TRANSPORTATION

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TRANSPORTATION

It is the movement of materials from one part to another, usually from the region of their availability to the region of their use storage or elimination.

FUNCTION OF TRANSPORTATION

- **Food :** It is available at particular points, e.g. leaves in plants, alimentary canal in animals. Food has to be transported to every living cell of the body for extraction of energy and materials.
- **Metabolic Gases :** Oxygen and carbon dioxide are two metabolic gases. Oxygen is required by every living cell for cellular respiration. It has to be transported from outside environment first to the respiratory surfaces and then to individual cells in animals or directly to cells in plants. Carbon dioxide is formed as a by-product. It is passed out for elimination.
- **Waste Products :** Toxic waste products are produced during metabolism. They have to be excreted. For this they are first taken to kidneys for separation, translocated to urinary bladder for storage and from urinary bladder to the region of elimination.
- **Water :** Plants absorb water from soil with the help of their roots. It is transported to all parts.
- **Hormones :** They are formed in particular regions from where they are transported to the areas of their functioning.

TRANSPORTATION IN HUMAN BEING

- In humans, transportation of oxygen nutrients, hormone and other substances to tissue, CO_2 to the lungs and waste products to the kidneys is carried out by a well-defined **Circulatory System.** In lower organisms material is transported by diffusion.

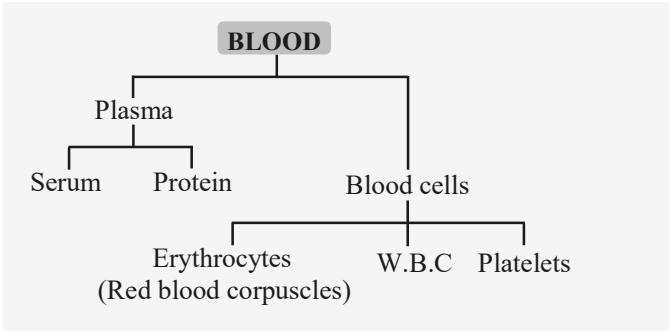
◈ **Circulatory System :**

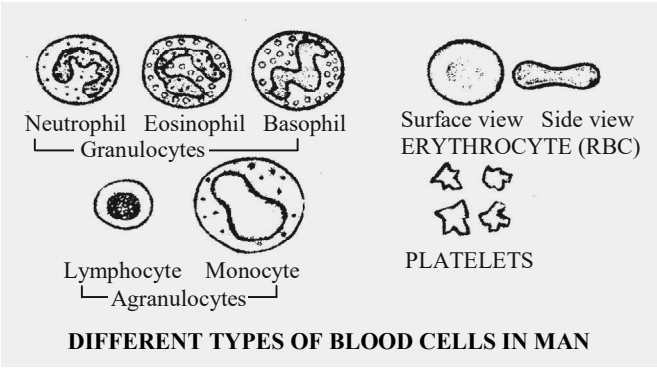
It comprises of the heart, blood vessels, blood, lymphatic vessels, lymph, which together serve to transport materials, throughout the body.

Components of the circulatory system in higher animals are -

- Blood
- Pumping organ- 'Heart'

- System of blood vessels for distribution and collection of blood - consisting of arteries, veins and capillaries.





DIFFERENT TYPES OF BLOOD CELLS IN MAN

◈ **Blood Corpuscles :**

I. Red Blood Corpuscles (RBC) or Erythrocytes :

- These are minute, circular biconcave discs having no nucleus. They look red due to the presence of red coloured pigment, haemoglobin. Red blood cells have life span about 120 days. They are produced in bone marrow number is 4.5 – 5.5 millon/cu.mm.

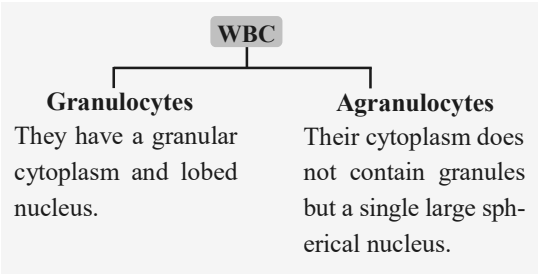
◈ **Function :**

- Haemoglobin transports oxygen from lungs to body tissues.

II. WBC or White Blood Cells or Corpuscles :

- These are large, nucleated colourless cells and are less numerous than erythrocytes. There are about 5000 W.B.C per mili litre of blood.

WBC are mainly of two Type W.B.C.



III. Blood Platelets :

- Platelets are rounded, colourless, biconvex and non-nucleated blood- cells, which help in the coagulation of blood they are called thrombocytes.

➢ KIND OF BLOOD VESSELS

There are **three types** of blood vessels present in human circulatory system.

(A) Arteries :

- Arteries carry blood from heart and supply to organs. These are thick muscular walled and deep seated. All Arteries carry oxygenated blood except pulmonary arteries which carry deoxygenated blood to lungs for purification. They do not have valves.

(B) Veins :

- Veins collect blood from the tissue of the organs and Bring it to the heart through two big veins,

the superior and Inferior vena cava. Veins carry deoxygenated blood except pulmonary veins. Veins are thin walled and placed more superficially. They contain valves.

(C) Capillaries :

- Capillaries are extremely thin-walled and narrow. They are closely placed with the cells of the tissue in an organ. Oxygen and food pass into the cells and carbon-dioxide and other wastes pass into the capillaries from the cells.

◈ Important Terms :

The following terms should be clearly understood before studying blood group.

(A) Antigen :

- A substance capable of stimulating the formation of an antibody is called antigen.
- It is any substance, a bacteria or virus, that the body regards as foreign and it may be formed in or introduced into the body, it is capable of causing some disease in the body and are present in the red blood cells of the donor.

(B) Antibody :

- It is specialised protein produced by certain white blood cells (lymphocytes) in response to entry into the body of a foreign substance. i.e. antigen in order to render it harmless.

➢ BLOOD GROUPS

- Landsteiner discovered four blood groups in human beings based on the mutual compatibility of the antigens and antibodies. They are A, B, AB and O.
- A person having O blood group can give blood to all the groups and hence called **Universal donar.**
- Similarly a person with AB blood group is called **Universal Recipient** as he can receive blood of all other groups.
- Blood group O does not contain any antigen on the surface of R.B.C therefore, no reaction will occur with the blood of the recipient
- The plasma of blood having blood group AB do not have antibodies therefore reaction will not occur with the antigen of the donars blood.
- **Rh factor (Rhesus factor) :** It is a kind of antigen in the blood, which was first found in the **Rhesus monkey**. On the basis of presence or absence of Rh factor human beings can be divided as- Rh positive (Rh^+) and Rh negative (Rh^-).
- They are much important in child birth. If blood of baby (embryo) is Rh^+ and mother is Rh^-. She may lose her baby as antibodies will attack the baby (nowadays, this condition is medically supposed not to be so serious and certain techniques and procedures are available to save the baby).

Blood group	Antigen present in RBC	Antibody present plasma	Can donate to	Can receive from
A	A	b	A and AB	A, O
B	B	a	AB, B	B, O
AB	A, B	None	AB	B, AB, A, O
O	None	a and b	O, A, B, AB	O

◈ Function of Blood :

Blood perform the following functions :

◈ **Transport of Oxygen and Carbondioxide :**

- Blood transports oxygen from the respiratory surface i.e. lungs, buccal cavity to body tissues and carbon dioxide from tissue to respiratory surface.

◈ **Transport of food :**

- Blood transports digested food to different cells of the body.

◈ **Transport of waste products :**

- Blood transports the waste products of cells and organs to the kidneys, lungs, skin and intestine, so that they may be eliminated.

◈ **Chemical coordination :**

- Hormones produced by endocrine glands are distributed to the vital tissues by the blood.

◈ **Defence against infection :**

- When bacteria or any other disease causing pathogen enters the body. It is distroyed by WBCs (one type of WBCs; called lymphocytes produce Antibodies against specific pathogen) and so immunity against the disease is created in the body.

◈ **Clotting of blood :**

- To prevent excess bleeding, blood-platelets and some protein form clot so as to prevent further bleeding.

◈ **Water balance :**

- Blood maintains body temperature constant and distributes and exchanges water between cytoplasm of cells.

◈ **Temperature regulation :**

- Heat produced by deeper tissues is taken to the body surface, so that it may be given out and thus body temperature is maintained.

◈ **Maintainance of body pH :**

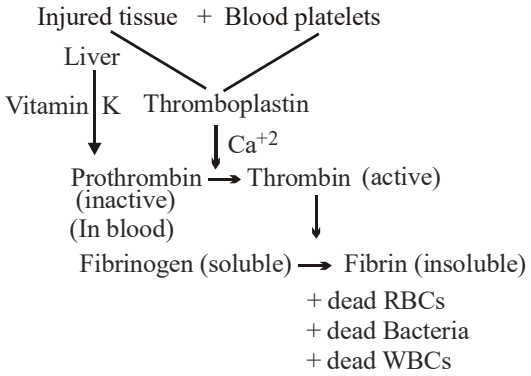
- In RBC, some carbon dioxide combines with water to form carbonic acid (H_2CO_3) that is disossociated into H^+ and HCO_3^-. These ions combines with ions of plasma to maintain a constant pH.

◈ **Maintenance of pressure :**

- Arteries produce a proper pressure of blood that helps to balance the atmospheric pressure.

◈ **Blood Clotting :**

- Sequence of events during clotting of blood :



Flow Chart Showing Clotting of Blood

➢ THE HUMAN HEART

- The heart is a pumping organ that receives blood from veins and pumps it into the arteries it is made up of cardiac muscles. It is situated in thoracic cavity which lies above the diaphragm between the two lungs.
- It is enclosed in a double-walled membranous the pericardium.

◈ **Chamber of The Heart :**

- The interior of the heart is divided into four chambers which receive the circulatory blood .

◈ **The Auricles :**

- The two superior chamber are called the right and left auricles. The auricles are separated by a partition called the **inter-atrial septum**. The

sinuatrial node (SAN) or the pacemaker is located in the upper wall of the Right atrium.

◈ The Ventricles :

- The two interior chambers of heart are the right and left ventricles. They are separated from each other by an **inter-ventricular septum**.

◈ Valves of The Heart :

- Valves are muscular flaps which prevent the blood to flow back through it. Two type of heart valves are distingushed :

◈ The Atrio-Venticular Valves :

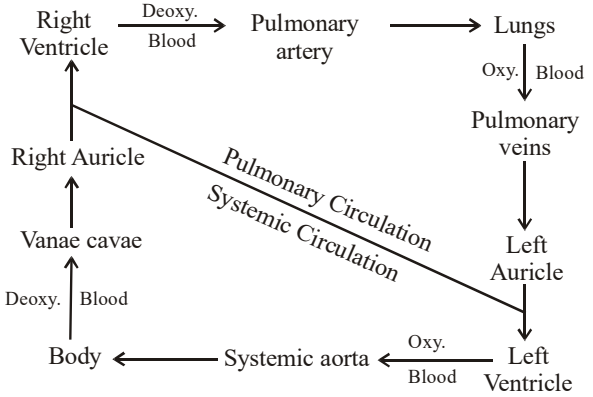
- These valves separated the atria from the ventricles the right side of the heart possesses the **tricuspid valve** and left side of the heart possesses the **bicuspid valve or mitral** valves are needed to avoid backward flow of blood in the chambers of the heat.

◈ Semilunar Valves :

- These are located in the arteries leaving the heart.

◈ Blood Flow Through The Heart :

- The path of blood flow can be shown as under :



➢ DOUBLE CIRCULATION

Double circulation has two components, pulmonary circulation and systemic circulation.

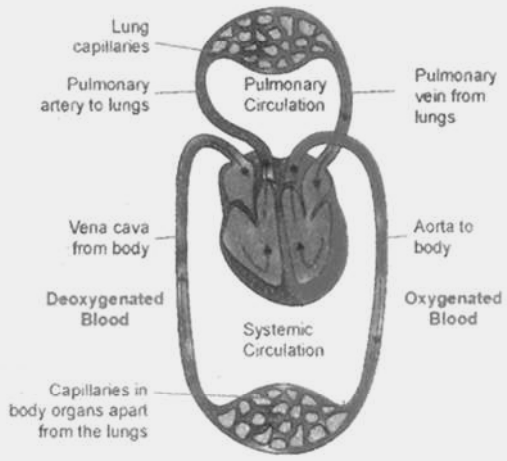


Figure : SHOWING DOUBLE CIRCULATION AND FUNCTION OF BLOOD OF PROVIDE OXYGEN.

◈ Pulmonary Circulation :

- It is movement of blood from heart to the lungs and back. Deoxygenated blood of the body enters the righ auricle, passes into righ ventricle which pumps it into pulmonary arch, With the help of two separate pulmonary arteries the blood passes into the lungs.

◈ Systemic Circulation :

- It is the circulation of blood between heart and different parts of the body except lungs. Oxygenated blood received by left auricle passes into left ventricle. The left ventricle pumps it into aorta for supply to different body parts including walls of the heart with the help of arteries.
- Double circulatin is an improvement over single circulation as the heart pumps both the types of bloods (oxygenated and deoxygenated) forcefully through the body. In amphibians and reptiles, the double circulation is incomplete due to mixing of the blood. It is complete in birds and mammals.

➢ TRANSPORTATION IN PLANTS

Some materials (gases) pass in and out of plants through **diffusion**. Other materials required for building plant body are obtained from soil, e.g. ,

nitrogen, phosphorus, other minerals, water. They have to be transported to long distances depending upon the size of the plant. There are two independent pathways having conducting tubes. One is xylem that moves water and minerals from soil to aerial parts. The other is phloem which carries food from the region of availability (e.g, leaves, storage organs) to the areas of utilsation.

◈ Xylem (Wood) :

- It is a complex tissue which transports sap (water and minerals). Xylem has four types of cells– xylem fibres, xylem parenchyma, tracheids and vessels. Vessels and tracheids are called tracheary elements because they take part in transport of sap. Both the tracheary elements have lignified wall .

◈ Phloem :

- It is complex tissue which takes apart in transport of food. Phloem has four types of cells – sieve tubes, companion cells, phloem parenchyma and phloem fibres. Only phloem fibres are dead cells. Other are living cells.

➢ TRANSPIRATION

Transpiratin is loss of water in vapour form from the exposed parts of a plant. There are three types of transpiration-lenticular, cuticular and stomatal.

Lenticular transpiration is the loss of water in vapour form from lenticels present in the bark by stems. It is only 0.1% of the total. **Cuticular transpiration** is loss of water in vapour form through the cuticular covering of the leaves and other aerial parts. Amount of cuticular transpiration depends upon the thickness.

Stomatal transpiration is loss of water vapours through stomata present over leaves and other soft aerial parts. It will always occur whenever stomata are open for gaseous exchange.

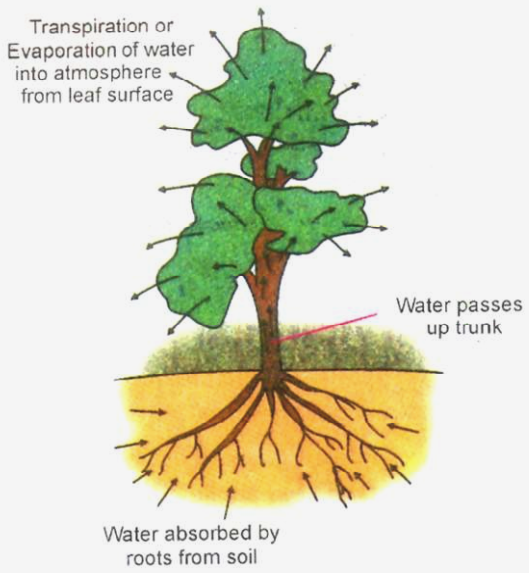


Figure : TRANSPIRATION OR EVAPORATION OF WATER FROM AERIAL SURFACES CAUSING ABSORPTION AND ASCENT OF SAP.