Notes

15

CIRCULATION OF BODY FLUIDS

The body of almost all the animals, has some form of fluid circulating in the body. Such fluids constitute the distributing system (to supply substances) as well as collecting system (to pick up substances) from the various parts of the body (including the remotest cell). What are these fluids? How are these circulated and in what way do they function in our body? These and many more questions will be answered in this lesson.

OBJECTIVES

After studying this lesson, you will be able to :

- *explain the importance of the circulatory system in human body;*
- *differentiate between open and closed system of circulation;*
- *list and draw the organs of circulatory system of cockroach;*
- *list and draw the organs of circulatory system in humans*
- *describe the histology, functions and composition of blood in humans*
- *compare the structure and functions of an artery, a vein and a capillary;*
- *explain the process of blood coagulation in humans*
- *mention blood groups and describe blood transfusion;*
- *explain blood pressure;*
- *describe lymphatic system and mention its components;*
- *define immunity and describe its different types;*
- *explain various immuno-deficiency disorders;*
- *name and describe some blood related disorders such as hypertension; atheroma and arteriosclerosis;*
- *explain ECG and role of pacemaker in treating heart beat-related disorders.*

15.1 CIRCULATORY SYSTEM

Our body is made of cells. Cells need nutrients and oxygen to survive, and wastes need to be removed from them. Hormones are also needed to be transported from the endocrine glands which secrete them to their respective target cells. This work of transportation of nutrients, gases, wastes and other substances from one part of our body to the other part, is carried out by blood, and as termed **circulation**.

> The organs responsible for the flow of blood and lymph through various parts of the body constitute the circulatory system

1. Functions of circulatory system

(i) Transport of nutrients to the tissues for their utilization

(ii) Transport of respiratory gases (O_2 and CO_2) to and from the cells.

(iii) Collection of metabolic wastes from different tissues and transport them to excretory organs for their removal.

(iv) Transport of hormones from endocrine glands to target organs.

(v) Protection of body by destroying pathogens.

(vi) Uniform distribution of heat in the body.

2. Types of Circulatory System

Depending upon the mode of circulation, the circulatory system may be open or close type.

(i) Open circulatory system

(a) Blood does not flow in closed vessels rather it flows through parts of the body cavity. It remains mixed with the body fluid.

(b) Sufficient high pressure for circulation is not maintained.

Organisms like prawns, insects etc have open circulatory system.

(ii) Close circulatory system

(a) Blood flows in well-defined tube-like vessels.

(b) Sufficient high pressure is maintained .

(c) System is more efficient than open type.

Closed system is found in all vertebrates.

15.2 CIRCULATORY SYSTEM OF COCKROACH

The circulatory system of cockroach is of open type. It consists of a pulsatile heart (dorsal blood vessel) and sinuses through which flows the blood. The blood is clourless and fill the entire body cavity which is rightly called **homocoel**. Thus the blood is called haemolymph. Haemocoel is divided into three sinuses (chambers) by two horizontal septa called **dorsal diaphragm** and **ventral diaphragm**. The three sinuses are dorsal sinus or pericardial sinus enclosing the heart, middle **perivisceral sinus** lodging the various visceral organs and the ventral **perineual**

sinus enclosing the ventral nerve cord. Both the diaphragm are perforated in that the three sinus remain in communication with each other.

The heart is an elongated tubular similar structure, closed behind and open in front, running all along the middle line thorax and abdomen. It consists of thirteen segmentedly arranged funnel shaped chambers. At the lateral side of each chamber is a pair of ostia one each side, which are guarded by **valves**. Through these ostia, heart communicates with the pericardinal sinus. Anteriorly, the heart continues into the head as anterior aorta which open into the haemocoel of head. Attached with each segment, a pair of triangular alary muscles is present on either side of the heart.

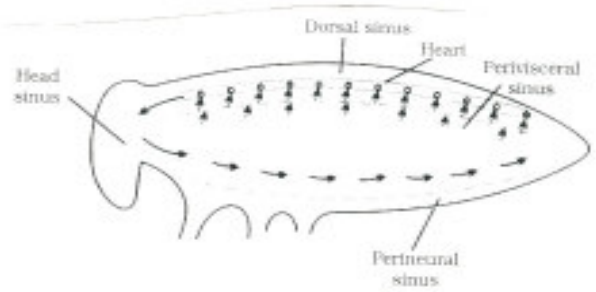


Fig. 15.1 Circulatory system of cockroach

The blood is a colourless fluid, made up of plasma and haemocytes. Since the blood of cockroach lacks any respiratory pigment, it is not involved with the transportation of respiratory gases. It rows only for (i) the transportation of the nutrients (ii) maintains hydrostatic pressure and (iii) acts as a reservoir of water. The blood of cockroach circulates due to contribution and relaxation of the heart and the alary muscles.

15.3 ORGANS OF HUMAN CIRCULATORY SYSTEM

The circulatory system consists of the following parts :

1. Heart – the central pumping organ.
2. Blood vessels – the connecting tubes – arteries, veins and capillaries.

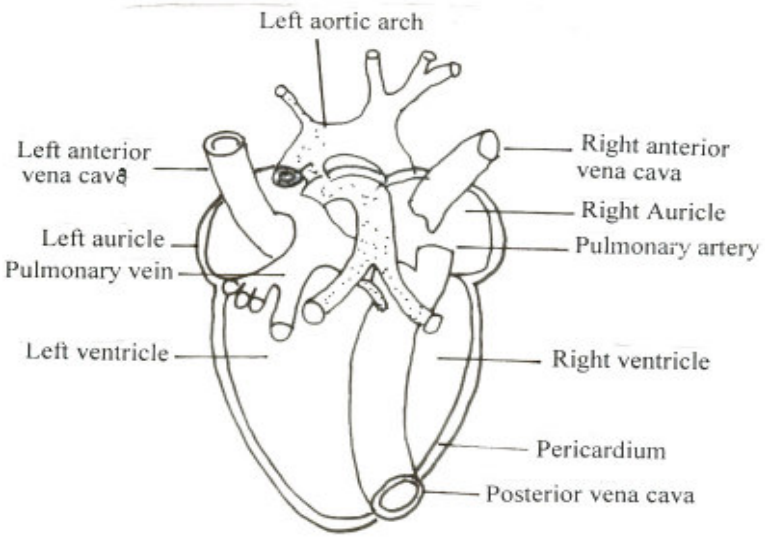


Fig. 15.2 (a) External structure of humna heart (Front view)

3. Blood – the circulating fluid which is a connective tissues made of a fluid matrix and cells.
4. Lymphatic system comprised of lymph nodes and vessels.

1. The human heart

It is a muscular organ made of cardiac muscle fibres (Fig. 15.2). It is able to perform its function by coordination between its contraction, relaxation and opening and closing of a number of valves present inside the heart. This fist sized organ consists of 4 chambers the two upper chambers – the atria and two lower chambers – the ventricles. Ventricles have thick muscular walls for pumping blood to longer distances. Heart is covered by a membrane – the **pericardium**.

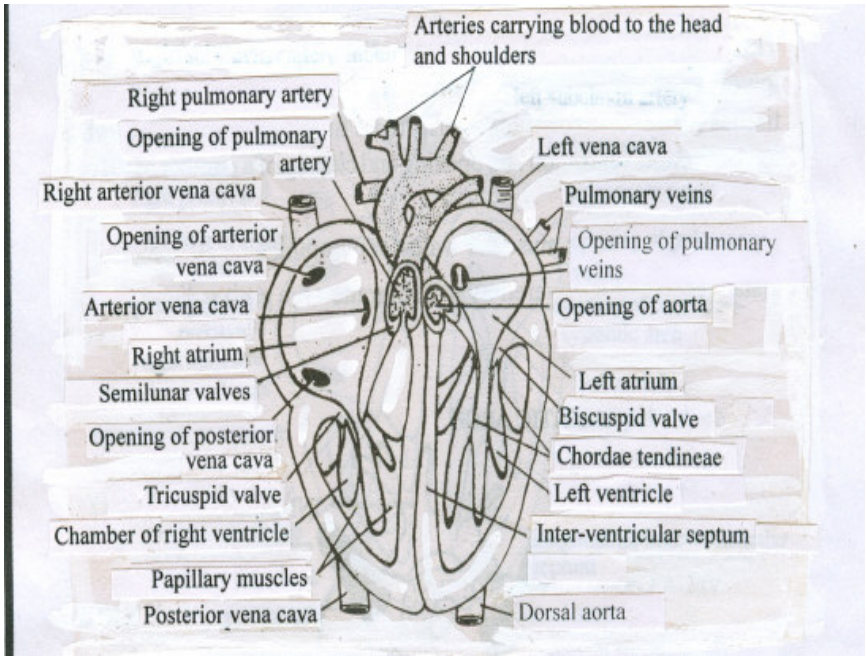


Fig. 15.2 (b) Internal structure of human heart.

(i) Valves inside the heart

Locate the following valves in the figure 15.3

(a) Right **atrio-ventricular valve** or **tricuspid valve**

(b) Left **atrio-ventricular valve** or **bicuspid valve**

Semilunar valves at the origin of aorta and pulmonary artery.

Valves open only on one side like a door and regulate the flow of blood by opening on one side to let blood flow out in one direction only and prevent the back flow of blood.

(ii) Heart beat and cardiac cycle

The **beating of heart** goes on by itself as long as one is alive. Each heartbeat consists of the steps mentioned below and makes two sounds – the Lubb and the Dubb during each beat.

(a) Contraction or **systole** of atria is followed by relaxation or **diastole**. The lubb sound or 1st heart sound occurs due to closure of atrioventricular valves.

(b) Contraction of ventricles followed by relaxation accompanied by the dubb sound or the 2nd heart sound due to closure of semi lunar valves. At the beginning of every heart beat the four chambers of the heart are in the relaxed state (**Joint diastole**). At this stage the venae cavae pour deoxygenated blood into right atrium and the pulmonary vein pours oxygenated blood into left atrium.

Heart beat originates at the **Sino-Atrial Node or S.A Node** which is a modified part of the muscular wall of the right atrium chamber (Fig. 15.3)

Sino-Atrial Node (S.A. node) in the upper corner of right atrium resulting in the contraction of the atrium. As a result tricuspid valve is pushed open and deoxygenated blood enters right ventricle. At the same time, the bicuspid valve is pushed open and oxygenated blood flows into left ventricle.

Atrio-Ventricular Node (A.V. Node) is located in the interatrial septum. As a result, the contracted atria begin to relax.

Bundle of HIS lying in the interventricular septum and then to

Purkinje Fibers lying in the walls of ventricles. As a result ventricles contract (Ventricular systole)

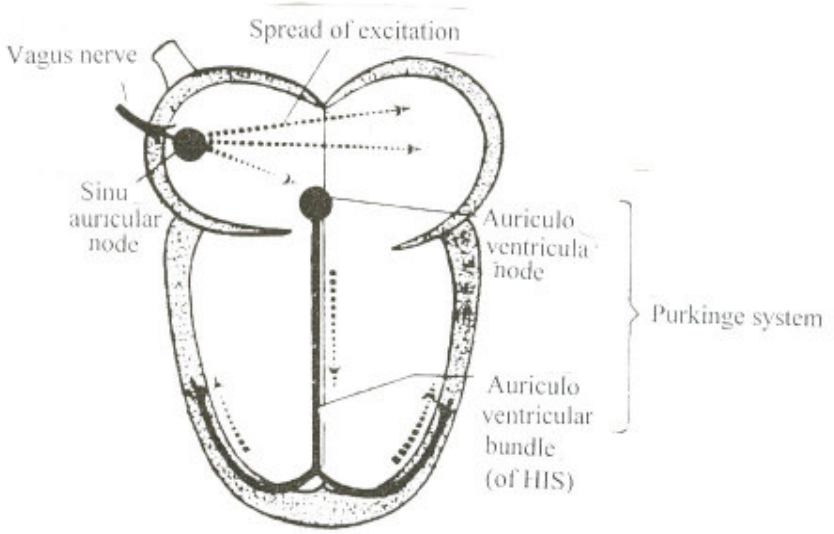


Fig. 15.3 Position of the Sino-atrial and atrio-ventricular nodes and the bundle of HIS and conduction of impulse for heart beat.

Since Sino-atrial Node initiates and regularizes the heartbeat, it is also called the **pacemaker**. The pacemaker is influenced by nerves, hormones, CO_2 and O_2 content of blood, heat etc.

Do You Know?

Sometimes the S.A. (Sino-Atrial) Node may become defective or damaged. A person may need to have an artificial pacemaker grafted in the chest. This regularizes the heartbeat.

Electro Cardiogram (ECG) is the instrument that records the conduction of heartbeat . This helps in detecting heart disorders.

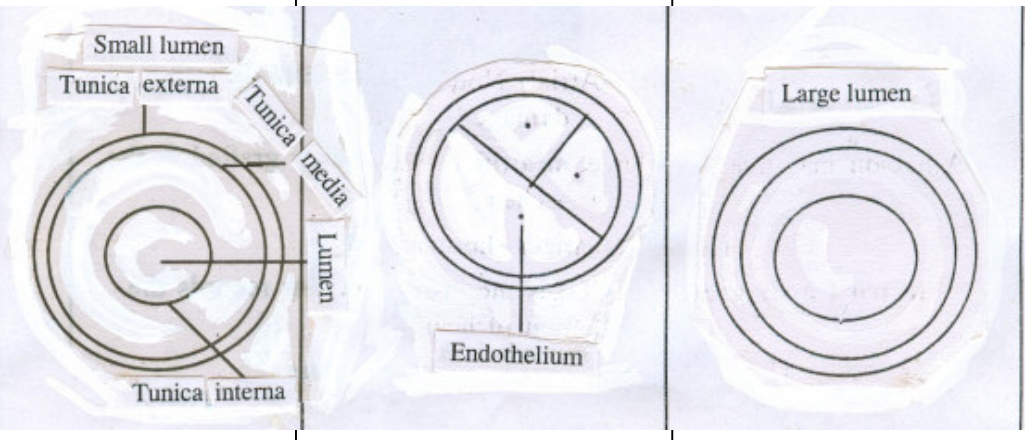
2. Blood vessels

The tubes transporting blood are called **Blood Vessels**. The wall of a blood vessel has three layers, tunica externa, tunica media and tunica interna. There are 3 kinds of blood vessels:

(i) Artery (ii) Capillaries and, (iii) Veins. These three vessels differ in structure and speed of blood flow, as shown below.

Table 15.1 Comparison in structure and function of an artery, the capillary and the vein.

Artery	Capillary	Vein
Transport blood away from the heart.	Link arteries to veins. Site of exchange of material between blood and tissues	Transport blood towards the heart.
Tunica media thick and composed of elastic, muscular tissue.	No tunica media. Only tissue present is squamous endothelium. No elastic fibers	Tunica media relatively thin and only slightly muscular. Few elastic fibers.
No semi-lunar valves.	No semi-lunar valve	Semi-lunar valves at intervals along the length to prevent back flow of blood
Pressure of blood is high and pulsatile.	Pressure of blood falling and non-pulsatile.	Pressure of blood low and non-pulsatile.
Blood flow rapid	Blood flow slowing	Blood flow slow
Low blood volume	High blood volume	Increased blood volume
Blood oxygenated except in pulmonary	Mixed oxygenated and deoxygenated blood.	Blood deoxygenated except in pulmonary vein



Arteries divide into **Arterioles** and then into **Capillaries**. This way they come in contact with all the tissue and bathe the cells with Blood Plasma. Diagram 15.4 shows the possible route that blood may take between arteriole, capillary bed and venule. Venules are thin blood vessels that join to form veins.

(i) Major Arteries and Veins

Blood that has been circulated through the body has lost much of the O_2, it carried. This de-oxygenated blood returns to the heart by the two major veins.

1. **Superior vena cava**-brings blood from head and shoulder region.
2. **Inferior vena cava**-brings blood from lower parts of the body.

These venae cavae open in the right atrium (refer to diagram 15.4) Contraction of right atrium forces this blood into the right ventricle.

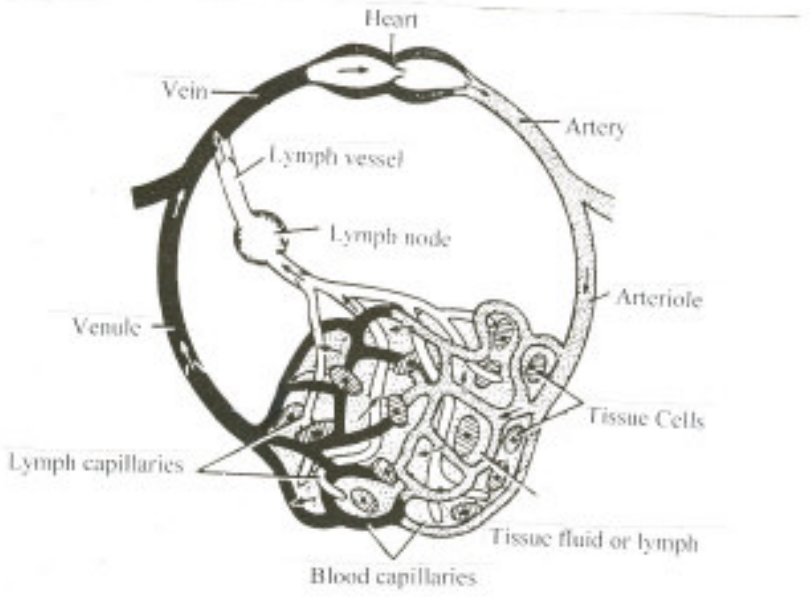


Fig. 15.4 The route that blood takes between arteriole capillary bed and venule.

Contraction of right ventricle pumps into **pulmonary artery** which transports blood to the lungs. Blood gets oxygenated in the lungs and returns to the left atrium through the **pulmonary vein**.

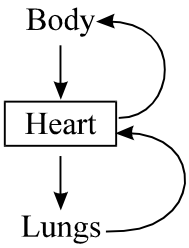
Blood then passes from the atrium into the left ventricle. Left ventricle pumps blood into aorta. The aorta turns round on the left and distributes blood throughout the body.

The flow diagram below summarizes the path of blood through the entire circulatory system. It is possible to summarize the path taken by the blood Since blood passes twice through the heart, it is termed **Double circulation**.

Double circulation

(i) Deoxygenated blood from the body to heart and oxygenated blood from heart to the body.

(ii) Deoxygenated blood from heart to lungs and oxygenated blood from lungs again to heart.



In one circulation, the blood passes through the heart twice. Once from body to heart to lungs and second time from lungs to heart to body.

Path of circulation

Once from body to heart : venae cavae

(Carry blood from tissues with very little oxygen and lot of CO_2)

to Right atrium

↓

Tricuspid valve open

↓

Right ventricle

↓

Pulmonary ateries

↓

(Carry blood to lungs to give up CO_2 and to collect O_2 from lungs)

Pulmonary veins

↓

(carry oxygenated blood back to heart)

↓

Left atrium

↓

Bicuspid valve

↓

Left ventricle

↓

Aorta

(carries blood with a lot of oxygen and distribution the body)

Pulmonary artery is the only artery that carries the de-oxygenated (**poor blood in O_2**) blood.

Pulmonary vein is the only vein that carries oxygenated blood (blood rich in O_2).

INTEXT QUESTIONS 15.1

1. Give one example each of animals with open and closed circulatory system.
   (i) Open circulation .....
   (ii) Closed circulation .....
2. Where in the heart are the following valves located?
   (i) Bicuspid .....
   (ii) Tricuspid .....
3. Name the following
   (i) Structure where the wave of contraction originates in heart
   .....
   (ii) Structure connecting arteries with the veins
   .....
   (iii) Blood vessel that brings oxygenated blood from the lungs to the heart
   .....
   (iv) Deoxygenated blood from brain and shoulder region is collected and brought to the heart by .....

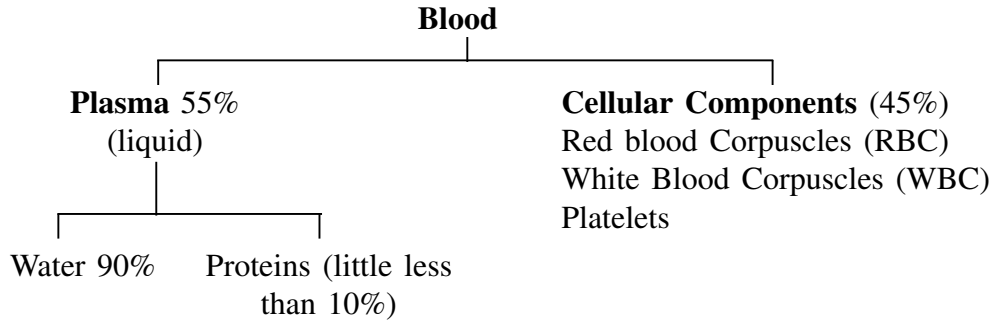
(ii) Components and functions of blood

Blood is a red coloured, thick and slightly alkaline, fluid which keep circulating through the blood vessels in our body. Why is blood so important? It is important because

1. it transports substances in the body such as Oxygen, nutrients, hormones. It also carries waste to the kidney.
2. it protects body against disease.
3. it maintains normal body temperature.

The components of blood

Blood is a fluid connective tissue made of plasma and blood cells.



A. Plasma

It is a pale yellow liquid consisting of **blood proteins** like **albumin, globulin and fibrinogen.**

Functions : Plasma has the following functions :-

1. Transport of products of digestion from small intestines to various tissues.
2. Transport of waste products from tissues to excretory organs.
3. Transport of hormones from endocrine glands to target organs.
4. Maintenance of temperature by distribution of heat all over the body.
5. Provides factors for clotting of blood (Fibrinogen).
6. Retention of fluids in blood (through plasma proteins).
7. Maintenance of acid-base equilibrium of blood.
8. Provides body immunity through antibodies (Immunoglobulins) which are made by one kind of WBC and then released into the plasma.

B. Blood Cells

The cells of blood are **Red Blood Corpuscles (RBC)** and **White Blood Corpuscles (WBC)** and cell fragments the **Platelets**. Blood cells are formed in the bone marrow. Their formation is termed **haemopoiesis** Table 15.2 gives the idea of the cellular components, their origin, function and structure.

Table 15.2 Cellular components of blood

Component	Origin of cells/mm	Number	Function
Erythrocytes (Red Blood corpuscle	Bone marrow	5.000,000	transport of • oxygen to tissues and a large amount of • carbon dioxide back to lungs
Leucocytes (White Blood Corpuscles)	Bone marrow	4,000 8,000	
(a) Granulocytes (72% of total white blood cell count)		4900	• engulf bacteria
neutrophils (70%)	Bone marrow	105	• anti-histamine properties
eosinophils (1.5%)		35	• Produce histamine and heparin
basophils (0.5%)			
(b) Agronulocytes (28%)			
monocytes (4%)	Bone marrow	280	• engulf bacteria (Phagcytosis)
lymphocytes (24%)	Bone marrow, lymphoid tissue, spleen	1680	production of antibodies to provide immunity
Platelets	Bone marrow	250,000	initiate blood-clotting

Do you know the following blood disorders ?

1. Increase in R.B.C (More than normal) polycythemia
2. Decrease in R.B.C (less than normal) anaemia
3. Increase in W.B.C.(more than normal) LEUKEMIA
4. Decrease in W.B.C (less than normal) LEUKOPENIA

Coagulation of Blood (Blood Clotting). You must have, sometime or the other, got a cut on your finger and seen blood flowing out of it . You would have noticed that after a few minutes, the blood flow stops, as the blood thickens and forms a lump. This lump is called clot. The process of thickening of blood is called **coagulation or clotting of blood**. We are lucky that the blood clots and the bleeding stops. If it did not, a person with a very small wound would lose a lot of blood and die. When blood vessels are injured, a sequence of reactions take place to prevent loss of blood. Steps involved are as follows :

Thromboplastin (from blood platelets) + Prothrombin (Plasma protein)

Ca^{++} ions

Thrombin

Fibrinogen (Plasma protein) → Fibrin (Insoluble fibres)

FIBRIN + R.B.C → CLOT (Scab) Prevents blood loss

Haemophilia – A genetic disease that results in a condition where blood fails to clot

Blood group

The blood may chemically be identified as belonging to any one of the four main group A, B, AB, and O. Blood types remain constant throughout lifetime as they are hereditary. These blood groups are due to the presence of special proteins present on the membrane of RBCs termed antigens. Antigens present could be A, B both A and B or no **Antigen** may be present at all. Blood plasma, on the other hand, contains **antibodies** a, b, or both a and b, or neither of the two. Antigen A reacts with antibody b and antigen B with antibody a causing clumping of blood.

Blood Group	Antigen	Antibody
A	A	b
B	B	a
AB	A, B	–
O	–	a, b

Blood transfusion

When excessive blood is lost from the body either due to an accident, hemorrhage or during surgery (operation), doctors transfer blood from a healthy person (Donor) to the patient (Recipient). This is called Blood **Transfusion.** When blood transfusion

is needed, the red cells blood selected must belong to a group which will not be affected by any antibody in the patient's plasma.

Clumping of donor's blood (Agglutination) may take place on transfusion if the blood group of donor does not match with that of the recipient. Table 15.3 shows blood groups and possibility of their transfusion.

> Clumping is a condition where the antibodies present in the plasma of recipient link donor's blood cells with each other.
>
> Agglutination is the process by which red blood cells clump together when the antigens on their surface react with complementary antibodies.

Table 15.3 Matching of Blood Group, Safe and Unsafe Transfusion of Blood.

Those who can safely receive blood of donor type	Donor	Blood group types who cannot
O, A, B, AB	Type O	
A, AB	Type A	O, B
B, AB	Type B	O, A
AB	Type AB	O, A, B,

The above table indicates that :

Blood group of recipient	Donor's blood group				
	Group O	Group A	Group B	Group AB	4 Safe transfusion
Group O	4	4	4	4	
Group A	4	4	4	4	5
Group AB	4	4	4	4	Dangerous transfusion

The above table indicates that :

1. Blood group of O type can be given to all groups. It is thus the **Universal** Donor. This is because there are no antigens in the blood of Group O.
2. Blood groups AB can receive blood from all other groups and is thus called **Universal Recipient**. No Antibodies in the blood of Group AB, so no reaction with antigens of other blood groups.

Rh Factor

Presence or absence of another blood protein in addition of ABO antigens makes a person Rh^+ or Rh^-.

> Rh factor in expectant mothers can sometimes cause problems. The blood of an Rh^+ embryo whose mother is Rh^- is in danger of severe clumping.

Antibodies are produced in the mother against the Rh^+ blood cells of the embryo. Whenever there is even the slightest mixing of foetal blood mothers blood.

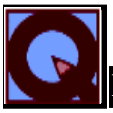
Blood Pressure

You have already learnt that during systole, the ventricles contract and force the blood into the arteries, which carry it to all parts of the body. The flow of the blood in the arteries exerts a pressure on their elastic walls. This pressure is called **blood pressure**.

The pressure of blood at the time of ventricular contraction is higher and is called **systolic pressure**. When ventricles are relaxed and are being filled by blood, there is a drop in pressure. This lower pressure is called **diastolic pressure**. These two pressures can be measured in the arteries of the arms. The device used for measuring blood pressure is called **Sphygmomanometer**.

A reading of 120/75 means that the person's systolic pressure is 120 mm of mercury and diastolic pressure is 75 mm of mercury. A typical reading for a healthy adult is 120 ± 5/70 ± 5 mm of mercury.

The difference between diastolic and systolic pressure can be felt as a throb in the arteries of the wrist. This throb at the wrist is called **Pulse**. The number of throbs felt at a particular point on the wrist (due to systole) per minute is called **Pulse Rate**. It is equal to the number of heart beats i.e. around 70 beats per minute for a normal adult.



INTEXT QUESTIONS 15.2

1. Name the following
   (i) The term given to the production of blood cells ……..……
   (ii) The three proteins present in the plasma
   (i) ……. (ii) ……. (iii) …….
   (iii) Cell fragments of blood involve in the clotting of the blood
   ……..……
2. Fill in the blanks
   (i) Transfer of blood from donor to recipient is called ….....……
   (ii) Antigen are present on ……., and antibodies in the ……..
   (iii) People from blood group O can receive blood from blood group /groups ……
   (iv) Blood pressure is measured by an instrument called……. The reading for a person with normal blood pressure will be around ….....……..

4. Lymphatic system

Our body has two kinds of circulating fluids – blood and lymph. Of these you have seen and felt the first (i.e. blood) in your own body, but lymph remains unnoticed even if it oozes out at any point of injury because it is colourless.

This system consists of a series of branching vessels and a collection of lymphatic organs. Let us understand. A continuous exchange of materials between the blood capillary and the intercellular fluid (fluid present between cells of tissues) goes on. Some important components like proteins etc. that could not be returned back to blood capillaries from intercellular fluid, are taken up by the lymph capillaries as lymph and drained into veins in the lower neck portion of the body. Lymph should be regarded as modified tissue fluid.

The clear, colourless liquid moving out of the capillary wall is called Lymph. Lymph comes in to direct contact with body cells. (Fig. 15.5)

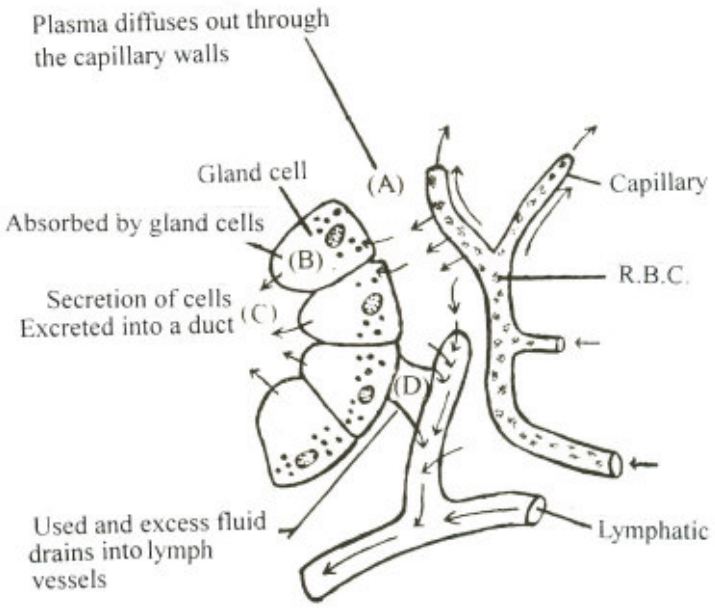


Fig. 15.5 Capillaries and lymph vessel

(a) Functions of lymph

(i) Supplies nutrition and oxygen to those parts where blood cannot reach

(ii) Drains away, excess tissue fluid from extra-cellular spaces back into the blood.

(iii) Absorbs and transports fats absorbed from small intestine

(iv) Collects nitrogenous waste

(v) Lymphocytes and antibodies present in lymph help in removing bacteria

(b) Differences between blood and lymph

Blood differs from lymph in a number of ways as shown in table 15.4

Table 15.4 Differences between Blood and Lymph

Blood	Lymph
1. Red in colour due to presence of haemoglobin	1. Colour less fluid
2. Flows rapidly	2. Flow is very slow
3. Contains RBC, WBC, Platelets and Plasma	3. Contains plasma and WBC
4. Route of blood flow Heart ↓ Arteries ↓ Capillaries ↓ Veins ↓ Heart	4. Route of lymph flow Tissue Spaces ↓ Lymph Capillaries ↓ Lymph Vessels ↓ Subclavian Vein ↓ Heart

The clear, colourless fluid that collects in a blister to provide protection to the underlying tissue is **lymph**.

The lymphatic system consists of a large number of **lymph ducts, lymph nodes and lymph vessels** (Fig. 15.6). It lacks a pumping mechanism. Fluid is pushed by muscle movement.

The lymph nodes are scattered throughout the body. They are more concentrated in the neck, armpits and groins

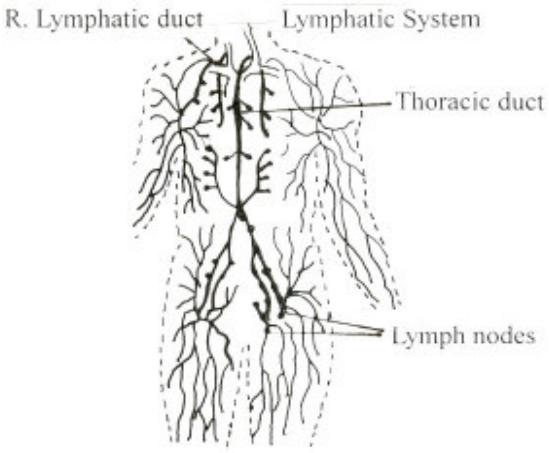


Fig. 15.6 Lymph vessels and lymph glands

Lymph nodes

Each node is a clump of tissue housing a number of lymphocytes. These nodes act as filters for bacteria, viral particles and cancerous cells. These resident lymphocytes then immediately attack the disease causing germs or pathogens.

The spleen and tonsils are lymphoid organs.

Spleen

It is the largest lymphoid organ and has the following functions

(i) Haemopoiesis – Formation of Blood cells in the foetus

(ii) Destruction of old and worn out blood cells and hence termed as 'grave yard' of RBC.

(iii) Blood reservoir

(iv) Defensive action by engulfing bacteria

15.5 IMMUNITY

The body's ability to resist or protect itself from the harmful effects of disease producing substance or organisms is called Immunity.

Any substance that causes this type of response in the body is known as **antigen**. Antigen may be bacteria, viruses, or allergens (such as pollen grains)

Antigens enable the body to protect itself with the help of antibodies produced by lymphocytes (WBC)

Immunity could be **natural or acquired**. Natural immunity is by birth. Acquired immunity develops during lifetime. It develops due to exposure to a disease or by vaccination.

Acquired immunity is of two types

(a) Active Immunity : Develops during exposure to disease causing germ. The body produces antibodies that remain in the blood to prevent further infection by that particular pathogen or disease causing organism. Vaccine containing weakened germs are administered to provide active immunity e.g DPT vaccine given for developing immunity against diphtheria, pertusis (whooping cough) and tetanus and BCG vaccine given for immunity against tuberculosis

People also develop immunity against chicken pox, small pox and measles after suffering from these disease. This form of immunity is usually a life long immunity

(b) Passive Immunity : This form of immunity is shortlived. It is developed by injecting readymade antibodies (collected from other animals). **Anti tetanus serum (ATS vaccine)** provides temporary immunity against tetanus.

A vaccine is a sample of an antigen, too small to cause a disease, but enough to produce antibodies. Vaccines have been developed for a number of diseases like polio, mumps, measles, tetanus, diphtheria, cholera, etc.

Cells Of Immune System

Lymphocytes are cells of the immune system. There are two major type of lymphocytes, T-cells and B-cells, both develop in the **Bone Marrow.**

T-Cells	B-Cells
1. Mature in thymus glands	Mature in lymphoid tissues like tonsils and appendix
2. T-cells identify antigens and destroy them	Recognise antigen with the help of surface receptors
3. Attack directly	Produce a large number of antibodies for attack
4. Life span is upto 3-4 years	Anitbodies are short lived

A person may lack T-cells or B-cells, or both. Such persons are highly prone to infections

Immuno Deficiency Disorders

Hereditary, congenital (by birth) or acquired defects in immune response are called **Immuno Deficiency Disorders.**

SCID and **AIDS** are two common examples of such disorders.

SCID (Severe Combined Immuno-Deficiency Syndrome) is caused due to the absence of both T-cells and B-cells. This defect is present by birth.

AIDS (Acquired Immuno Deficiency Syndrome) causes considerable reduction in T-cells and ultimate destruction of the Immune System. It is caused by HIV (Human Immuno Virus).

You should know

AIDS may be caused by

1. Sexual contact with a person infected with HIV
2. Blood transfusion from HIV infected person
3. Sharing of contaminated needles with HIV sufferers or Drug addicts
4. From infected mother to foetus through the placenta

15.6 DISORDERS RELATED TO BLOOD AND HEART

You must have heard of people suffering from high blood pressure. In these people, the blood pressure is more than the normal (120/75). The state of having high blood pressure is called **hypertension**. Hypertension is usually related to stress, overweight, age or faulty diet.

Other heart related disorders are **atherosclerosis** and **arteriosclerosis.** Sometimes, especially if too much of fatty food is taken over a long period, there is a tendency for fat to deposit on the inner wall of the arteries. Such a deposit is called **atheroma** and the disorder **atherosclerosis**. This narrows the lumen of the arteries supplying the heart and consequently interfere in the functioning of the heart.

Also with age the wall of the arteries harden and lose their flexibility. Further, there may be deposits on the inner side of the walls of the arteries supplying the heart. This condition is **arteriosclerosis** and interferes with normal functioning of the

heart. To remedy the situation, the lumen of the arteries to the heart to be widened by placing a small piece of tube (stent). This is **ballooning angioplasty**. Sometimes the artery may have to be replaced and this treatment is called 'heart by-pass'.

ECG

Electrocardiograph is a machine which can record the heartbeat like a graph which is called **eletrocardio gram (ECG)**. From the ECG, the doctor can make out which chamber of the heart is not contracting or relaxing properly and suggest treatment accordingly.

INTEXT QUESTIONS 15.3

1. Fill in the blanks :

   (i) The clear colourless liquid flowing out of the blood capillary walls is called …..……

   (ii) Lymphatic system consists of …..……. lymph nodes and …..…….

   (iii) A number of …..……. are present in lymph nodes and attack bacteria

2. Give one example of lymphoid organ in your body …..…….....……

3. Give **two** examples of Immuno Deficiency Syndrome ….....…….

4. Name the **two** kinds of lymphocytes of your immune system …...…….

5. Name **two** heart related disorders

   (i) ..... (ii) .....

WHAT YOU HAVE LEARNT

- Circulatory system is of two kinds; closed and open type.
- Circulatory system consists of muscular pump (heart), tube like vessels (blood vessels) and circulating fluids (blood, lymph).
- Blood helps in transport of gases, collection of wastes, maintenance of body temperature and protection from diseases etc.
- Wave of contraction in the heart is conducted from S.A. node of A.V. node to bundle of HIS, to purkinje fibers.

- Blood vessels are arteries, capillaries and veins
- Superior and inferior venae cave bring deoxygenated blood to heart. Pulmonary vein brings pure (oxygenated) blood to the heart and arota supplies it to the body.
- Production of blood is called haemopoiesis which takes place in the bone marrow
- Blood consists of plasma and cell components RBC, WBC and Platelets
- In the A, B, O Blood group system, a person with blood group O is a universal donor and person with blood group AB is universal recipient.
- Rh factor is important in matching blood groups for transfusion as well as in the case of expectant mothers.
- Normal blood pressure for healthy person is 120 ± 5/75 ±5 mm of mercury and is measured by Sphygmomanometer.
- The colourless fluid moving out of capillary wall is called lymph
- Spleen an tonsils are examples of lymphoid organs and house lymphocytes (T-cells and B-cells)
- Body's ability to protect itself from harmful substances is called immunity

TERMINAL EXERCISES

1. Give one function of each of the following :
   (i) R.B.C.
   (ii) Platelets
   (iii) Plasma
2. With the help of a flow chart describe the steps involved in the coagulation of blood
3. Why is a person with blood group AB called universal recipient?
4. Differentiate between the systolic and diastolic pressures. What are the values of these pressures for a normal human adult?
5. Give **three** differences between lymph and blood.
6. What is immunity? Differentiate between active and passive immunity.
7. What are (i) hypertension and (ii) atherosclerosis?
8. What is an ECG and what is its function?

ANSWERS TO INTEXT QUESTIONS

15.1 1. Name the following
   (i) Prawn, insects etc
   (ii) Vertebrates like human, fish, birds
2. (i) Between left atrium and left ventricle
   (ii) Between right atrium and right ventricle
3. (i) Sino-atrial node (ii) capillaries (iii) pulmonary vein
4. Superior vena cava

15.2 1. (i) Haemopoiesis
   (ii) Ablumin, globulin and fibrinogen
   (iii) Platelets
2. (i) Blood transfusion
   (ii) Cell membrane of RBC; plasma
   (iii) Only from blood group O
   (iv) Sphygmomanometer, 120 + 5 / 75 + 5 mercury

15.3 1. (i) Lymph
   (ii) Lymph ducts and lymph vessels
   (iii) Lymphocytes
2. Spleen or tonsils
3. SCID and AIDS
4. T-cells, B-cells
5. Hypertension, atherosclerosis, arteriosclerosis (any 2)