

## Chapter - Life Processes (5)

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### Introduction :-

All the plants and animals includings human beings are alive. All living organisms have some common characteristics which make them different from non-living things.

### Characteristics of living Organisms :-

- They can move by themselves.
- They can grow. (Increase in the number of cells)
- They respire.
- They can respond to the changes around them.
- They need food, water and air.
- They can reproduce.
- They excrete.

### Nutrition :-

- It is defined as a process by which living beings obtained nutrients or synthesise them and change them into simple form by a series of bio-chemical reactions.
- There are 2 types of nutrition :-
  - ① Autotrophic Nutrition
  - ② Heterotrophic Nutrition

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## Autotrophic Nutrition:-

- In this green plants take in substances such as carbon dioxide, water from outside and convert them into carbohydrates in the presence of sunlight and chlorophyll by the process called photosynthesis.
- The carbohydrates produced are utilised for providing energy to the plant.
- The carbohydrates which are not used immediately are stored in the form of starch in the plants.
- Photosynthesis takes place in the leaf of a plant.
- Within a leaves photosynthesis occurs particularly in specialised cells called mesophyll cells which contains chloroplast.
- The overall equation of photosynthesis is
 
$$6CO_2 + 12 H_2O \xrightarrow[\text{chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6 H_2O + 6O_2$$

(glucose)
- The steps involved in photosynthesis are:-
- Absorption of sunlight by the chlorophyll.

- Conversion of light energy into chemical energy and splitting of water into Hydrogen and Oxygen molecule.
- Reduction of carbon dioxide to form carbohydrates by using chemical energy.
- These steps need not takes place one after the other immediately. For ex - Desert plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorb by the chlorophyll during the day time.
- Chlorophyll is present in the chloroplast. These are green colour plastid. Inside the chloroplast the centre is filled with a liquid called stroma. A number of organised flattened membranous sacs called the thylacoids are present in the stroma. Thylacoids are arranged in stacks like the piles of the coin called grana.
- Chlorophyll pigments are present in the thylacoid unit.
- Photosynthesis has 2 phases :-  
 1) Light Phase  
 2) Dark Phase

### Heterotrophic Nutrition:-

→ In Heterotrophic nutrition animals can't prepare their food by themselves and are directly or indirectly dependent on autotrophs for their food. These organisms are called as the heterotrophs.

→ Heterotrophic Nutrition are 3 types:-

- i) Saprophytic
- ii) Parasitic
- iii) Holozoic

#### i) Saprophytic Nutrition:-

In this mode of nutrition organisms release some enzyme to digest the dead organic food and obtained nutrition from the dead and decaying matter. These organisms are called saprophytes. For ex:- mushroom, bread moulds, yeast and many bacteria.

#### ii) Parasitic Nutrition:-

Some organisms leave outside or inside the body of other organisms (host) and derive their nutrition from the host (donor) body without killing it. These type of nutrition is called as parasitic Nutrition and the organisms are called

as parasites. For ex- Plasmodium (malaria parasite), Ascaris (round worm) are human parasite, cuscuta is a plant parasite.

#### iii) Holozoic Nutrition:-

It is defined as the feeding of complex organic matter by ingestion.

Depending on food habits these animals are classified into 3 types :-

- Herivores
- carnivores
- omnivores

#### Herivores :-

These are the animals that feed on the plants and plants product.

#### Carnivores :-

These are the animals that feed on the flesh of the other animals.

### Omnivores :-

These are the animals that feed on both plants and animals.

### Nutrition in the Amoeba and Paramecium :-

In Amoeba food is taken in using temporary finger like extention (Pseudopodia) → (Pseudo - False, Podia - Finger) of the cell's surface which fuse over the food particle to form a food vacule. Inside the food vacule the complex food is digested into the cytoplasm and the remaining undigested food is thrown out by cell surface.

In paramecium the cell has a definite shape and food is taken in at a specific spot. food is moved to the spot by the movement of cilia of the cell surface.

### Nutrition in human beings :-

→ The human digestive system consist of a tract and digestive glands.

→ The digestive tract or alimentary canal extends from mouth to anus.

→ The process of nutrition involves 5 steps :-

- Ingestion
- Digestion
- Absorption
- Assimilation
- Egestion

→ The food passes through the different structures of the tract to convert the complex substance into simpler ones.

Mouth → oesophagus → stomach → small intestine  
Large intestine ←

→ There are 3 digestive gland associated with alimentary canal :-  
 - Salivary gland  
 - Pancreas  
 - Liver

### Mouth :-

→ It is a transverse aperture bounded by movable lips. It helps in taking the food into the mouth cavity.

8. In the mouth the carbohydrate part of the food is partially digested by the salivary amylase. It is secreted from the salivary gland present in the mouth.

### Mouth cavity (vocal) cavity (Buccal cavity) :-

→ Here 3 pairs of salivary glands are present and on the floor of the cavity a muscular tongue is present. The cavity is supported by upper jaw and lower jaw.

### Teeth :-

→ In humans there are 4 kinds of teeth :-

- Incisors
- Canines
- Premolars
- Molars

→ These are very hard structure developed for efficient mastication.

→ An adult human has normally 32 teeth. The teeth are different in shape, structure, number and function.

- '4' Incisors for biting
- '2' Canines for tearing
- '4' Premolars for grinding & chewing
- '6' Molars for grinding, crushing and mastication.

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The number of teeth mentioned above is only for single jaw.

### Tongue :-

→ It is a muscular sensory organ and bears taste buds.

→ Buccal cavity opens into pharynx which is the common passage for both food and air.

→ The food pipe continues as the oesophagus and the air passage continues as larynx and trachea (wind pipe).

### Oesophagus :-

→ It is a long tubular and muscular structure which moves the food from pharynx to the stomach.

→ It exhibits peristaltic movement (contraction and expansion movement of walls so that the partially digested food is pushed forward).

→ It does not produce any digestive enzyme hence

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no digestion occurs here.

### Stomach:-

> It is a wide 'J' shaped muscular bag located left side of the abdomen below the diaphragm.

> The partially digested food reaches into the stomach from the oesophagus.

> In the inner lining of the stomach are embedded a number of gastric glands that secrete gastric juice into the stomach cavity.

> The gastric juice contains HCl, a protein digesting enzyme called pepsin and mucus.

> Here the protein part of the food is digested by the enzyme called pepsin secreted from the gastric gland in the stomach wall.

### Function of HCl:-

> The HCl creates an acidic medium which converts the

inactive pepsin to active pepsin and the action of pepsin for digestion.

> It kills all the germs present in our food.  
Stomach Crest point:-

The opening of the stomach into the intestine has a ring like structure called pyloric sphincter.

### Small Intestine :-

> The small intestine is the longest part of the alimentary canal. It is about 6.5 to 7.5 m long and 2.5 cm wide.

> It is comparatively longer in herbivores and short in carnivores.

> It is a narrow and highly coiled tube having 3 parts :- - Duodenum

- Jejunum  
- Ileum

### Duodenum:-

→ It is the initial part of the small intestine into which the bile and the pancreatic ducts open. Duodenum means 12 finger width in length.

### Jejunum:-

→ It is the part next to the Duodenum which is about 2m in length. Jejunum means empty because it's nearly always empty after the death.

### Ileum:-

→ It is the longest part of the small intestine which is about 4m in length. Ileum means twisted.

### Large Intestine:-

→ The pancreas secrete pancreatic juice which contains 3 types of enzyme, amylase for digesting carbohydrates, trypsin for protein and lipase for fats.

→ Intestinal juice is secreted from the wall of the small intestine which finally convert the proteins to amino acids, complex carbohydrates into glucose and fats into fatty acids and glycerol.

→ Internally the inner lining of the small intestine is provided with small finger like projections called villi which increases the surface area for absorption.

### Large Intestine:-

→ It is wider than small intestine.

→ It is about 1.5 to 1.8 m long and lies outside the small intestine.

### Large Intestine:-

→ After the digestion in the stomach, the food enters the small intestine where it receives the secretion of liver and pancreas for further digestion.

> The unabsoed food is sent here for the further absorption.

> The external opening of the large intestine is anus, which is kept close by a ring of muscles called sphincter. It opens only during defecation.

### Caecum :-

> It is a small pouch situated at the junction of the small intestine and large intestine.

### Colon:-

> It is much broader than ileum and is little more than a metre long.

### Rectum:-

> It is the last part which is about 15 cm long opens at the anus.

### Function of large Intestine:-

> It secretes no enzyme.

> It only absorbs much water but very little digested food.

> It helps in the defaecation.

> The faeces are normally composed of nearly 75% water and 25% solid matter.

> The bad odour of the faeces is due to the bacterial action on it.

> The composition of the faeces varies from person to person as well as according to the kind of food consumed.

### Note:-

> From the end of caecum projects a narrow curved shaped tube called vermiform Appendix.

> When it is inflamed it causes appendicitis. And today it is a function less organ.

### Salivary gland:-

> There are 3 pairs of salivary glands :-

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- Parotid gland (cheek)
- Submandibular gland (lower jaw)
- Sublingual gland (Below the tongue)

→ Saliva contain an enzyme called salivary amylase (ptyalin) which act on the starch.

### Pancreas:-

→ This gland is situated between stomach and duodenum which secrete pancreatic juice that contains 3 enzymes - Amylase, trypsin and lipase which acts on the starch, proteins and fats respectively.

→ It also secretes hormones like insulin and glycogen that regulates the glucose metabolism in the body.

### Liver:-

→ It is the largest gland of the body having 2 lobes left and right lobes.

→ It secretes bile juice which is stored temporarily in gall bladder.

→ It contains no enzyme but contains bile salts that helps in the emulsification of fats.

### Gastric Gland:-

→ These are present in the wall of the stomach and secrete gastric juice.

### Intestinal Gland:-

→ These are present in the wall of the small intestine and secrete intestinal juice.

### Note:-

The gastric juice contains dilute HCl and mucus & enzymes called Renin and Pepsin.

Renin helps into the conversion of milk to curd.

HCl kills the bacteria swallowed with the food and makes the medium acidic for activation of pepsin.

Pepsin gets activated in the acidic medium so acts upon the proteins.

### Defecation :-

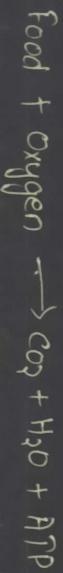
→ The process of elimination of undigested food from the body to (out) outside is called Defecation.

### Respiration :-

→ The food material taken in during the process of nutrition is used in the cells to provide energy for various processes.

→ The process of releasing energy from the food is called respiration.

→ The word respiration is derived from the Latin word respiro which means breathe. The process of respiration can be summarized as follows:-



### Types of Respiration :-

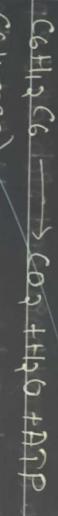
→ It can occur in the presence or absence of oxygen. On this basis respiration is of 2 types:-

- Aerobic
- Anaerobic

### Aerobic Respiration :-

→ During aerobic respiration glucose is completely broken down into carbon dioxide and water by the process of oxidation and a large amount of energy is produced (38 ATP).

→ The organisms which undergo aerobic respiration are called Aerobes.



### Anaerobic Respiration :-

→ During this respiration incomplete oxidation of food takes place and much less amount of energy is produced (2 ATP).

→ Organisms which undergo anaerobic respiration are called Anaerobes.

→ This process occurs in certain bacteria, yeast & in our muscles. During this process ethyl alcohol and lactic acid is produced as end products by product.



$\rightarrow$  Respiration in leaves occurs during day and night time.

Respiration in plants :-

Respiration in plants occurs by the process of diffusion.  
Rate of respiration in plant is slower than animals.

Roots :-

$\rightarrow$  Oxygen diffuse into the root hair and reach all the parts of the root and CO<sub>2</sub> released from root hair by the process of diffusion.

$\rightarrow$  Here gaseous exchange occurs through tiny opening called lenticels.

Leaves :-

$\rightarrow$  In leaves respiratory organs are present.  
In these animals exchange of gases takes place through body surfaces.

Stems :-

$\rightarrow$  In fact, respiration takes place through skin and also through lungs. Thus, it happens both cutaneous as well as pulmonarily respiration.

$\rightarrow$  Stomata are present in young stems but lenticels are present in the bark of the woody plants.

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> In aquatic animals like fish, prawn, tadpole. Respiration takes place through gills.  
Respiration in Human Beings :-

> It takes place through lungs. This type of respiration is called pulmonary respiration.

> Rate of breathing under normal condition is 15-18 times per minute. But during heavy exercise the rate of breathing many times increase upto 40-25 times per minute.

> Respiration in human beings consists of nostrils, nasal cavity, pharynx, trachea, bronchi, bronchioles and alveoli.

> Nostrils are the nasal openings through which air enters where hairs are present which prevent dust particles entering the system.

> From the nostrils air travels to nasal cavity. If from nasal cavity air enters into pharynx and then into trachea through a slit glottis. The glottis always remains open except during swallowing.

> The pharynx opens into larynx which then opens into trachea. The trachea extends downwards through the neck and divides it into two major bronchi. One bronchi enters the right lung and other to the left lung.

> Trachea has collagenous rings to prevent it from collapsing. Each individual has a pair of lungs which are in the thorax cavity. This cavity is separated from abdominal cavity by a muscular partition called diaphragm.

> The bronchi is further divided into small bronchioles. Each bronchiole enters into group like structure called alveoli which is surrounded by intimate contact of blood.

> The pathway of air into lungs :-

External nostrils → Nasal cavity → Pharynx

→ Bronchi ← Trachea ← Larynx ← Glottis ←

→ Bronchioles → Alveoli

Breathing :-

Breathing In :-

When we breathing in air from outside into the alveoli of the lungs. this is called breathing in or Inhalation or Inspiration.

Breathing Out :-

When we breathe out air from the lungs is called breathing out or exhalation or expiration.

Exchange of gases between alveoli & blood :-

- In human beings the respiratory pigment haemoglobin which has high affinity for oxygen is present in the RBC.
- Carbon dioxide is more soluble in water than oxygen and hence mostly transported in the dissolved in our blood.
- In the tissue the exchange of the gases occurs between the oxygenated blood and tissue cell.

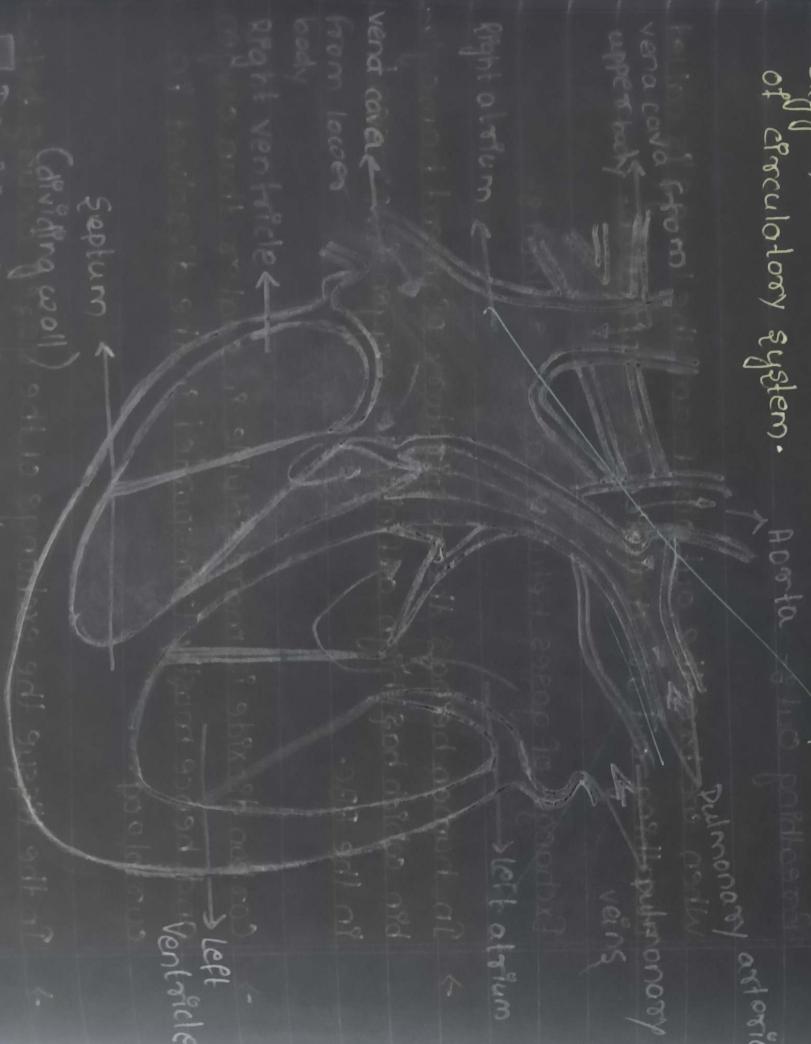
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→ The oxygen moves from the blood to tissue by diffusion and the carbon dioxide goes from tissue to the blood. This process is called internal respiration.

### Transportation in Human Beings

→ In human beings the transport of the materials such as oxygen, carbon dioxide, food and waste products is a function of circulatory system.



Deoxygenated Blood

Oxygenated Blood

Blood

- Bicuspid valves  $\Rightarrow$  Two flaps (wing-like structure)
- Tricuspid valves  $\Rightarrow$  Three flaps

These valves provide one way passage and prevent the back flow of the blood.

### Blood :-

~~It has two types of blood vessels & which transports oxygen & carbon dioxide.~~

$\Rightarrow$  It is a connective tissue and is the liquid medium through which transportation of body materials is carried out.

$\Rightarrow$  It is red in colour because it contains a red pigment called Haemoglobin.

$\Rightarrow$  It contains 3 different kinds of cells:- WBC

~~Red blood cells & white blood cells~~

$\Rightarrow$  RBC

$\Rightarrow$  WBC

### Note:-

$\Rightarrow$  Mainly blood has 2 parts :- Required part (Plasma)

$\Rightarrow$  Solid part (Blood cells)

$\Rightarrow$  Blood cells are manufactured in the bone marrow.

### Plasma :-

$\Rightarrow$  It is the liquid part of the blood which contains 90-92% water.

$\Rightarrow$  It also contains several salts, glucose, proteins, fats, amino acids, enzymes, hormones, antibodies, etc.

### Blood cells :-

$\Rightarrow$  There are 3 types of blood cells :-

- RBC (Erythrocytes)

- WBC (Leucocytes)

- Platelets (Thrombocytes)

### Function of Blood :-

$\Rightarrow$  Transportation of CO<sub>2</sub> from tissue to lungs.

$\Rightarrow$  Transportation of O<sub>2</sub> from lungs to tissue.

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→ Transportation of excretory materials from tissue to the kidney.

→ Transposition of the digested food from the small intestine to the tissue.

→ Formation of the clot to prevent blood loss.

Blood vessels:-

These are 3 types of blood vessels:-

- Arteries
- Veins
- Capillaries

Arteries:-

→ These are the blood vessels which carry oxygenated blood from heart to various parts of the body.

→ All arteries except pulmonary artery carry oxygenated blood.

→ They have thick elastic muscular walls.

→ Blood flows in arteries under high pressure and without valves.

→ Largest Artery - Aorta

Vessels:-

→ These are the blood vessels that carry blood from various parts of the body to heart.

→ All veins except pulmonary vein carry deoxygenated blood.

→ They have thin less elastic muscular walls.

→ The veins are provided with valves.

→ Largest vein - Vena cava

Capillaries:-

→ These are the fine microscopic vessels.

→ Arteries branch out into smaller and smaller arterioles which finally form the capillaries.

These capillaries join to form venules, veins and finally Vena cava.

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## Cardiac cycle :-

- One complete contraction (Systole) and relaxation (Diastole) of the heart is called a heart beat.
- The sequence of these events takes place during the completion of one heartbeat is called the cardiac cycle.
- The blood circulation in human heart is double circulation (Systemic and pulmonary).
- Pulmonary circulation involves the circulation of the blood from the heart to the lungs.
- The systemic circulation involves circulation of the blood to the different body parts.
- Double circulation is made possible because the human heart is divided into two halves in which one half pumps deoxygenated blood to the lungs and the other half pump the oxygenated blood to the rest of the body.
- The double circulation in human is very necessary to prevent the mixing of deoxygenated blood with the oxygenated blood.
- Fishes on the other hand have only two chambers where the

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blood is pumped to the gills for oxygenation and passes directly to the rest of the body. Here the circulation is single circulation.

→ The amphibians have 3 chambered heart & teleost fishes mixing up oxygenated and deoxygenated blood. exception - Crocodile has 4 chambered heart. All the amphibians and seeples have 3-chambered heart.

## Blood Pressure:-

→ The pressure at which blood is pumped around the body by the heart is called Blood pressure.

→ The blood pressure of a person is always expressed in the form of 2 values called systolic pressure and diastolic pressure.

→ The maximum pressure at which the blood leaves the heart through the aorta during contraction phase is called systolic pressure.

→ The minimum pressure in the arteries during the relaxation phase of heart is called the diastolic pressure.

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-> The normal B.P. is  $\frac{120}{80}$  mmHg.

-> B.P. is generally measured by an instrument called sphygmomanometer.

### Lymph :-

-> It part from the blood vessels and capillaries there are another type of vessels called lymph vessels.

-> The light yellow fluid in the lymph vessel is called lymph.

-> It also helps in the transportation at the lymph nodes, antibodies, and new white cells are produced.

### Pace Makers :-

In some heart patient, the heart doesn't beat normally. In such patient a machine called pacemaker is inserted in the patient's heart so that heart beat is normally.

The functioning of the heart can be graphically recorded by an instrument called electrocardiograph. The graphic recording is called an electrocardiogram (ECG).

## Transportation in Plants

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-> Plant transport system moves energy stored from the leaves and raw material from the root to independent organises conducting pathways:- -xylem - phloem

-> The water and minerals absorbed by the roots are transported through xylem while food prepared by the leaves is transported through phloem.

### Transportation of Water and Minerals :-

-> The transportation of water and minerals in upward direction is called transpiration.

-> The instrument used to measure the transpiration is called porometer.

-> Minerals and water needed by the plants are absorbed by root hairs from the soil by the process called osmosis (water) and diffusion (minerals).

-> A lot of water evaporates through stomata present on the surface of the leaf which is also called transpiration.

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### Transportation of food and other substance :-

→ The transportation of soluble products of photosynthesis to different parts of the plant is called translocation.

→ It is carried out by the phloem tissue.

→ Besides the products of photosynthesis, the phloem also transports amino acids and other substances.

→ The transportation of the food and other substances takes place in both upward and downward direction hence it is called bidirectional conduction.

→ The phloem moves the materials according to the plant's need. e.g. In the spring, sugar stored in the root or stem is used to transport to buds which need energy to grow.

### Excretion in Human Beings

→ Excretory system in human consists of a pair of kidneys, a pair of ureters, a urinary bladder and a urethra.

→ Urine formed in the kidney passes by a pair of ureters to the bladder where it is stored until it is released through urethra.

→ Each kidney has large numbers of filtration units called nephrons.

- The nephron has a cup-shaped structure at its upper end called Bowman's capsule.

- The Bowman's capsule contains blood capillaries which is called glomerulus.

- One end of the glomerulus is attached to the renal artery which brings the dirty blood into it.

→ The biological process involved in the removal of harmful metabolic waste from the body is called excretion.

- The other end of the glomerulus comes out of the Bowman's capsule as a blood capillary and finally joins a renal vein.

## Working of the Nephron:-

→ The main function of Nephron is to form urine. There are 3 main processes involved in the urine formation:-

- Glomerular Ultra filtration
- Tubular absorption
- Tubular secretion

### Glomerular Ultra filtration:-

→ It is the filtration of body fluids and solutes from the blood into the Bowman's capsule out of the glomerulus.

→ All the substances from the blood are filtered except the large protein molecules. This fluid is called a Glomerular filtrate.

→ It consists of water, urea, salts, glucose and other plasma solutes.

### Tubular Reabsorption:-

→ Glomerular filtrate contains a lot of useful materials like glucose, salts, water etc. These substances are reabsorbed by the blood capillaries surrounding the nephron at various levels.

### Tubular Secretion:-

→ This occurs mainly in the collecting duct of the nephron. In this process substances like potassium, hydrogen, creatinine and certain drugs like phenylparacetamol, etc are directly excreted by the tubular cells from the blood.

→ The fluid which flows through the collecting duct is called urine that consists of water, urea, uric acid, mineral ions etc.

### Functions of the kidney:-

→ Helps to remove toxic materials like urea from the blood.

→ It controls water balance and level of mineral salts in the body.

### Note:-

The process of control of water content and concentration of ions in the body is called osmoregulation.

Dialysis or Dialysis is a disease of kidney which is caused by the improper functioning of the kidneys which lead to accumulation of wastes in the body tissue.

### Dialysis -

The condition when a person's kidney stops working is called kidney failure or renal failure.

If a kidney transplant isn't possible due to some reasons then the patient is treated periodically on a kidney machine by a <sup>dry</sup> procedure called Dialysis. (Hemodialysis)



- Excretion in the plants:-
- Excretion of the waste products is very simple and much less in plants as compared to animals.
- Excess food materials in many cases is stored in the roots, stems, leaves & seed.
- The various methods of excretion are given below:-
- Waste products of photosynthesis and respiration - O<sub>2</sub>, CO<sub>2</sub>, water, heat are released into the atmosphere through stomata in the leaves and lenticels in the stem.
- Excess H<sub>2</sub>O is lost by the process of transpiration.
- Ammonia is formed as a breakdown product of protein.
- Some of the waste products of metabolism collect in the leaves and bark of the trees. So plants shed their leaves and bark to get rid of the waste.
- Some waste materials keep accumulating within the cells. Calcium, oxalates crystals called Raphides are such waste.