Date 11/9/19 Page

Chapter - 1

Life Processes

Notes

* What are Life Processes?

The basic functions performed by living organism to maintain their life on this Earth are called Life Processes.

The basic life processes are Nutrition, Respiration, Excretion; Control and Co-Ordination, Growth movement & Reproduction.

* **Nutrition** - is a process by which living organism obtain food or synthesize it for growth repair maintenance & organism use it as a source of energy for the biosynthesis of its body constituent

Food - Food is a kind of fuel which provides energy to all living organism Thus food is the basic requirement of all living organism.

Modes of Nutrition - Organism show two basic mode of nutrition —

1) Autotrophic Nutrition

2) Heterotrophic Nutrition

1) **Autotrophic Nutrition** - The word 'auto' means 'self' & 'trophe' means nutrition. The word autotrophic means self nutrition.

- In autotrophic nutrition organism manufacture their food from simple inorganic compounds. All green plants, some bacteria & a few protista Euglena have autotrophic nutrition

Depending upon source of energy used in preparation of food autotrophic nutrition is of two types -

a) **Photosynthetic** - Green plants, some bacteria and protista utilise solar energy & synthesis simple sugar from CO_2 & H_2O with help of chlorophyll.

b) **Chemosynthetic** - Some non-green autotro-phs like iron & sulphur bacteria make use chemical energy released during oxidation of simple inorganic compounds

* Heterotrophic Nutrition - All animals mostly protista & bacteria can't manufacture their own food like autotraphs, they obtain ready made food.

Types of Heterotrophic Nutrition

a) Saprophytic - Organism feed on dead & decomposing organism & decaying organic matter such as wood, leather, leaves they are called saprophytic organism. Ex. Fungi (mushroom, yeast, agaricus) & many bacteria.

b) Parasitic Nutrition - An organism live on inside another living organism & derive its food, the organism that derives food from another living organism is called parasite & organism from which food is derived is called host. Ex- Cuscuta.

* Holozoic Nutrition - means feeding on solid food. The food may be a whole plant or whole animal & its parts. Holozoic animal are classified into following :- 1) Herbivores
2) Carnivores
3) Omnivores.

* **Mixotrophic Nutrition** - Double mode of nutrition. It combines autotrophic & heterotrophic nutrition. It is found in some protista. such as Euglena

* **Photosynthesis**

- This is the synthesis of simple sugar from CO_2 & H_2O by cells of green plant in presence of chlorophyll by trapping light energy of sun.

- O_2 is released as a by product. The complete equation for photosynthesis.

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

* **Main events during Photosynthesis**

- CO_2 from atmosphere enter into leaves through stomata.

- Water from soil is taken by the roots & send to the leaves by xylem is distributed to mesophyll cells.

- Sunlight is absorbed by chlorophyll present in ~~meso~~ mesophyll cells.

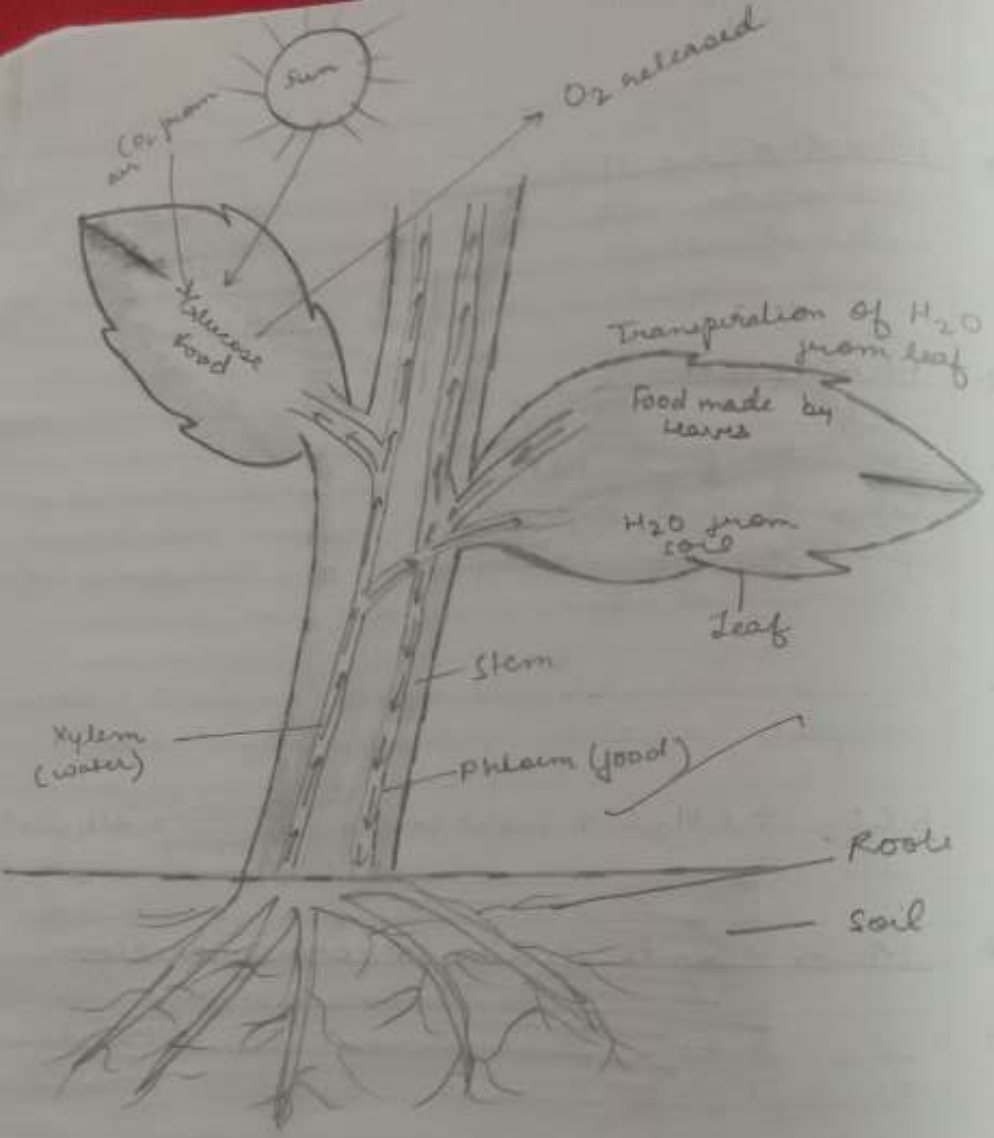

Fig:- Process of photosynthesis

- Hydrogen ion from water combine with CO_2 & form glucose.
- O_2 produced as a by product during process is given out in atmosphere. Solar energy is converted into chemical energy & is stored in glucose molecules.
- Glucose is used as a source of energy - starch, cellulose, fat are also synthesize from glucose.
- Extra glucose is stored in form of starch in different parts of plant.

* **Chloroplast** (The site of Photosynthesis)

- Chloroplast are organelles for photosynthesis. These are mainly found in mesophyll cells that are located b/w upper & lower epidermis of leaf. They are also present in the guard cell of stomata & outer layer of young green stem.
- Chloroplast are disc shaped cell organelles. They appear green due to presence of chlorophyll.

- It contained in the thylakoid membrane of chloroplast ; its molecules trap solar energy.

* Stomata (The site of exchange of gases)

- Stomata are minute pore in epidermis of leaves. They provide passage for air for exchange of O_2 & CO_2 b/w leaf cells & atmosphere.

* Mechanism of Photosynthesis - During day time, when sunlight falls on leaves the following occur -

- Light energy from sun is trapped by chlorophyll molecules.

- Light energy is converted into chemical energy that causes splitting of water molecules into hydrogen & oxygen.

- Reduction of CO_2 from Carbohydrate (dark reduction or biosynthetic fate)
[illegible] chemical phase of photosynthesis
[illegible] into the grana lamella
[illegible] phase hydrogen ions are
[illegible] photolysis of water & solar
[illegible] converted into ATP.

- Both H^+ ions & ATP are used during bio synthetic phase.
- Biosynthetic phase takes place in stroma of chloroplast, it doesn't need light. In this process CO_2 is reduced to glucose with help of H^+ ions. Energy is needed during this phase comes from ATP which is generated during photochemical phase.

* **Nutrition in Unicellular Organism**

- In unicellular organism like amoeba & paramecium nutrition is heterotrophic (holozoic)
- Amoeba is an omnivorous animal. It feed on bacteria, algae.

Nutrition evolve following steps:

- **Ingestion** - Amoeba doesn't have oral aperture food is captured by finger like pseudopodia.
- **Digestion** - In unicellular organism digestion is intracellular, that is within cell, inside food vacuole.

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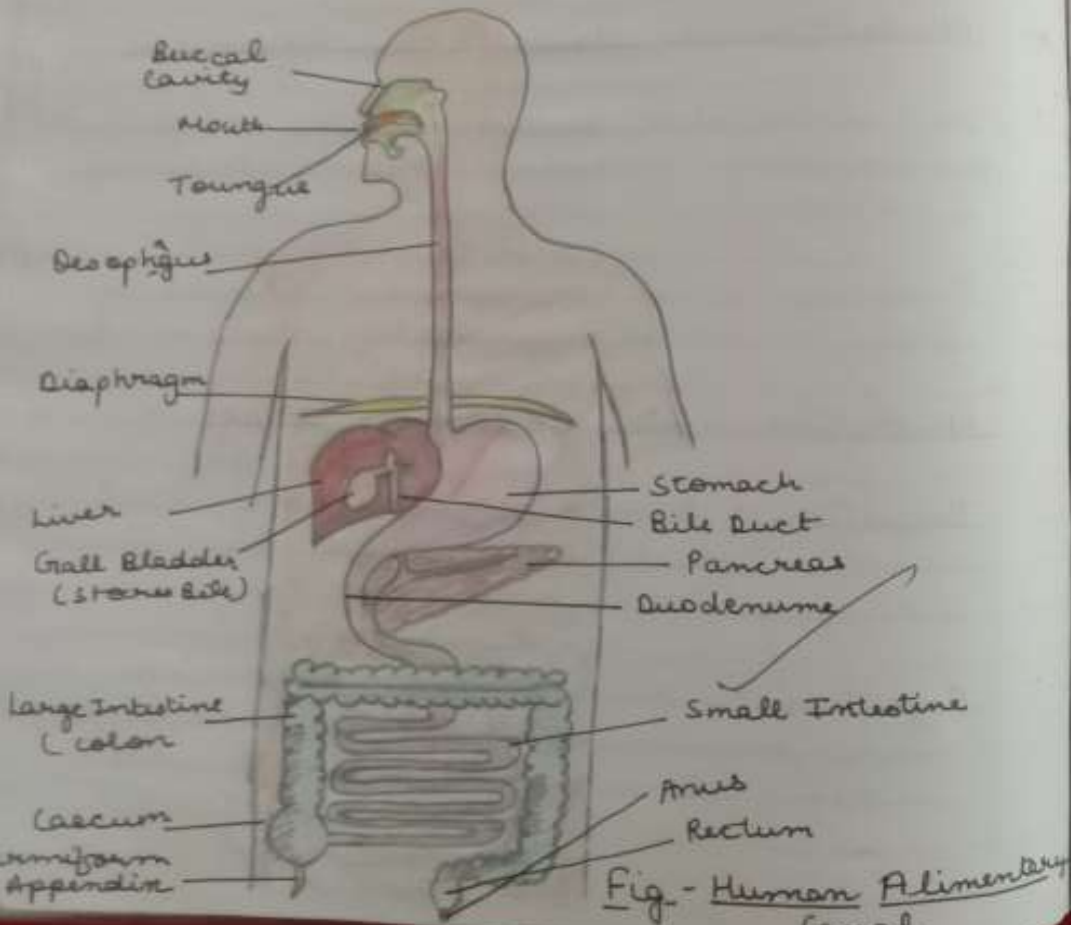

Fig - Human Alimentary Canal

- **Absorption** - The digested food diffuses into the cell cytoplasm.
- **Assimilation** - The absorbed nutrition are used for growth, repair, energy & storage.
- **Egestion** - In amoeba, the undigested food vacuole spread out by indo cytis.

→ **Nutrition in Human Being**

Human being are omnivores. They feed on different parts of the plants and they consume animal products like egg, meat and milk.

The food broken down into simple molecules in digestive system.

Digestive system divides into following types -

1) **Buccal Cavity** - is the space where food is chewed and mix with saliva. Its opening is called mouth. Mouth is bounded by an upper and lower jaw. The jaws are covered by cheeks on the side & by lips in front. Different types of teeth are Incisor, Canine, Pre-Molar and molar

are found in human buccal cavity. They are hardest non-bony structures and invaded in the bony sockets of jaw bones. Adult human has 32 teeth, 16 in each jaw. Human teeths are thecodont (partially embedded in sockets of jaw bones), heterodont (teeths of different types modified for cutting, chewing), diphydont (that is developed twice first as milk teeth & later on as permanent teeth)

Functions of Different Teeth -

1) Incisors → Biting
2) Canines → Tearing (non-function in human)
3) Pre-Molar → Chewing and Grinding
4) Molar → Same as of pre-molars

Human Being Dental formula → $\frac{2\ 1\ 2\ 3}{2\ 1\ 2\ 3} \times 2$

$\frac{4+2+4+6}{4+2+4+6}$

$\frac{16}{16} = 16+16$

$= 32$

→ Pharynx - Pharynx is a funnel shaped structure where food channel and air channels cross each other.

2) Jejunum - is about 2.5 m (8 feet) long and narrow than duodenum.

3) Ileum - is about 3.5 m (12 feet) long

The inner lining of small intestine is produced into finger like projection called villi.

These villi greatly increase the area of intestine for absorption.

→ Large Intestine - is is wider than small intestine. It is about 1.5 to 1.8 m (5-6 ft) long and 6 cm wide. It is divided into ccum, colon and rectum

1) Caecum - is a small pouch. The opening of small intestine into caecum is control-led by valve which permits the food to move down into large intestine but not back, from caecum areas a blind tube the vermiform appendix.

2) Colon - is an inverted U-shaped tube divided into 4 parts namely - ascending colon, descending colon, transverse colon, & sigmoid colon.

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3) Rectum - is ran 15 cm (about 7 inch) long terminal tube that open to the exterior by anus.

→ Functions of large Intestine

* Absorption of water from the food
* Secretion of mucus
* Egestion of undigested waste matter

→ Digestives Glands

1) Salivary Gland - Three pair of salivary gland open into the buccal cavity. They secrete saliva. Saliva is an alkaline (ph = 7.2). It lubricate and moisten the food. The enzyme salivary amylase present in saliva convert starch into maltose (starch) & saliva is an antiseptic it contain lysozyme which kills germs present in food & in mouth.

2) Liver - Liver is the largest gland in the body. It is reddish-brown & its weight about 1.5 Kg. It present on the right side of abdominal cavity in the concavity of diaphragm. It is formed of depatic cell that are arranged in chords.

Liver produce bile juice which is stored in gall bladder & is released in duodenum when required.

3) **Pancreas** - Pancreas is a leaf-shaped gland. It is a dual gland. It produces pancreatic juice which contains enzymes for the digestion of sugars and protein. The endocrine part produce insulin and glucagon hormones which are associated with the metabolism of glucose. The pancreatic duct releases pancreatic juice in the duodenum.

Gall Bladder - is a transparent, ovoid sac embedded in one of the liver lobes. It receives bile from the liver via hepatic duct & stores it. The gall bladder opens into the proximal arm of duodenum through common bile duct.

Respiration

→ Respiration is the process of oxidation or breaking down of organic compound, particularly glucose with the release of energy.

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + 38 \text{ ATP}$$

* **Mechanism of Respiration**

Respiration involves following steps :-

1) Intake of oxygen from the environment
2) Stepwise oxidation of food.
3) Release of energy as ATP
4) Elimination of Carbon Dioxide
5) Intake of oxygen and release of CO_2 constitude the physical process.
6) Stepwise oxidation of food & release of energy represent the biochemical process

- Glycolysis → is the first step of respiration. It takes places in the cytoplasm.

It result in the breakdown of glucose in (6 carbon compound) to pyruvic acid (3 carbon compound).

During glycolysis 2 molecules of ATP are used and 4 molecules of ATP & 2 molecules of pyruvic acid or pyruvate are formed

Further conversion of pyruvic acid depends on the presence or absence of oxygen

a) In Presence of oxygen pyruvic acid mithochondria & starts crabes cycle

b) In absence of oxygen pyruvic acid break down into ethyl alcohol or latic acid. It is called anaerobic respiration.

* Krebs Cycle – In the presence of oxygen pyruvic acid is completely oxidised into carbon dioxide and water and energy is released in the form of ATP

* Types of Respiration

Respiration is of 2 types.

i) Aerobic Respiration
ii) Anaerobic Respiration

i) Aerobic Respiration Aerobic Respiration occur in the presence of oxygen. During this process is ~~comple~~ glucose is completely oxidised into carbon and water.

$$C_6H_{12}O_6 \xrightarrow{\text{Glycolysis}} \text{Pyruvate} + 6CO_2 \xrightarrow{\text{Krebs Cy.}}$$

$$\longrightarrow 6CO_2 + 6H_2O + 38\,ATP$$

ii) **Anaerobic Respiration** - Anaerobic Respiration occur in the absence of oxygen. In this case glucose is incompletely breakendown into alcohol and CO_2 or into latic acid. Thus energy released in anaerobic respiration is much less that aerobic respiration.

$$C_6H_{12}O_6 \xrightarrow[\text{in cytoplasm}]{\text{Glycolysis}} \text{Pyruvate} \xrightarrow[\text{(in cytoplasm)}]{\text{Absence of } O_2}$$

$$2C_2H_5OH + 2CO_2 + 2ATP$$

* **Respiration in Animals**

All animals (except gut parasite) need onygen for respiration & spell out CO_2 produced during respiration

* **Exchange of Gases in Unicellular Organism**

- Unicellular animals like Amoeba and Paramecium and simple multicellular animals ~~so~~ show direct respiration. The onygen dissolved in Water diffuses directly into their body cells.

* Exchange of Gases in Complex Multicellular Organism

• Multicellular Animals have evolve different organs for uptake of oxygen & getting rid of CO_2

→ Aquatic Animals - Depend on oxygen dissolved in water. Therefore exchange of respiratory gases occur between respiratory organs & water present in aquatic animals are -

1) Skin - In earthworm, naries, leech & frog etc., skin help in exchange of gases.

Respiration through the skin is called cutaneous respiration

2) Gills - Aquatic arthropoda, molluscs & fishes have gill for respiration.

Respiration by gills is called branchial respiration

Terrestial animals take use of oxygen present in the air. They have following organs for obtaining oxygen from air:

Trachea

1) In Insect, centipete & millipedes.

2) Book lungs - Scorpions & spiders

3) Pulmonary sac - Pila.

4) Lungs - All vertebrates except fishes

* Respiratory Organs in Man.

- Lungs are the main respiratory organs in our body. Respiration through lungs is called pulmonary.

* Conducting organs of respiratory tract -

Nostril, Nasal Passage, Pharynx, Larynx, Trachea, Bronchi and Bronchioles.

1) Nostrill and Nasal Passage - Nasal passage are pair of tubed in the buccal cavity. They are secreted from buccal cavity by a bony plate.

Function

i) The hair present in the nostrils trap bateria & dust particles

ii) The moist mucous lining of nasal passages make the air moist

2) Pharynx - In Pharynx, the food and air tubes cross each other.

The opening of air tubes or trachea in the Pharynx is called glottis. It is guarded by a cartilageous flap epiglottis

3) Larynx (Voice Box) - The anterior part of trachea is dilated & is called larynx. It has two pair of vocal chord. The vocal chords (Vibration) produced voice.

4) Trachea (Wind Pipe) - It is a long tube slo from larynx in the neck to bronchi. In the thoracic cavity. Its walls is supported with 'C' shaped cartilagenous ring.

5) Bronchi and Bronchioles - On entering thoracic cavity, trachea divides into two primary bronchi. Each primary bronchi enters the lung of its side & immediately divides into secondry & tertiary bronchi.

6) Respiratory Bronchioles - Each primary bronchus enters the lung of its side immediately divide into secondry & tertiary bronchi. A bronchus with its branches is called bronchial tree.

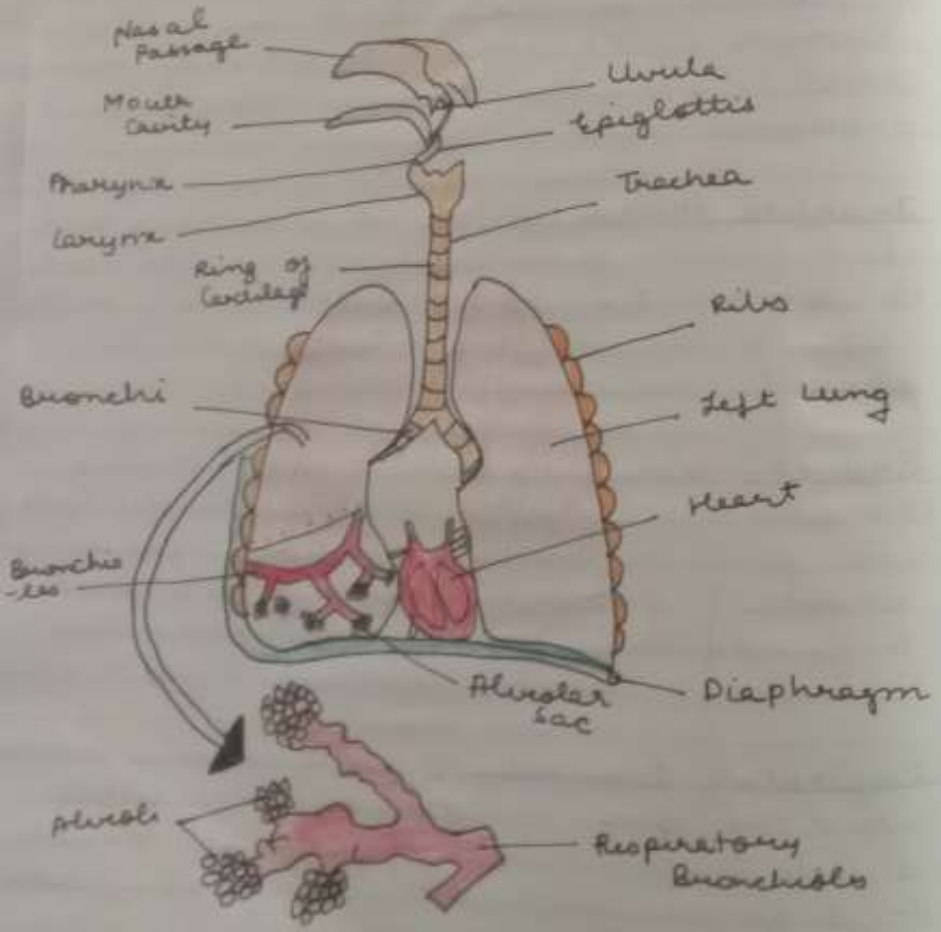

Fig - Human Respiratory System

*7) Alveolar Sac & Alveoli - The respiratory bronchioles finally end in alveolar ducts. Each alveolar duct is connected with several thin walled alveolar sac with numerous alveoli or air sacs.

* Lungs (The main Respiratory Organ) :-

The lungs are the pair of conical & highly spongy, air filled sacs formed of million of alveoli. Lungs occupy major part of thoracic cavity. The right lung is larger than the left lung with three lobes, while left lung has two lobes.

→ Mechanism Of Breathing :-

Breathing is a complex process. It involves renewal of air in the lungs. It is completed in two steps → Inspiration & Expiration.

i) Inspiration (inhalation) → During inspiration the thoracic cavity expands by the contraction of intercostal muscles which pulls the rib & the sternum upward, forward & outward. The contraction of radial muscles of diaphragm causes flatting of dome-shaped diaphragm.

& the fresh air from air passage is served into the lungs, fills the alveoli

ii) Expiration (exhalation) - During expiration volume of thoracic cavity decreases by the relaxation of intercostal muscles that push the ribs invert & relaxation of radial muscles that make flattened diaphragm to become dome shaped. This processed the lungs & air is pushed out

→ Exchange Of Gases

1) External Respiration - It is exchange of gases b/w alveolar air & blood in alveoli capillaries. It occurs in the lung alveoli

2) Internal Respiration or Tissue Respiration - Internal respiration occurs in the tissues. The oxygen diffuses from blood capillaries to the cells & CO_2 from cells into the blood capillaries.

* Transportation :-

The movement of glucose, oxygen & other organic & inorganic substance from one part of the body to the other is known as Internal Transport of Materials or Transportation

→ In Plants :-

* Xylem Transport Or Transport of Water Minerals

→ Xylem tissue forms water conducting system throughout the plant body. Xylem vessels & tracheids of roots, stems & leaves are interconnected. Water & minerals are absorbed by the hair of roots & are transported through xylem vessels to the leaves at the top of the plant. This upward movement is called ascent of sap.

* Transported Of Food & Other Substances

→ The transport of food from leaves is called translocation. The food manufactured in the mesophyll cells of the leaves by photosynthesis enters the sieve tubes of the phloem as sucrose & is transported as a dilute aqueous solution to all plant parts.

→ Human Circulatory System

* Heart - Heart is a muscular pumping organ. It is situated almost in the middle of the chest b/w two lungs. Its lower conical end is tilted to the left. Heart

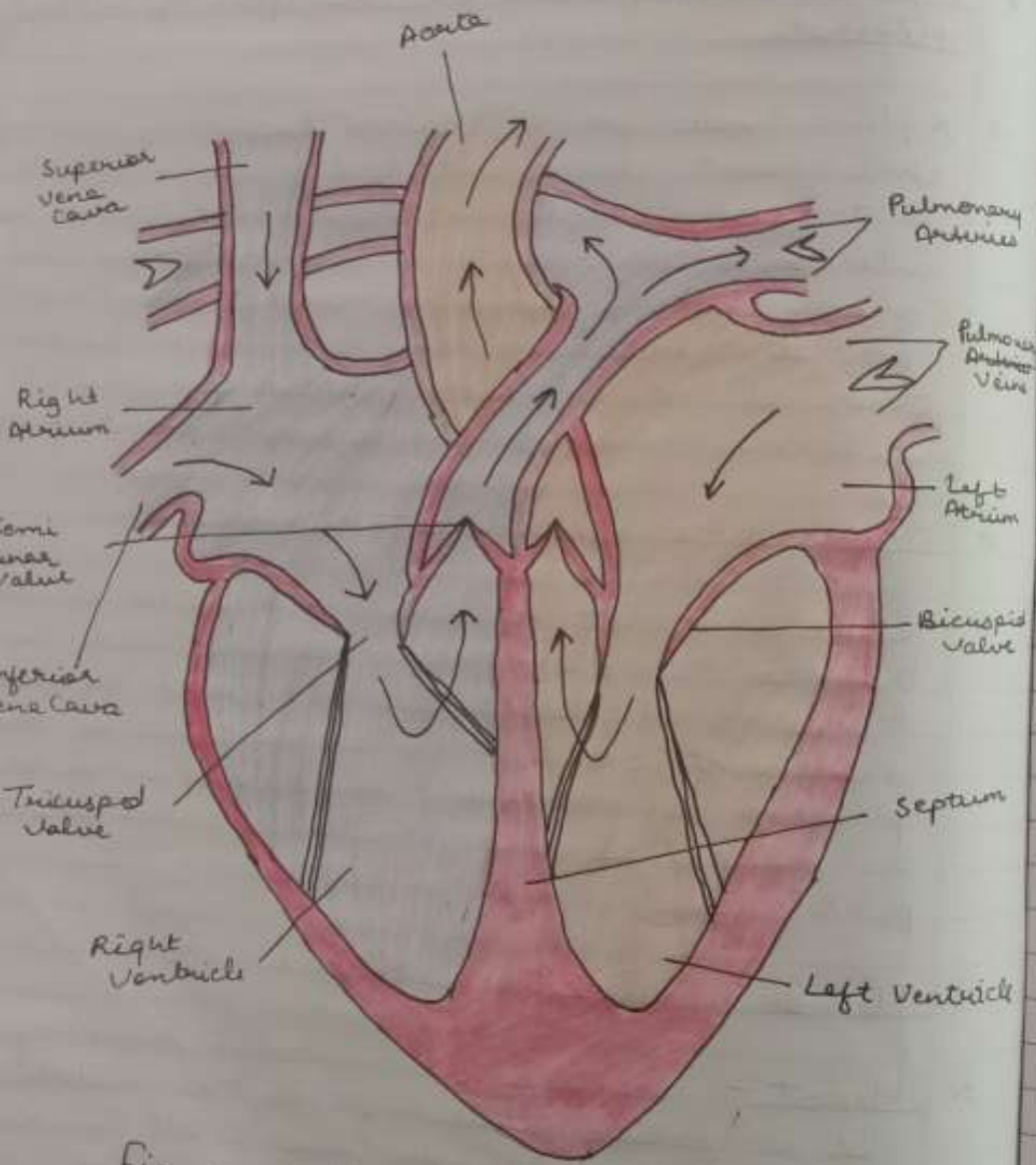

Fig. - Human Heart

is enclosed in a sac called pericardium formed of two pericardium layer or membrane. The two pericardium protects heart from injury & frictions.

* **Heart Chambers** - Humans heart have four chamber. It consist of two auricle & two ventricle.

a) **Auricle / Atrium** - The two thin walled auricles are separated by a thin & inter-auricular septum. The right auricle receives deoxygenated bloods by two large vessels (vena cava). The left auricle receives oxygenated blood from lungs by two pairs of pulmonary veins.

b) **Ventricles** - The two thick walled ventricls are separated by a thick inter ventricular septum. The left ventricle is larger & its walls are thicker than the right ventricle. The right ventricle supply deoxygenated blood to lungs through pulmonary aorta. The left ventricle supply oxygenated blood to the entire body by a single aorta.

c) **Cuspid Values** - Those atrium opens into ventricle of its side by an atrioventricular aperture which is guarded by

cuspid valve

* Tricuspid Valve - a tricuspid valve guards the right atrioventricular aperture & allows blood from right atrium to right ventricle

* Bicuspid Valves - A bicuspid valve guards the left atrioventricular aperture & allows blood to flow from left atrium to left ventricle. The bicuspid valve is also called mitral valve

* Semilunar Valve - There are of moon shaped or pocket shaped flap. There semilunar pulmonary valves guards the opening of right ventricle into the pulmonary aorta, to prevent backflow of blood into the ventricle. There semilunar aortic valve guards the opening of left ventricular into aorta

→ Blood flow through Heart / Working of Heart :-

• In mammals heart, oxygenated & deoxygenated blood remain completely separate in left & right

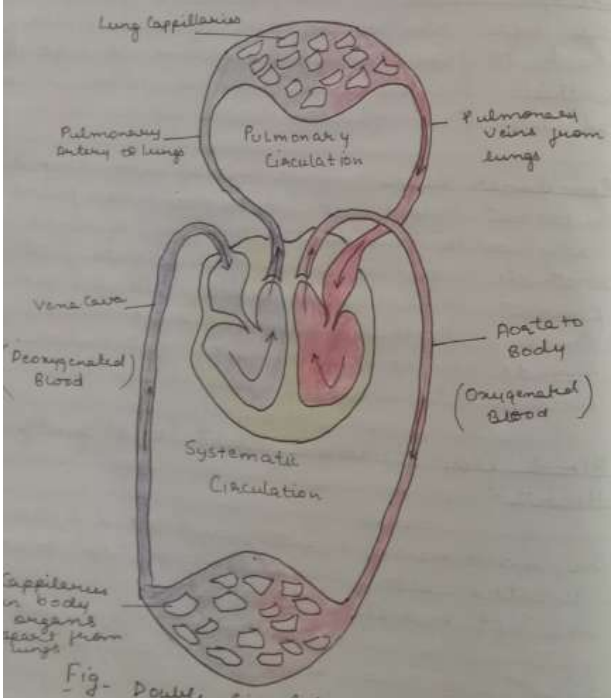

Fig- Double Circulation

- The deoxygenated blood from the entire body brought to the right atrium.
- The oxygenated blood from lungs is brought to the left atrium by four pulmonary veins.
- The two auricles contracts & push blood into respective ventricles through right & left atrioventricular aperture.
- The two ventricles contract simultaneously from right ventricles deoxygenated blood is pumped into pulmonary trunk & is carried to lungs through pulmonary artery.
- From left ventricular aperture oxygenated blood distributed in all parts of the body through aorta.

* Double Circulation -

Separation of deoxygenated & oxygenated blood results in two independent circulation is known as double circulation. It is divided into 2 parts :-

i) Pulmonary Circulation - Pulmonary circulation for the oxygenation of deoxygenated blood

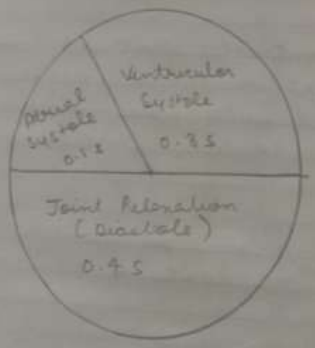

Fig.- Cardiac Cycle

ii) Systematic Circulation - For the supply of fully oxygenated blood to all body organs. Such a supply is useful for animals which have high rate of metabolism to fulfill their energy need & for maintaining constant body temperature.

→ Heartbeat & Cardiac Cycle

Working of heart includes rhythmic contraction & relaxation of auricles & ventricles. The contraction phase is called systole & the relaxation phase is called diastole.

A heartbeat includes 1 systole followed by 1 diastole. The sequence of atrial & ventricular events occuring once during each complete heartbeat is termed as cardiac cycle. Thus total duration of cardiac cycle is 0.8 s & heartbeats 72 times/min

→ Blood Pressure - It is a pressure, represent the blood discharge due to contraction of left ventricle on the wall of blood vessels. The BP (Blood Pressure) is maximum in main artery during ventricular systole (ventricular contraction).

BP is measured as -

i) Systolic Pressure - Systolic pressure represent during ventricular contraction. It is about 120 mm of 'Hg' in normal person.

ii) Diastole Pressure - Diastole pressure represents during relaxation of ventricle. It is about 80 mm of 'Hg' in a normal person.

⇒ BP is measured with sphygmomanometer. Normal BP of human beings is 120/80 where 120 represents systole & 80 represent diastole.

Excretion - The removal of harmful & unwanted metabolic wastes & salt from the body is called excretion. These, if accumulate, are toxic to the body.

• Excretory System - is a system of organs & tissues that take part in separation, collection & elimination of waste products.

* Excretion in Plants

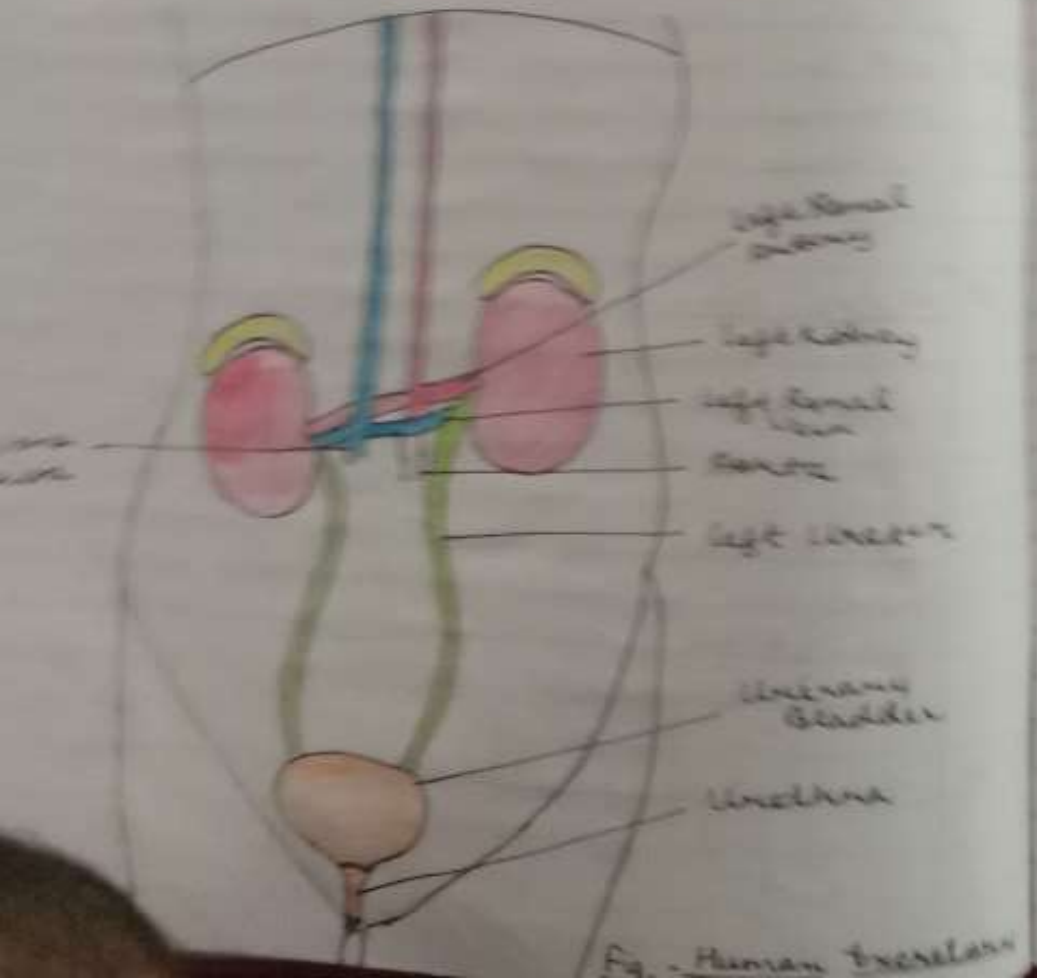

Fig. - Human Excretory

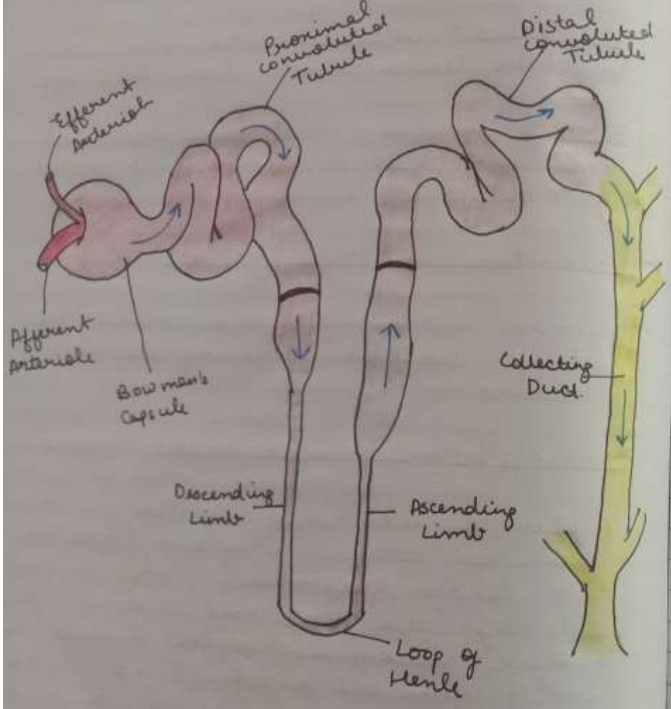

Fig - Structure of Nephron

is collected in the urinary bladder. It is released periodically.

* **Nephron : The Functional Unit Of Kidney**

Each Kidney is formed of a large no. of **nephrons**. These are basic filtration units of kidney. These are closely associated with blood capillaries.

Each nephron is differentiated into 2 parts :—

1) **Renal Corpuscle**

- The proximal part of each nephron is in the form of double-walled hollow cup known as Bowman's Capsule
- Its cavity is filled with a tuft of blood cappillaries Glomerulus
- The cappillaries in the glomerulus are formed by the branching of Efferent arteriole (which carries away) and Afferent arteriole (which carries towards) arteriules of renal artery.

* **Function** — Renal Corpuscle work as ultra-filters. The blood while passing through glomerular cappillaries is filtered under

pressure & filtrate is collected in the cavity of Bowman's capsule.

2) Renal Tubule

- It has 3 parts :- Proximal Convoluted Tubule (PCT), U-Shaped Henle's Loop and Distal Convoluted Tubule (DCT).

The Distal Convoluted Tubule opens into the collecting tubule which finally opens into pelvis part of ureter. All parts of renal tubule are covered with a network of peritubular capillaries.

→ Functions of Kidney

The Kidneys in human body excrete nitrogenous wastes (urea), forms urine & remove excess of water & salts.

Hemodialysis

- Kidneys are vital organs for survival. Several factors like infection, injury or restricted blood flow to kidneys reduce the activity of kidney.

- An artificial kidney is a device to remove nitrogenous waste products from the blood

through dialysis

- Artificial Kidneys contain a no. of tubes with a semi-permeable lining, suspended in a tank filled with dialysing fluid.

- The patient blood is passed through these tubes. During this passage, the waste products from the blood pass into dialysing fluid by diffusion. The purified blood ~~pass into~~ pumped back into the patient.

- Normally, in a healthy adult, the initial filtrate in the Kidneys is about 180 L Daily.