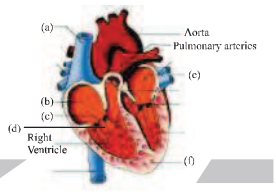


Chapter - 18

Body Fluids and Circulation

Points To Remember

Blood : A special connective tissue that circulates in principal vascular system of man and other vertebrates consisting of fluid matrix, plasma and formed elements.

Plasma : The liquid part of blood or lymph which is straw coloured, viscous fluid and conta (only lymbphocytes) ins about 90-92% of water and 6-8% proteins.

Lymph : A clear yellowish, slightly alkaline, coagulable fluid, containing white blood cells in a liquid resembling blood plasma.

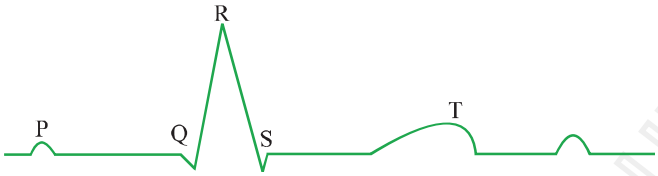
Serum : Blood plasma from which fibrinogen and other clotting factors have been removed.

Heart Beat : The rhythmic contraction and relaxation of the heart, which includes one systole (contraction phase) and one diastole (relaxation phase) of the heart. Heart beat count of healthy person is 72 times per minute.

Cardiac output : The amount of blood pumped by heart per minute is called cardiac or heart output. The value of cardiac output of a normal person is about $72 \times 70 = 5040$ mL or about 5L per minutes.

Electrocardiograph : (ECG) the machine used to record electrocardiogram.

Electrocardiogram ECG : The graphic record of the electric current produced by the excitation of the cardiac muscles. It is composed of a 'P' wave, 'QRS' wave. (complex) and 'T' wave (Refer fig. 18.3, page 286 (for a standard ECG) (NCERT class XI Biology)



Diagrammatic presentation of a standard ECG.

Name and Number/ Percentage	Structure	Life Span and Formation	Function
(A) Erythrocytes RBCs - 4.5 to 5.5 million per cubic millimetre of blood	Red colour Circular, biconcave denucleated, elastic lack of cell organelles like ER, ribosomes, mitochondria etc.	Formed from birth onward by red bone marrow Life-120 days excess RBCs are stored in spleen	Transport of oxygen and some amount of carbon dioxide through haemoglobin
(B) Leucocytes (WBCs) 5000-8000 per cubic mm of blood	Colourless rounded or irregular, nucleated 12 to 20mm wide, life 1-4 days	Formed in red bone marrow, Lymph nodes, spleen and thymus	Acts as soldiers scavenger and some help in healing
(i) Agranulocytes (a) Lymphocytes 20-45% of leucocytes	Large rounded nucleus, 6-10 mm	Lymph nodes, spleen, thymus red bone marrow, life few days to months or even years	Non Phagocytic secrete antibodies
(b) Monocytes 6-8% leucocytes,	Largest of all (12-15 mm) bean shaped nucleus	Red Bone marrow, life 10-20 hours	phagocytic, very motiles engulf germs
(ii) Granulocytes (a) Eosinophils 2-3% of leucocytes	bilobed nucleus, granules in cytoplasm	Red Bone marrow, life 4 to 8 hrs. in blood	play role in immunity non phagocytic
(b) Basophils 0-5% of leucocytes	Three lobed nucleus (s-shaped)	Red Bone marrow, life 4 to 8 hours in blood	release heparin and histamine
(c) Neutrophils 60-65% of leucocytes	Many lobed nucleus fine granules	Red Bone marrow, life 4 to 8 hours in blood	phogocytic, engulf germ and dead cells
(C) Platelets thrombocytes 1,50,000-3,50,000 mm_3 of blood	Colourless, rounded or oval, or irregular non-nucleated fragments	Red Bone marrow worm out ones phagocytized in blood	help in blood clotting

Blood Pressure—The resistance offered by the lumen of the artery to the flow of Blood.

Cardiac Cycle : The rhythmic contraction and dilation of different parts of heart in one beat.

Hypertension : The condition when blood pressure is higher than normal (120/80 mmHg)

Systole : Contraction of heart muscles.

Diastole : Relaxation of heart muscles.

Lymph

The colourless mobile fluid connective tissue drains into the lymphatic capillaries from the intercellular spaces. It is formed by squeezing of blood through capillaries, within tissues. Its flow is unidirectional *i.e.,* from tissues to heart.

Composition :

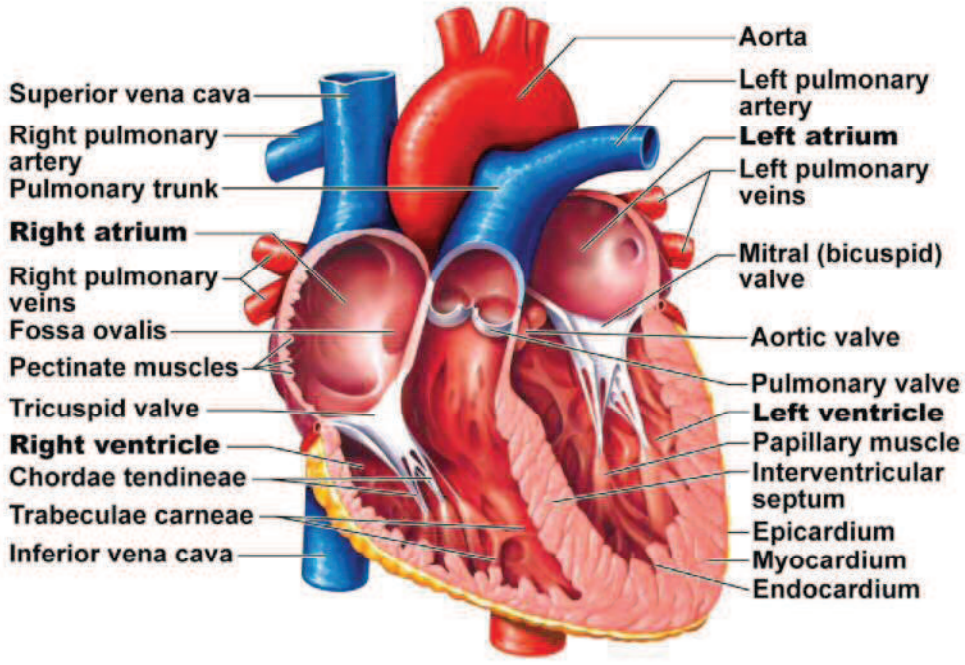
It is composed of fluid matrix, plasma, white blood corpuscles or leucocytes.

Functions :

(i) It drains excess tissue from extra cellular spaces back into the blood,

(ii) It contain lymphocytes and antibodies.

(iii) It transport digested fats.

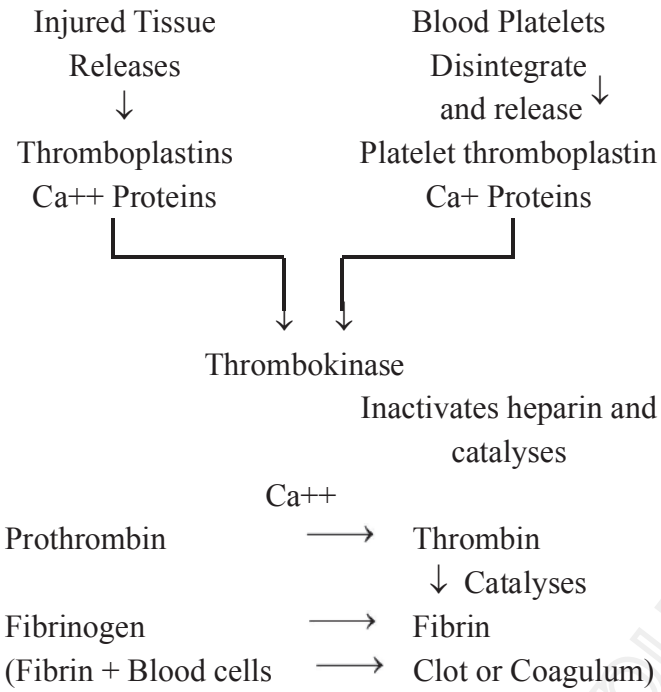


- It is the mesodermally derived organ situated in thoracic cavity in between the two lungs. Protected by a double membrane covering called Pericardium.
- Four chambers–two (left and right) atria, and two ventricels (left and right)
- Inner-artrial septum separates the two atria and inter ventricular septum separates the two ventricles, while the atria and ventricles are separated by atrioventricular septum.
- The valves between right atrium and right ventricle is tricuspid while between left atrium and ventricle is bicuspid or mitral value.
- The opening of the right and the left ventricles into the pulmonary artery and the aorta are guarded by semilunar values.
- The value allow the flow of blood only in one direction, *i.e.,* from atria to ventricles and from ventricles to pulmonary artery or aorta.

Functions of Blood

Transport, of food, respiratory gases (O_2 and CO_2), hormones, metabolic intermediates, waste products, supply of raw materials, regulation of water balance, regulation of pH and body temperature, and provides immunity.

Blood Clotting



Bipod Groups

Blood Group	Antigen (on the Surface of R.B.Cs)	Anti body : (in plasma)	Possible recipients having blood group	Possible donors having blood group	Remarks
A	A	Anti B	A.AB	O,A	—
B	B	Anti A	B, AB	O,B,	—
AB	A and B	None	AB	O,A,B,AB	Universal recipient
0	None	Anti A and anti B	O/A,B,AB	O	Universal Donor

Rh (Rhesus) Group :

Discovered by Landsteiner and Wiener in 1940. The antigen found on the surface of RBCs. The presence of this antigen is termed as Rh-positive (Rh+) and its absence as (Rh–). It plays a crucial role in childs birth born out of a marriage between Rh– woman and Rh+ man, causing to produce anti Rh antibodies.

→**SAN (Sino-artrial node) :** A patch of tissues present in the right upper corner of the right atrium, acts are pacemaker due to having a unique property of self exitation.

→**AVN (Atrio Ventricular Node) :** A mass of tissues seen in the lower left corner of the right atrium close to the atrio-ventricular septum. Fresh wave of contraction generated here, passes over both the ventricles simultaneously along the bundle of his.

Heart Valves

Tricuspid Valve : The valves formed of three muscular flaps or cups, which guard the opening between the right atrium and the right ventricle.

Bicuspid Valve (Mitral Valve) :

The valves which guard the opening between the left atrium and the left ventricle, made up of two flaps.

Semilunar Valves : The valves present at the opening of the right and the left ventricles and allow the entry of blood into pulmonary artery and the aorta respectively.

Reading of ECG : 'P' Wave represents the electrical excitation (or depolarisation) of the atria and leads to the contraction of both the atria.

'QRS' complex : represents the depolarisation of the ventricles, which initiates the ventricular contraction.

'T' Wave : represents the return of the ventricles from excited to normal state (repolarisation). The end of T-wave marks the end of sytole.

Double circulation : The passage of same blood twice through heart in order to complete one cycle. eg.

(i) The blood pumped by the right ventricle (deoxygenated blood) is transported through pulmonary artery to lungs where CO_2 is exchanged with O_2 through diffusion and returns back to the heart through pulmonary vein. It is called pulmonary circulation.

(ii) The oxygenated blood from left ventricle is transported through aorta to different body parts (cells and tissues) where O_2 is exchanged with CO_2 through diffusion and then returned back to the heart through vena-cava. It is called systemic circulation.

Disorders of circulatory System

Hypertension (High blood Pressure) : It results from narrowing of arterial lumen and reduced elasticity of arterial walls in old age. It can cause rupturing of capillaries. It is a silent killer.

Coronary Artery Disease : (CAD) Atherosclerosis. The supply of the blood to heart muscles is affected. It is "caused by deposits of Calcium, fat, cholesterol and fibrous tissues to make the lumen of arteries narrower.

Angina Pectoris : Caused due to arteriosclerosis, when no enough oxygen is reaching the heart muscle due to which the person experiences acute chest pain.

Heart attack : Caused when the heart muscle is suddenly damaged by an inadequate blood supply.

Cardiac arrest : The state in which the heart stops beating.

Arteriosclerosis : The state of herding of arteries and arterioles due to thickening of the fibrous tissue and consequent loss of elasticity. It causes hypertension.

Questions

Very Short Answer Questions (1 mark each)

1. Name the instrument used for measuring blood pressure.
2. What is lymph node ?
3. A cardiologist observed an enlarged QRS wave in the ECG of a patient. What does it indicate ?

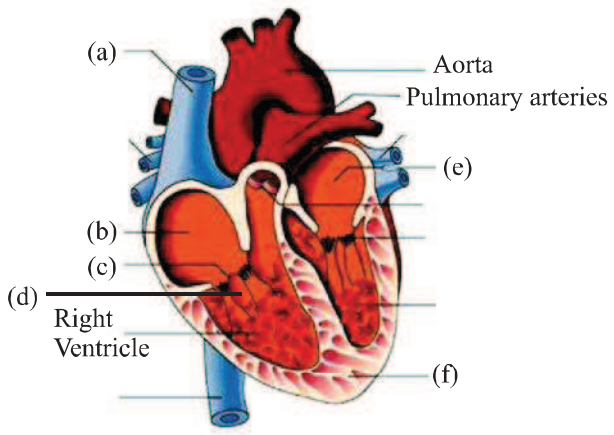
4. Name the enzyme that catalyses the formation of carbonic acid in erythrocytes.
5. What is systemic circulation ?
6. Give two examples of extra-cellular fluids.
7. What name is given to the blood vessels which generally bring blood to an organ ?
8. Which adrenal hormone accelerates the heart beat under normal conditions ?
9. Name the blood vessel that carries blood from the intestine to liver.
10. Define cardiac cycle.
11. Name the protein found in RBCs.
12. What happens to a person suffering from hemophilia ?

Short Answer Questions-I (2 marks each)

13. Explain when and how the two sounds of heart are produced.
14. Define joint diastole. What are constituents of the conducting system of human heart ?
15. Give the names of various types of formed elements present in the blood.

Short Answer Questions-II (3 marks each)

16. Draw a diagram showing schematic plan of blood circulation in human.
17. Why is the SA node called pacemaker of the heart ? Write its full from.
18. In the following diagram of section of a human heart, label a, b, c, d, e and f.



19. What is lymph ? Describe its circulation in brief.
20. What is stroke volume ? What is its relation with cardiac output ?

21. A person suffering from fever is advised to take blood test. What may happen to his WBC count and why ?

Long Answer Questions (5 marks each)

22. Neena is having blood group A-ve while her husband's blood group is O +ve. Their first child is having blood gp. A +ve. Her second child was born with severe anemia and jaundice. What could be the reason ? How this situation could have been avoided ?
23. Draw a diagram to show the internal structure of human heart. Lable any two heart chambers, any two heart valves and chordae tendinae in it.
24. Describe the structure of human heart.
25. What is cardiac cycle ? Describe the event that occur during it.
26. Explain Rh grouping and its incompatibility in humans.

Answers

Very Short Answer (1 mark each)

1. Sphygmomanometer.
2. A lymph node is speicalised structure in lymphatic vessel concerned with the alteration of foreign bodies by the lymphocytes.
3. QRS waves denotes ventricular contraction of heart which may be normal or abnormal.
4. Carbonic anhydrase.
5. The kind of blood circulation that is concerned with the supply of oxygenated blood from the left ventrice to all body parts and return of oxygenated blood to the right atrium of heart.
6. Interstitial fluid and blood plasma.
7. Afferent blood vessel.
8. Noradrenalin.
9. Hepatic portal vein.
10. A regular sequence of three events (i) auricular systole (ii) ventricular systole and (iii) Joint diastole during the completion of one heart beat.

11. Haemoglobin.
12. The person suffering from haemophilia lacks clotting factors in blood, which result the defective clotting mechanism. In case of injury the person is at a risk of blood loss.

Short Answer-I (2 mark each)

13. (i) 'Lubb' the first second which is low pitched, is caused by the closure of bicuspid and tricuspid valves.
    (ii) 'Dup' the second sound which is high pitched, is caused by the closure or semilunar valves.
14. In a cardiac cycle when both atria and ventricles are in a diastole and are relaxed simultaneously is called a joint diastole.
    Conducting system constitutes : SA node → AV node → Bundle of His → Purkinje fibres.
15. Erythrocytes, lymphocytes, monocytes, neutrophils * eosinophils, basophils and platelets.
16. SA node being self excitatory initiate a wave of contraction in the heart.
    SA node — Sino–Atrial Node.

Short Answer-II (3 marks each)

17. Refer fig. 18.4, page 287 (NCERT Text Book Class XI-Biology)
18. Refer fig. 18.2, page 283 (NCERT Text Book Class XI-Biology)
19. Refer contend fig. 18.2, page 282 (NCERT Text Book Class XI-Biology)
20. During one cardiac cycle or one heart beat the volume of blood pumped by the heart is called stroke volume. This is normally 70 mL.
    In one minute the heart beats about 72 times and the amount of blood pumped per minute is called cardiac output. This is usually 4900 mL. or 5 litres.
21. The WBC count of this person may show an increase from the normal range. As pathogens may be present in his body, so the body is producing more WBCs to fight against those pathogens. WBC count is a good tool to asses the presence of infection in a sick person.

Long Answer (5 marks each)

22. During her first pregnancy with her first Rh +ve child, her body prepared antibodies against Rh antigen in her blood. In second pregnancy these Rh antibodies from mother leaked into the blood of foetus (Rh +ve) and destroyed foetus RBCs. It was the cause of severe anemia.

    This situation could have been avoided if she had got herself administered anti; Rh antibodies immediately after first deliver to kill Rh antibodies.

23. Refer fig. 18.2, page 283 (NCERT Text Book Class XI-Biology)
24. Refer content 18.3.1., page 283 (NCERT Text Book Class XI-Biology)
25. Refer content 18.3.2., page 284 (NCERT Text Book Class XI-Biology)
26. Refer content 18.3.2., page 281 (NCERT Text Book Class XI-Biology)