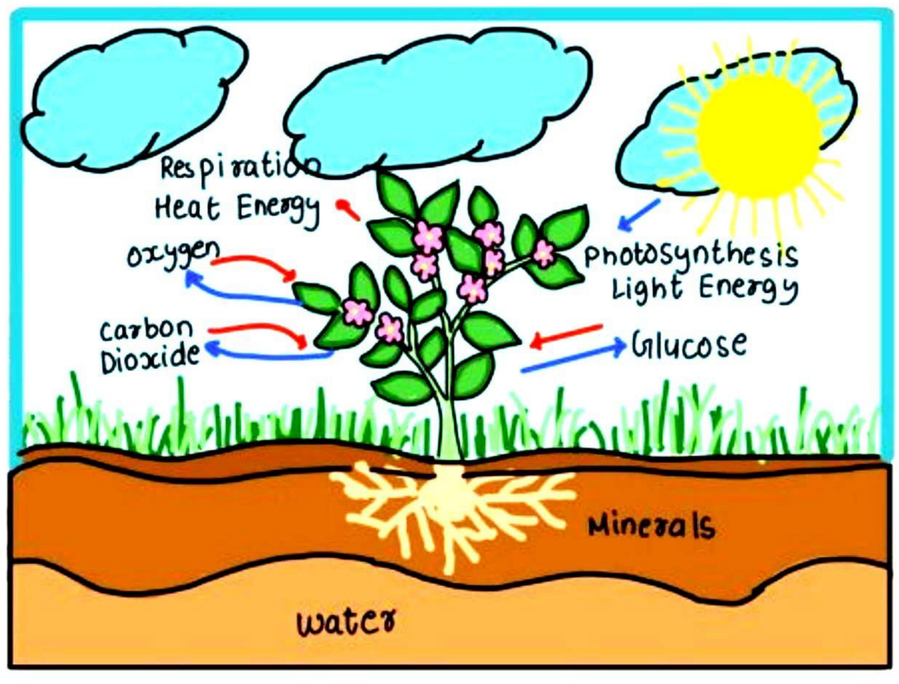
Pain In Leg Muscles While Running

Intense running induces anaerobic respiration in muscle cells due to heightened energy demand. This process yeilds lactic acid , resulting in aching leg muscles. Resting post-activity alleviates the pain associated with lactic acid accumulation in the muscles.



Respiration In Plants

Respiration in plants differ from animals and humans as they do not process specialized structures for gaseous exchange. Instead , gaseous exchange in plants takes place through stomata in leaves and lenticels in stem. While plants show respiratory activity in roots , stems and leaves, their respiratory rate is significantly lower compared to animals.



➡ Transportation

- All organisms, including animals, require essential elements like air, water and food for survival.
- These necessities are obtained through process such as breathing, drinking and eating.
- Transportation systems, such as vascular tissue in plants and specialized circulatory systems in animals are crucial for distributing these vital substances to cells and tissues.

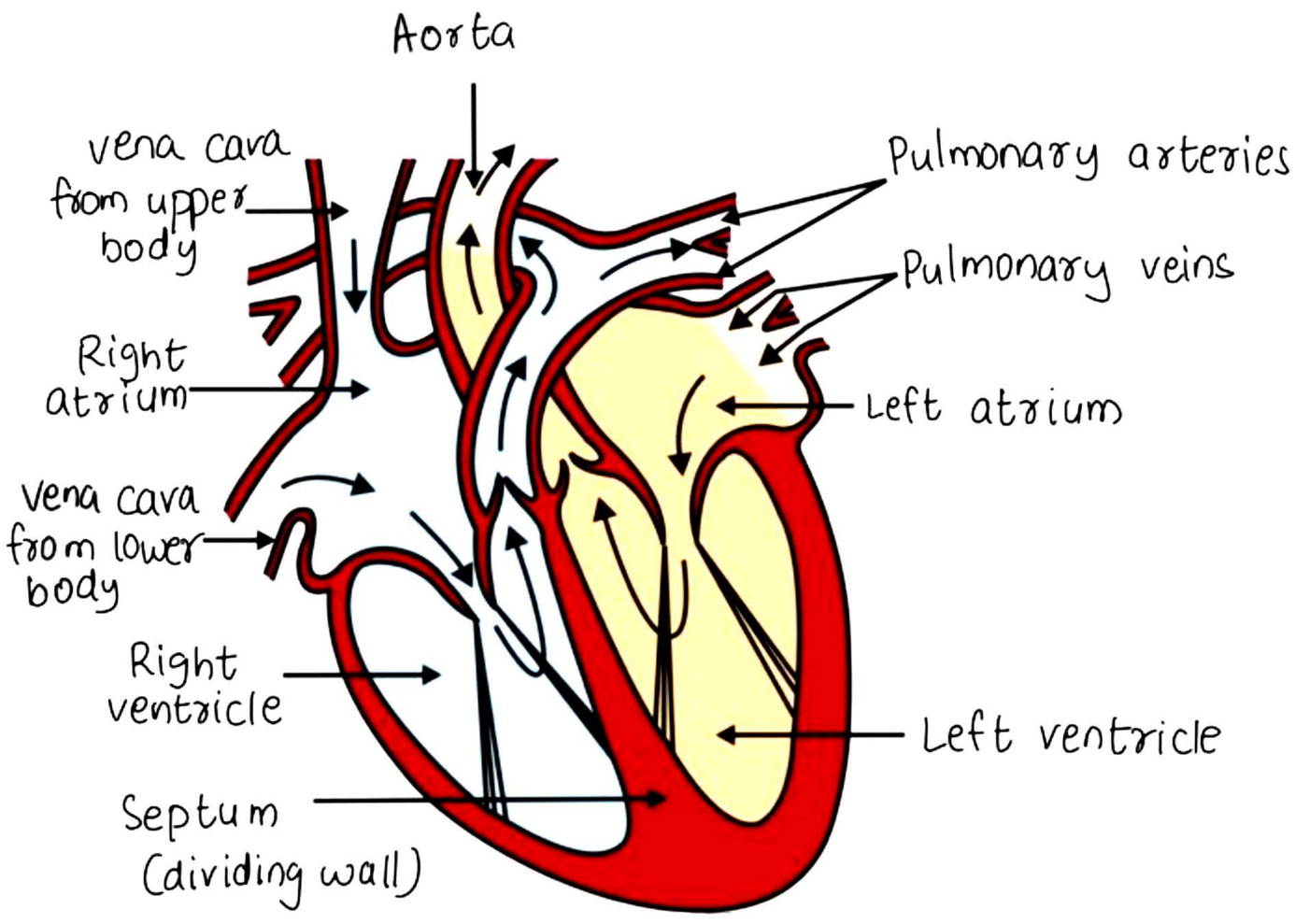
➡ Transportation In Human Beings

Transportation with in humans is faciliated by the circulatory system, comprising blood, blood vessels, and the heart. This system primarily ensures the delivery of oxygen and nutrients while removing carbon dioxide and other waste products.

Additionally it plays a crucial role in immune response by aiding in the fight against infections.

Heart

- The muscular organ which is located near the chest, slightly towards the left in the thoracic region
- The heart is the main pumping organ of the body. The human heart is divided into four chambers which are involved in the transportation of oxygenated blood.
- The upper chambers are called atria, whereas the lower two chamber are called ventricles.

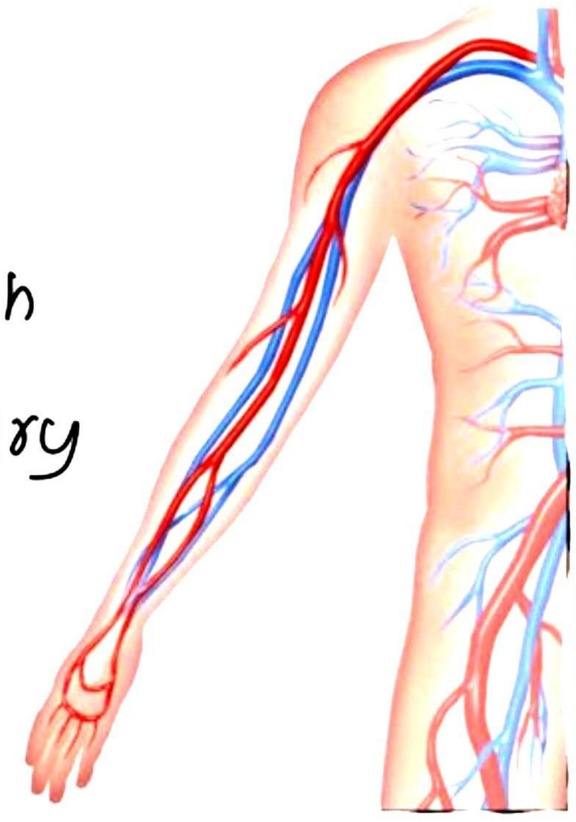


Human Heart

Arteries

- Arteries are robust blood vessels responsible for conveying oxygenated blood from the heart to different organs, excluding the pulmonary arteries. Unlike other arteries,

pulmonary arteries have a distinct function ; they transport deoxygenated blood from the heart to the lungs , where it undergoes oxygenation.



Veins

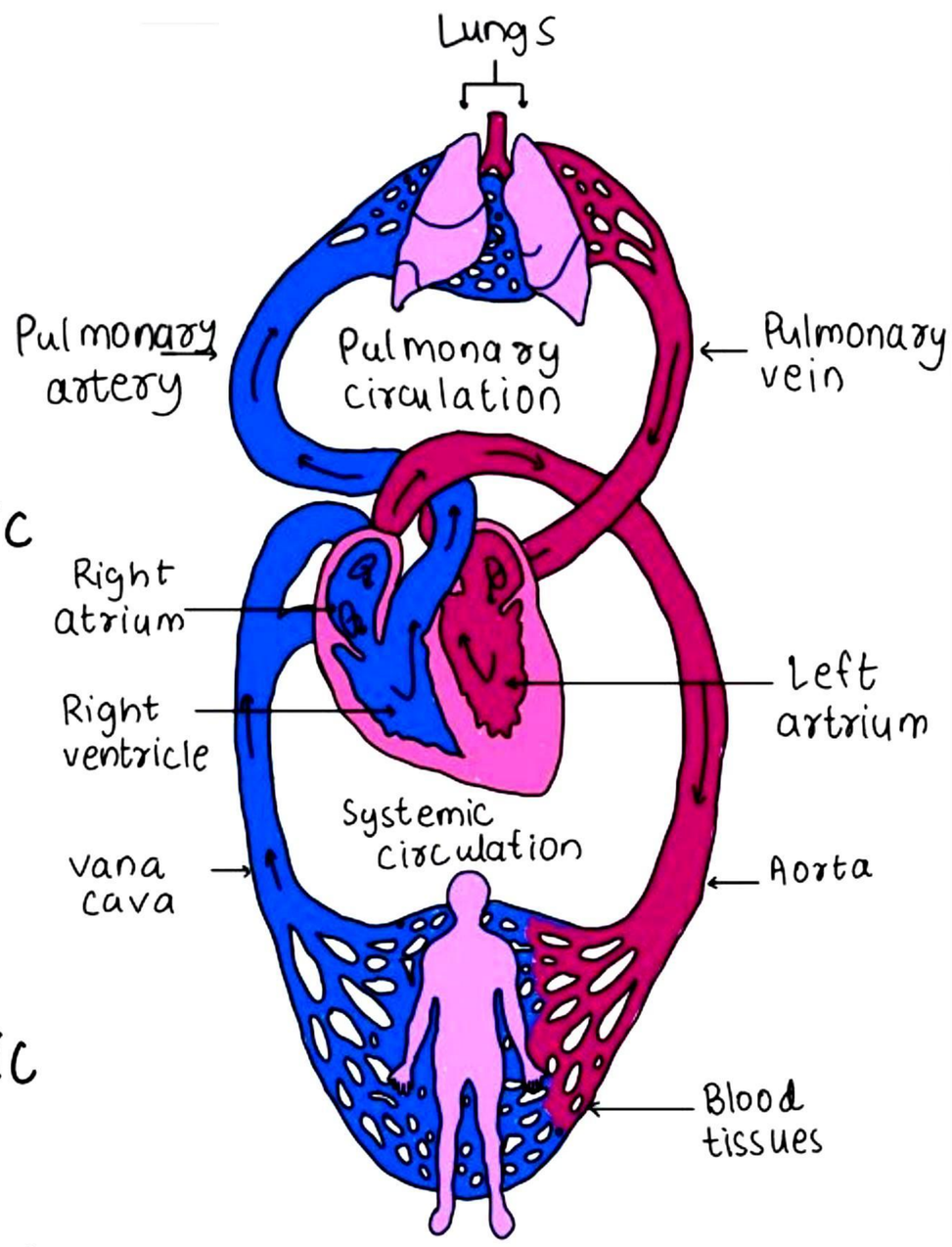
Veins are delicate blood vessels tasked with transporting deoxygenated blood from various organs back to the heart , except for pulmonary veins. Unlike other veins , pulmonary veins carry oxygented blood from the lungs to the heart. Valves with in veins serve to prevent the backward flow of blood.

Capillaries

Capillaries are characterized by their single - cell walls. Blood , classified as a connective tissue , serves as the transport medium for various substances with in the body and comprises three primary components : plasma , blood cells and platelets. Plasma , a light - colored fluid , forms the matrix of blood primarily composed of water.

Double Circulation

Double circulation in the human body involves the blood passing through the heart twice. Firstly , it undergoes pulmonary circulation , where it moves through the heart for oxygenation in the lungs. Secondly , it goes through systematic circulation, distributing oxygenated blood throughout the body. This characteristic of the circulation system in human is termed double circulation.



Double Circulation

Blood Pressure

Force of Blood Flow in vessels. Diastolic (heart filling) : 60 - 80 mm Hg. Systolic (heart bumping) : 90 - 120 mm Hg. Crucial for cardiovascular health assessment.

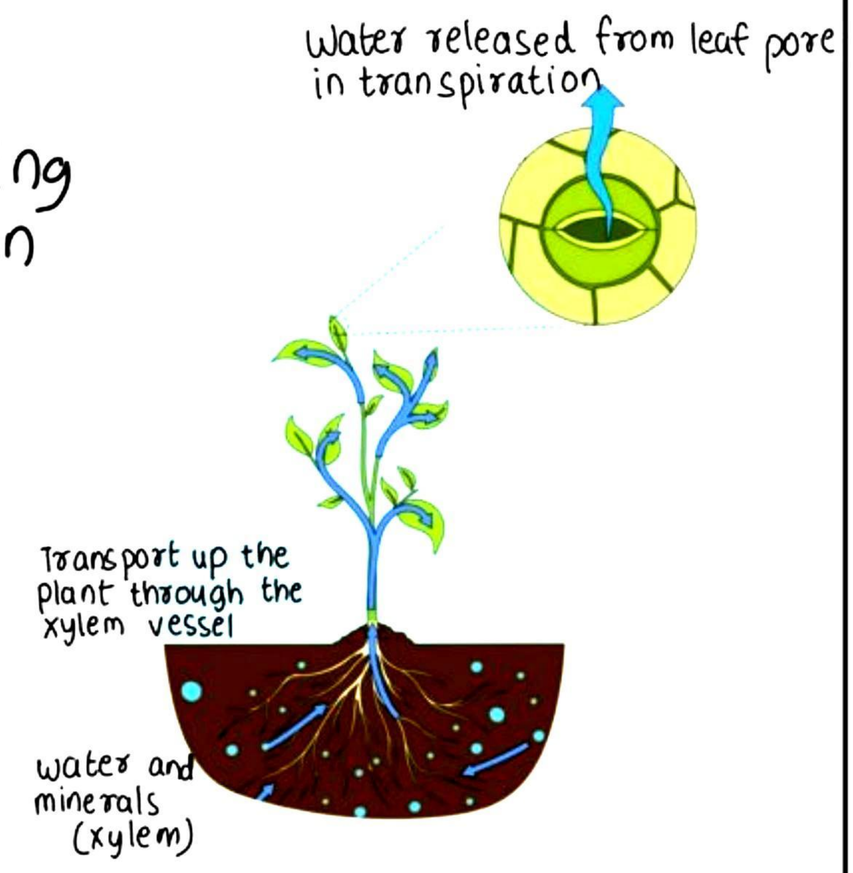
Diastolic indicates minimum arterial pressure, systolic denotes maximum. Normal ranges vital for monitoring and managing hypertension, a significant risk factor for heart disease and stroke.

Transportation In plants

Transportation is crucial for the survival of plants, involving the movement of water and essential nutrients to all plant parts. Water is conveyed through xylem, while nutrients are transported via phloem.

Transport of water

Water transport : Roots uptake ions, creating concentration gradient. water from xylem in roots. This cohesive and adhesive process facilitates water movement from the soil to leaves.



Transpiration

Transpiration is the release of water vapour from plants aerial parts. This vital process aids water and mineral absorption from roots to leaves, also regulating plant temperature.

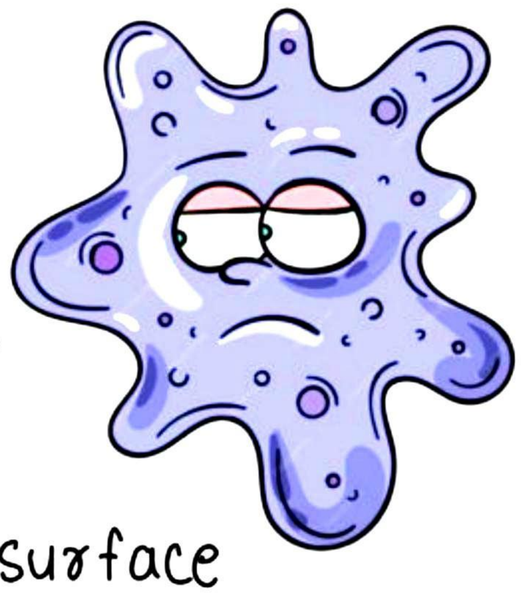
Transportation of food and other substances

Transportation of soluble products, like those from photosynthesis, occurs through translocation with in the phloem, a section of the vascular tissue. Energy is essential for this process, as substances such as sucrose are actively moved into the phloem, utilizing ATP-derived energy. In contrast, while the xylem transports water and minerals from roots to various plant parts, it does so without utilizing energy.

Excretion

Excretion involves eliminating metabolic waste and other unnecessary substances from the body.
Unlike animals, plants do not possess a sophisticated excretory system. They lack specialized organs for excretion, resulting in a less complex excretory process compared to animals.

Excretion in Unicellular Organisms



Excretion in unicellular, such as amoeba and bacteria primary occurs through simple diffusion across the general body surface. Additionally, in organisms like amoeba and paramecium, excess waste is expelled via contractile vacuoles. Furthermore, undigested food in unicellular animals is excreted when the food vacuole fuses with the general body surface

and release its contents externally.

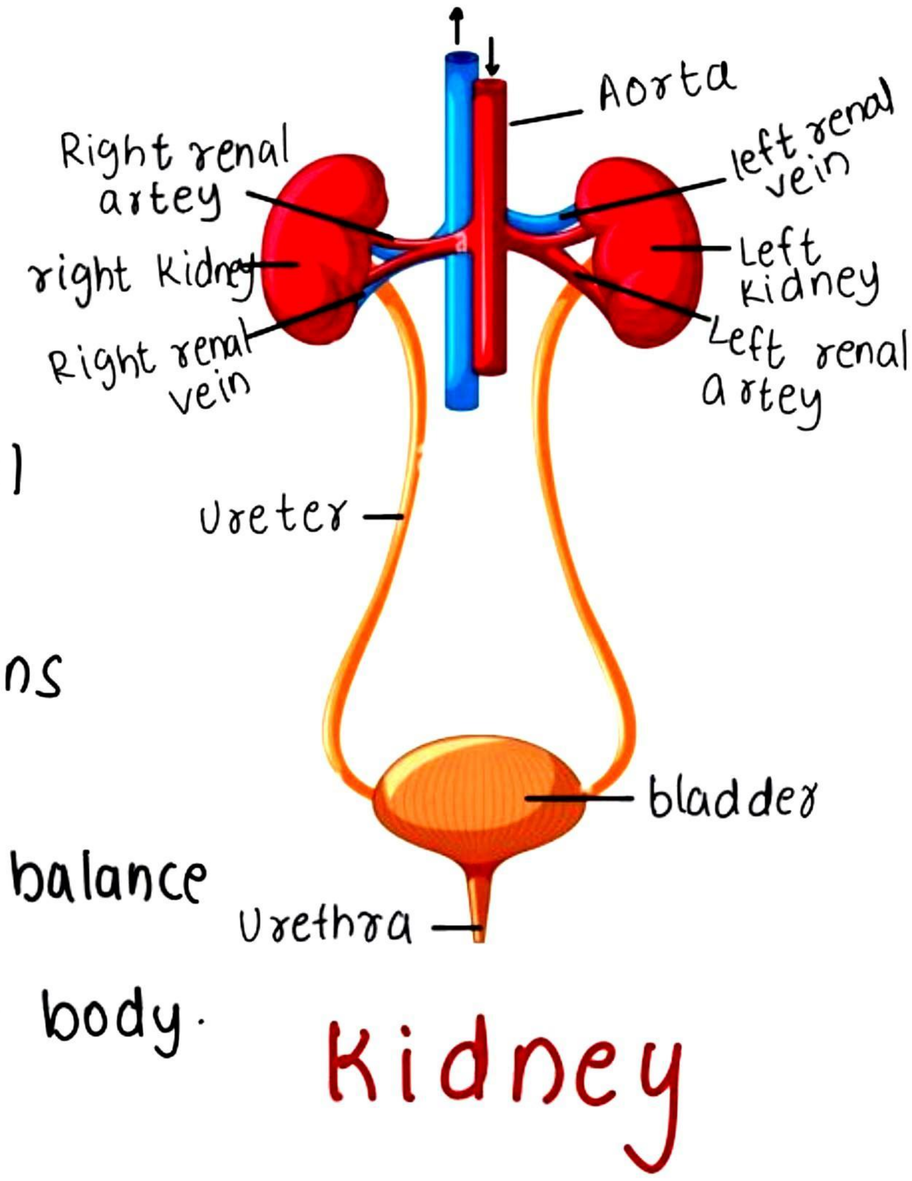
➡ Human Excretory system

The human excretory system is composed of two kidneys, each linked to the urinary bladder via tube known as the ureter. Urine accumulated in the urinary bladder and is discharged through the urethra when necessary.

Kidney

The kidney found in pairs, serve as the primary excretory organs of the body, functioning as its filtration units. Comprised of numerous tiny filtration units called nephrons. Kidney plays pivotal roles such as

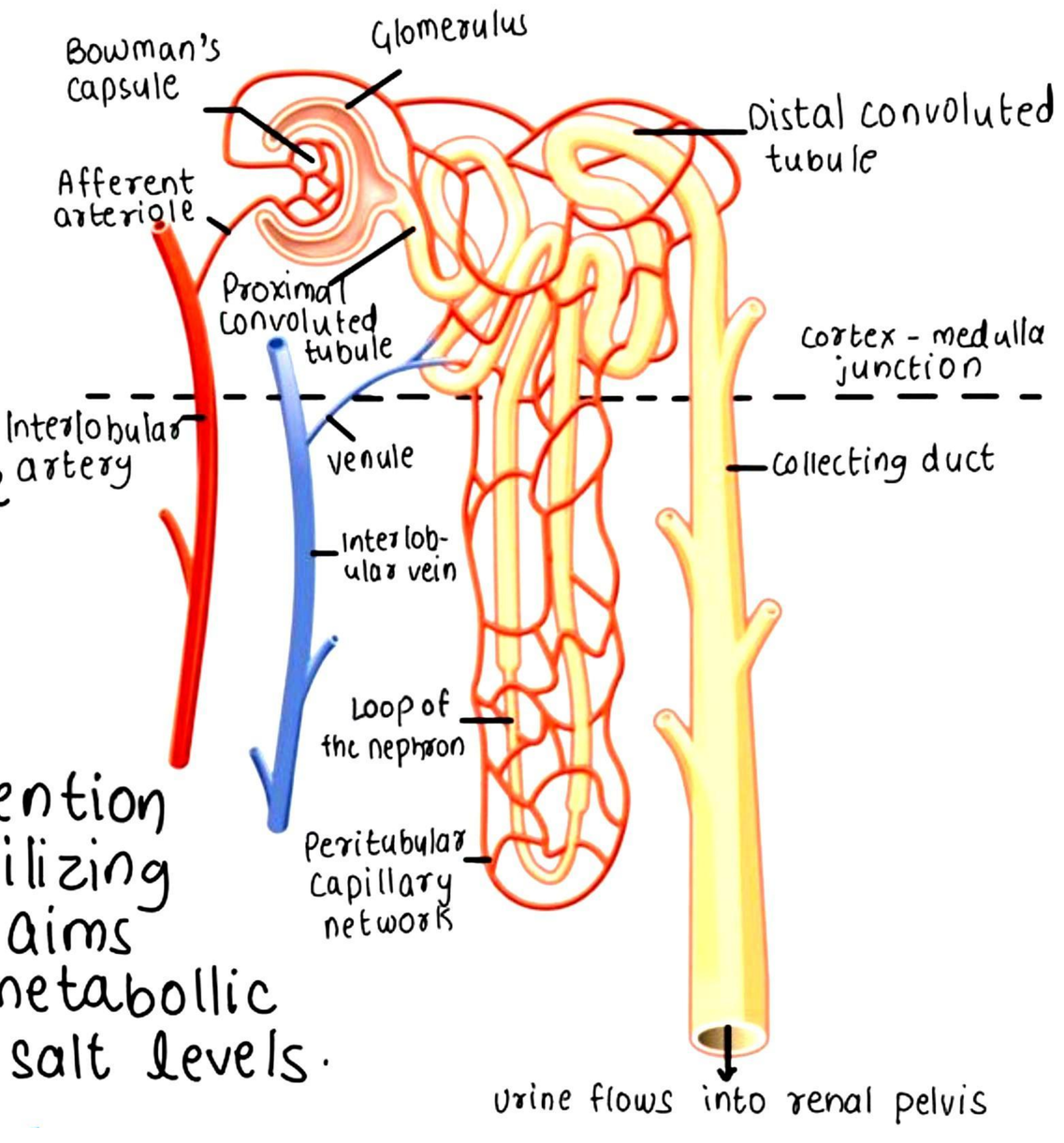
- Filtering waste materials, medications and toxins from the blood.
- Regulating osmolarity to maintain fluid balance
- Managing ion concentration with in the body.
- Regulating PH levels.
- Controlling extra cellular fluid volume.
- Producing hormones that aid in red blood cell production, support bone health and regulate blood pressure.



Kidney

Nephron

Nephrons, kidney's functional units, include millions in each kidney. Comprising Bowman's capsule and glomerulus, they filter waste and essentials. Renal tubule segments reabsorb nutrients and filter waste producing urine.



Haemodialysis

Haemodialysis is a crucial intervention for kidney failure complications. Utilizing a dialyzer or artifical kidney, it aims to regulate electrolytes, remove metabollic waste, and balance water and salt levels.

Blood is routed through tubes with a semi-permeable membrane, while a dialysate on the opposite side of the membrane draws out impurities.

➡ Excretion In plants

- Metabolic process in plants, such as cellular respiration and photosynthesis, produce various excretory by-products.
- Major excretory products include carbon dioxide, excess water from respiration, and nitrogenous compounds from protein metabolism.
- Plants release oxygen during photosynthesis and carbon dioxide during respiration through stomatal pores on leaves.
- Gaseous waste exchange occurs through these pores, with oxygen being utilized in respiration and carbon dioxide in photosynthesis
- Excess water is expelled through transpiration, while organic by-products like gums, oils, latex and resins are stored in different plants and eventually shed off. Additionally, plants may excrete waste into the soil.