TRANSPORTATION

Need for transportation - Organisms need to transport various substances such as food, oxygen and waste materials throughout their body. For this they require a proper transport system. Transport in living organisms follows two basic principles - diffusion and osmosis. Transportation in plants: Plants need to transport two things –

(a) Raw materials like water, carbon-di-oxide and minerals which are required for manufacturing food and building plant body.
(b) The manufactured food from leaves to all parts of the body. Plant transport system moves energy stored from leaves and raw materials from roots.

Two pathways of conducting tubes:

(i) Xylem - which moves water, minerals obtained from the soil; and
(ii) Phloem - which transports products of photosynthesis from the leaves where they are synthesized to other parts of the plant.

Transport of water and minerals through xylem tissue: Xylem tissue consists of:
(a) Xylem tracheids
(b) Xylem vessels
(c) Xylem parenchyma
(d) Xylem fibers

Tracheids and vessels of roots, stems and leaves are interconnected to form a continuous system of water conducting channels reaching all parts of the plant. The cells of the roots in contact with the soil actively take up ions which creates a difference in the ion concentration between the root and the soil. Thus, there is steady movement of water into root xylem from the soil, creating a column of water which is pushed upwards.
Evaporation of the water molecules from the cells of a leaf creates a suction which pulls wafer from the xylem cells of the roots. Transpiration is the loss of water in the form of water vapours from the aerial parts of the plant. Transpiration helps in the absorption and upward movement of water and minerals dissolved in it from roots to leaves, it becomes the major driving force in the movement of water in the xylem during the day when the stomata are open. Fig. 6.12 pg. 109.

Importance of transpiration:
(a) It helps in the absorption of water and minerals
(b) It helps in the upward movement of water and minerals
(c) It helps to remove excess water from the plant body
(d) It helps to regulate the temperature of the plant as evaporation causes cooling effect.

Transport of food through the phloem:
Phloem tissue consists of
(a) Sieve tubes
(b) Companion cells
(c) Phloem parenchyma
(d) Phloem fibers.

Sugar and other metabolites synthesized in the leaves in the leaves and hormones synthesized at the tips of roots and stems are transported to other parts of the plant through the phloem. Phloem also transports amino acids. These substances are delivered to the storage organs of

roots, fruits and seeds and to the growing organs. This is known as translocation. This occurs in the sieve tubes with the help of adjacent companion cells both in upward and downward directions.
Unlike transport in xylem which is explained y simple physical forces, the translocation in phloem is achieved by utilizing energy. Sucrose is transferred into phloem tissue using energy from ATP. This increases the osmotic pressure of the tissue causing water to move into it. This pressure moves the material in the phloem to tissues which have less pressure. This allows the phloem to move material according to the plant's needs. For example, in the spring, starch, oil and sugar stored in the root or stem tissue is converted into soluble sugar and is transported to the buds which need energy to grow.
Since plants are stationary and they have many dead cells in their body, hence their energy needs are lesser than animals and therefore their transport system is relatively slow. However, the distances over which transport systems have to operate is v. large in plants such as v. large trees.

TRANSPORTATION IN HUMAN BEINGS:
In humans, transportation of oxygen, nutrients, hormones, and other substances to the tissues, carbon-di-oxide to the lungs and waste products to the kidneys is carried out by a well defined circulatory system.
Human transport system has two parts-Blood circulatory system and Lymphatic system Blood circulatory system consists of blood, blood vessels and heart. Blood - It is a fluid connective tissue, consisting of blood cells and blood plasma. It is pumped throughout the body by the heart. There are three types of blood cells –

(a) Red blood cells - They are maximum in number, enucleated, biconcave and have red colored iron containing pigment called hemoglobin. They help in the transport of mainly oxygen and little amount of carbon-di -oxide.

(b) White blood cells - nucleated, irregular shaped cells, lack haemoglobin. Function: (i) They engulf any foreign particles that enter the body thus providing protection against infections.
(ii) They produce antibodies and provide immunity to the body.

(c) Platelets - Cell fragments, enucleated.
Function: They bring about blood clotting.
All the three types of blood cells are produced in the bone marrow. Blood Plasma - It is the fluid part of the blood. It consists of mainly water with dissolved chemicals like proteins, salts, nutrients, hormones and waste substances. The blood cells are present in the plasma.

Serum - It is blood plasma from which fibrinogen protein has been removed. Functions of blood - - Blood helps to perform the following functions:
(a) It transports oxygen with the help of RBC's.
(b) Blood plasma transports carbon-di- oxide, nutrients, excretory products, hormones etc.

(c) Blood helps to regulate body temperature as it carries the heat produced from one place to another place in the body.
(d) clotting of blood - Blood forms a clot at the site of injury, thus preventing further loss of blood and rapid healing of wounds.

BLOOD VESSELS: There are three types of blood vessels
(a) Arteries
(b) Veins
(c) Capillaries

ARTERIES
Those blood vessels which carry blood away from the heart.
All arteries except the pulmonary arteries carry oxygenated blood.
They are deep seated.
They are wider with thicker walls
They are more elastic.
They lack valves. e.g. Dorsal Aorta.

VEINS
Those blood vessels which carry blood towards the heart.
All veins except the pulmonary Veins carry de-oxygenated blood
They are superficial.
They are narrower with thinner Walls.
Less elastic.
They have valves, e.g. Pre-caval vein.

CAPILLARIES: Each artery divides into smaller vessels upon reaching an organ or tissue and brings the blood in contact with all the cells. These smallest vessels having one cell thick walls are called capillaries. Their walls are permeable, so that water and dissolved substances pass in and out, exchanging oxygen, carbon-dioxide, dissolved nutrients and excretory products with the tissues.

HEART: It is a muscular organ made up of cardiac muscles. It lies in the thoracic cavity of the body. It is conical in shape, lying in the center with its tip tilted slightly to the left. It is protected by the rib cage and the protective membranes.
Human heart is four chambered and a longitudinal septum separates the right half from the left half. The right side has only de-oxygenated blood whereas the left side has only oxygenated blood. There is no mixing of the two types of blood. The upper two chambers are the left and right atria and the lower two chambers are the left and right ventricles. The horizontal septum which separates the atria from the ventricles is not complete and the openings are guarded by valves. These valves regulate the flow of blood from the atria to the respective ventricles. The walls of the ventricles is thicker than the walls of the atria, and the wall of the left ventricle is the thickest because from here the blood is pumped to all the body parts, therefore more pressure is required. Fig.6.10 pg 106.

Blood vessels entering and leaving the heart:
Veins: Two major veins called the superior and inferior vena cavae or pre and post caval veins bring de-oxygenated blood from the upper and lower parts of the body respectively into the right atrium of the heart.
Four pulmonary veins bring oxygenated blood from the lungs into the left atrium of the heart.
Arteries: Pulmonary artery carries de-oxygenated blood from the right atrium of the heart to the lungs for oxygenation. A major artery called the dorsal aorta (largest artery) carries oxygenated blood from the heart to all the body parts. Working of the heart and blood circulation:

The heart contracts and relaxes rhythmically. When the atria contracts the ventricles relax and vice-versa. Initially, all the chambers of the heart are relaxed. At this stage, the pre-caval and the post-caval veins bring deoxygenated blood into the right atrium of the heart. Simultaneously, the pulmonary veins pour oxygenated blood from the lungs into the heart. Hence both the atria are filled with blood.
Both the atria contract together and the valves between the atria and the ventricles open. De-oxygenated blood from the right atrium and oxygenated blood from the left atrium pour into the respective ventricles. As a result both the ventricles are filled with blood.
Now, both the ventricles contract. De-oxygenated blood from the right ventricle is taken to the lungs by the pulmonary artery and oxygenated blood from the left ventricle is taken to all the body parts by the dorsal aorta. Since the blood flows twice through the heart in one cycle this type of circulation is known as double circulation. Fig. 6.11 pg.106

HEART OF DIFFERENT VERTEBRATES:
The separation of right side and left side of the heart is useful to keep oxygenated and de-oxygenated blood from mixing. This separation allows a highly efficient supply of oxygen to the body which is useful in animals having high energy needs such as birds and mammals. In animals, like reptiles and amphibians, their body temperature changes with the change in the temperature of the environment. They have three-chambered heart and tolerate some mixing of oxygenated and de-oxygenated blood. Fish have only two chambered heart and blood is pumped to gills is oxygenated and passes directly to the rest of the body. Thus, blood goes only once through the heart in fishes during one cycle of passage through the body.

LYMPH: It is a fluid connective tissue involved in transportation. It is colourless as it lacks red blood cells. Through the pores present in the walls of the capillaries, some amount of plasma, proteins and blood cells escape into the inter-cellular spaces in the tissues to form the tissue fluid or lymph. It is also called extra cellular fluid because it is present outside the cells. It is similar to blood plasma except it is colourless, has lesser proteins and more wastes. Lymph drains into lymphatic capillaries from the inter cellular spaces, which join to lymph vessels that finally open into larger veins that take blood to the heart. Lymph carries digested and absorbed fat from intestine and drains excess fluid from extra ceilular space back into the blood. It also protects the body by killing the pathogens with the help of lymph ceiis in the lymph nodes

EXCRETION

it is the process by which organisms get rid of nitrogenous metabolic wastes from their body
It is important because if these wastes accumulate, they become toxic and result in the death of the individual.
Unicellular organisms can easily get rid of these wastes by diffusing them into the surrounding medium. E.g. Amoeba.

Multicellular organisms require a proper excretory system to get rid of their wastes.

EXCRETORY **SYSTEM IN HUMAN BEINGS**

It consists of (1) One pair of kidneys
(2) One pair of Ureters
(3) Urinary bladder
(4) Urethra

1. Kidneys
These are the main organs of excretion. Each kidney is bean shaped and lies in the abdominal cavity, one on either side of the vertebral column. They are reddish brown in colour.The left kidney is placed slightly higher than the right kidney. Internally each - kidney is made up of more than one million small units called nephrons or uriniferous tubules. These are the structural and functional units of the kidneys.

2. Ureters
These arise from the inner side of each kidney is a long narrow muscular tube. Each Ureters opens by separate openings into the urinary bladder. Function of the Ureters is to allow passage of urine from the kidneys into the urinary bladder.

3. Urinary bladder
It is an elastic bag like structure meant for temporarily storing the urine. Urine is stored in the bladder until the pressure of expanded bladder leads to urge to pass it
Out.

4. Urethra
It arises from the bladder as a short muscular tube like structure. It opens to the outside to discharge the urine by a urethral opening. .

Blood supply to the kidneys
A branch of the dorsal aorta called renal artery supplies oxygenated blood, but containing waste substances to each kidney. Renal veins bring de- oxygenated blood but free of the nitrogenous wastes from each kidney and join the inferior vena cava.

Function of kidneys:
(1) Kidneys maintain ionic concentration and water balance in the body. 2 They filter the blood making it free of nitrogenous wastes and extra water.

STRUCTURE OF NEPHRON AND URINE FORMATION:
Each nephron consists of a cup like structure called the Bowman's capsule and a highly convoluted tubule. The renal artery sends a branch into each Bowman's capsule where it capillaries. This network of capillaries is known as glomerulus. The branch which leaves the capsule is narrower and it forms a network of capillaries around the body of the tubule. Blood in

the glomerulus is under pressure; therefore filtration takes place under pressure in the Bowman's capsule. This is known as ultra

Filtration. As a result many useful substances like amino acids, glucose, and water also gets filtered into the tubule. These useful substances are then selectively reabsorbed by the blood of the capillary network around the tubule. Whatever is left in the tubule are the nitrogenous waste substances in water. This forms the urine. Urine formed in each nephrons passes into the Ureters and is temporarily stored in the bladder from where it is let out through the urethral opening Figure 6.14 page 111 of text book

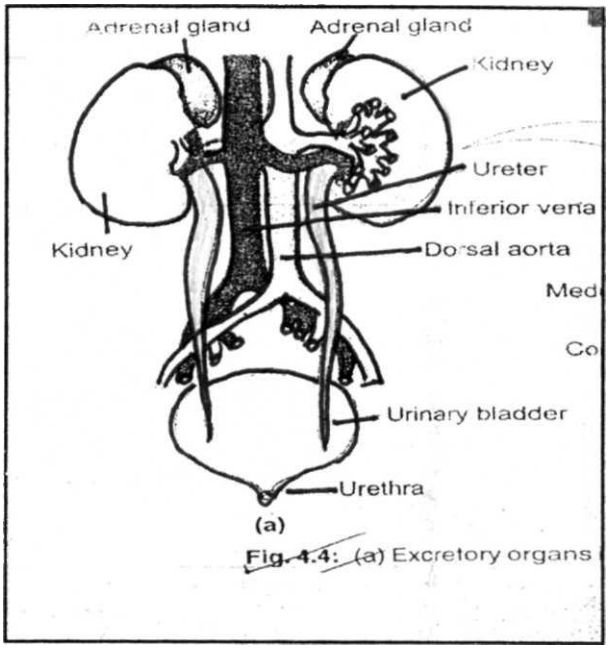

Fig. 4.4: (a) Excretory organs

In case of kidney damage due to any infection, injury or effect of medicine an artificial kidney is used. An artificial kidney is a device to remove waste products by the process called dialysis,

EXCRETION IN PLANTS

Plants have different methods to excrete. These include-

1) Oxygen and Carbon dioxide are given out through stomata in the leaves.
2) Excess of water is given out during transpiration
3) Some wastes are stored in the vacuoles.
4) Waste products are stored in leaves which fall off
5) Some wastes are stored as resins and gums in old xylem tissue.
6) Some wastes are given out in to the soil by roots.