Chapter 7

Blood Circulation

Points To Study:

7.1 Blood composition and blood groups
7.2 Blood donation and blood banks
7.3 Human Heart and blood circulation
7.4 Diseases due to blood infection

In the last chapters we have studied that we get energy by digestion of food. We have also learnt that during respiration living organisms take in oxygen (O_2) and give out carbon dioxide (CO_2). Have you ever wondered how this food, water and oxygen reaches to each and every cell of our body and simultaneously how excretory substances produced in various body parts are transported to the place from where these are expelled out. In this chapter we will study about the transport of substances in the animals. In our body, a red coloured fluid is present for transporting of substances, which is called blood. Blood oozes out when there is cut or injury on our body. Blood is found in all the vertebrate example- fish, frog, lizard, goat, human etc. What is the composition of blood? What is blood? Where is blood found in the body? And what is its importance for human life? Let us find out.

7.1 Blood composition and blood groups

Take a prepared slide of blood. Observe it under the microscope with the help of your teacher. What you see in the blood?

Human body has 2 parts-

i) Plasma in liquid form ii) Corpuscles in solid form

Let us study these parts of blood in detail.

Plasma : It is light yellow, clear, sticky, and transparent liquid substance. About 50-60 percent of blood is plasma. Generally it has 90%Water and 10% inorganic and organic substances. The blood plasma is alkaline in nature due to presence of inorganic alkaline salts.

Blood contains protein, glucose, fatty acids, hormones organic substances etc. Plasma keeps the fluidity of blood. That is why blood is called loose connective tissue.

Blood corpuscles :

About 40 percent of blood is formed of corpuscles. These are of the 3 types:

1. Red blood corpuscles or erythrocytes.
2. White blood cells or leucocytes (WBC).
3. Platelets or thrombocytes.

1. Red blood corpuscles : While observing the slide, you might have seen that some blood corpuscles are round, disc shaped, flattened at both the side and demucleated.

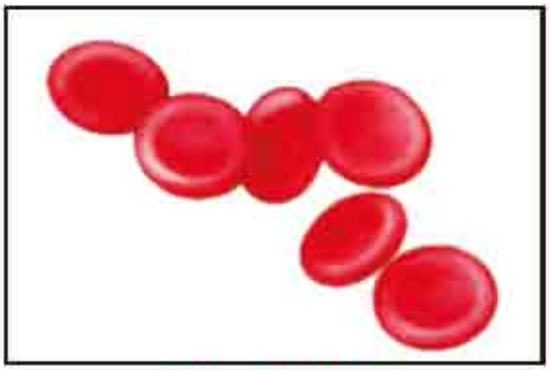

Fig. 7.1 RBC

Red blood corpuscles have a pigment called haemoglobin which provides red colour to the blood. Haemoglobin carries oxygen in the whole body in the form of oxyhaemoglobin. Red blood corpuscles are formed in bone marrow.

Functions of red blood corpuscles:

- Transportation of oxygen to every cell of the body.
- To maintain the body temperature constant.

2. White blood corpuscles: On the blood slide, there are comparatively larger and nucleated corpuscles , called white blood corpuscles. These are irregular in shape like that of Amoeba. They do not have any pigment and thus they are colourless. Their number is less as compared to red blood corpuscles. These corpuscles have many functions in the blood. These are also called the soldiers.

Fig. 7.2 WBC

Functions of white blood cells:

- Their function is defensive. They destroy the infective pathogens or parasites and keeps the body healthy.
- They clean up the blood by phagocytosis of dead and damaged cells.

3. Blood Platelets or Thrombocytes : Blood Platelets are small in size, enucleatedand irregular. Their number is also less in blood. Like RBC, these are also formed in bone marrow.

Functions of Blood Platelets:

Fig 7.3
Blood platelets

- Their main function is to help in clotting. It controls the blood flow during any injury.

We often came to hear or read through T.V. or newspaper, about the road accidents. Sometimes we even come tosee such accidents live. During these accidents, excessive blood loss occurs from the body of injured person, so he needs blood immediately. Every person has a different blood group. They are provided with the related blood from the blood bank. what are blood groups and blood bank? Let us try to find out:

Blood Groups: A scientist named Karl Landstiener(1868-1943), for the first time gave the concept of Blood Groups. It came to know that the blood group of the donor and the recepient should be the same. Donor is one who gives the blood and the recepient is one who gets the blood. If unknowingly blood of a different blood group is transfused to a patient, then blood gets clotted and blood flow gets hindered. In this case the recepient may even die. Why the recepient dies on the transfusion of wrong blood group?

Let us try to find out-

After the knowledge of blood groups, it was found that, blood has two types of protein-

(1) Antigen (2) Antibody

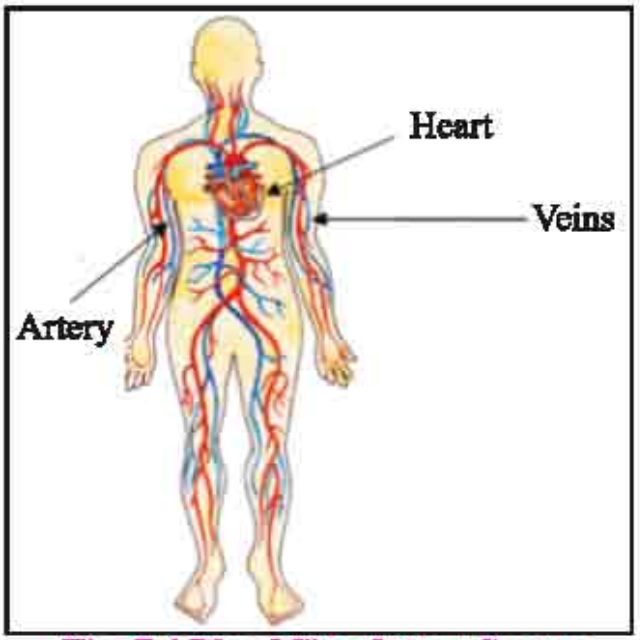

Fig. 7.4 BloodCirculatory System

(1) Antigen

Two types of antigens are found in human blood: antigen A and antigen B (these are represented as 'A' and 'B')

(2) Antibody

Like Antigens, Antibodies are also of two types- antibody 'a' and antibody 'b' (these are represented as 'a' and 'b'.)

Blood clots in the body is only possible when antigen A and antibody a or antigen B and antibody b are present simultaneously. This clotting of blood hinders the blood flow in blood vessels.

On the basis of presence of these antigens in blood, Karl Landstiener classified human blood in four groups A,B,AB and O which are shown in Table 7.1.

Table 7.1 Human blood groups

S.No.	Blood group	Antigen	Antibody
1.	A	A	b
2.	B	B	a
3.	AB	A and B	None
4.	O	None	a and b

Importance of blood groups: Knowledge of blood groups proved as a boon for the society in the form of blood donation. This made it easy for people to have blood of suitable group during accidents or diseases from blood blank or registered voluntary blood donors.

Blood groups are also of importance in the field of law and judgement. Criminals can be identified on the basis DNA test obtained from blood.

If a person has blood deficiency then it can be recovered by transfusing the matching blood groups. This technique is called Blood Transfusion. In this process the blood groups of donor and recepient are matched and then transfused as shown in table 7.2.

Table 7.2 Information about blood transfusion.

Donor blood group	Recepient's blood group			
	A	B	AB	O
A	✓	x	✓	x
B	x	✓	✓	x
AB	x	x	✓	x
O	✓	✓	✓	✓

Note: The symbol ( )means that blood can be given and the symbol (X) means that blood can not be given.

Observing table 7.2 we can say that recipient having blood group AB can take blood from people having any type of blood group while donor having blood group O can give blood to people having any type of blood group. On this basis we can say that person with AB blood group is universal recipient and person with blood group O is universal donor.

7.2 Blood donation and blood bank.

During accidents, excessive blood loss takes place which causes blood deficiency in the body of injured person. So he needs blood. Always try to take blood from the relatives as it is easy to have desired blood group. But if this is not possible then try to get it from the blood bank. The government has opened blood banks in every district hospital. Some public welfare organisations have their own private blood bank. To keep the blood in blood bank properly, preserved sodium citrate is added to it. Blood can be kept in blood bank safely for 30 days

The place where blood is stored safely is called a blood bank

Fig 7.5 Blood Donation

Fig 7.6 Blood Bank

To maintain the continuity of blood in the blood bank, blood donation is required. Blood tests are carried out for the donor's blood. If he is suffering from a serious disease, then his blood is not accepted. Blood donation camps are organised to collect the blood. Red Cross society, all government hospitals and big private hospitals have facilities to collect blood. When required, blood of desired blood group is made available to the the injured person or patients from these blood banks.

Also know this:

Who can donate blood?

Any male or female can donate blood :

1. Who is of the age 18 years to 60 years.
2. Who is of the weight above than 45 Kg.
3. Who is not suffering from the serious diseases like AIDS, Hepatitis B or C, Syphilis, Malaria or any other such disease.
4. Who has not donated blood since last three months.
5. Who has not gone through a surgery in last six months.
6. Whose haemoglobin is more than 12.5.
7. Whose blood pressure is normal.
8. Whose body temperature is 37.5 o and pulse rate is normal.
9. Female who is not pregnant.

Points to be noted after blood donation

1. Intake of liquids like juice, milk etc. within 24 hours of blood donation.
2. No physical exercise or hard work upto 24 hours of blood donation.

Functions of blood:

- Blood transport oxygen and carbon-dioxide to the body.
- Blood transport nutrients and excretory substances.
- Protects our body from diseases from destroying the foreign virus and bacteria.
- It made a blood clot while an injury thus prevents blood flow.
- It transports other substances like homones, antibodies etc.
- Maitains the body temperature.

Blood is transported by heart and blood vessels. Now we will study the blood vessels and working of heart.

Blood vessels: Body has various types of blood vessels which transports

blood from one place to another. The two types of blood vessels are-

(1) Artery (2) Vein

Artery: Arteries carry the oxygenated blood from heart to all the parts of the body. As the blood flows fast and in high pressure, therefore, the walls of arteries are thick and flexible. Arteries divide into many small vessels to reach tissues and there they get divided into much thinner tubles called capillaries.

Veins: The veins collect the blood containing carbon dioxide from all the body parts and bring it to the heart. The walls of veins are thin as compared to the arteries. Veins have valves which allow the blood only towards the heart.

The capillaries in the tissues again combine to form veins which carry blood to the heart. Let us do an activity to experience the blood flow in arteries.

Activity 1

Place index and middle fingers of your right hand on the inner part of your left wrist as in fig. 7.7. Do you feel any beating sound? Why there is such beating? This beating is called pulse and it is due to the flowing blood in the arteries. How many times beating takes place in a minute? How many pulse have you counted? The number of pulse per minute is called pulse rate. A healthy person has pulse rate of average 72 pulse per minute. Find out other body parts where you can feel the pulse. Like an example given in table 7.3, fill in the table by writing pulse rate of your friends.

Fig 7.7
Pulse rate

Table 7.3 Pulse rate

Name of the student	Pulse rate
Shashank	75

This pulse is due to the beating of heart. Let us find out the structure and function of heart.

7.3 Human heart and blood circulation

Heart is an organ that functions like a pump to transport substances by blood. It beats continuously.

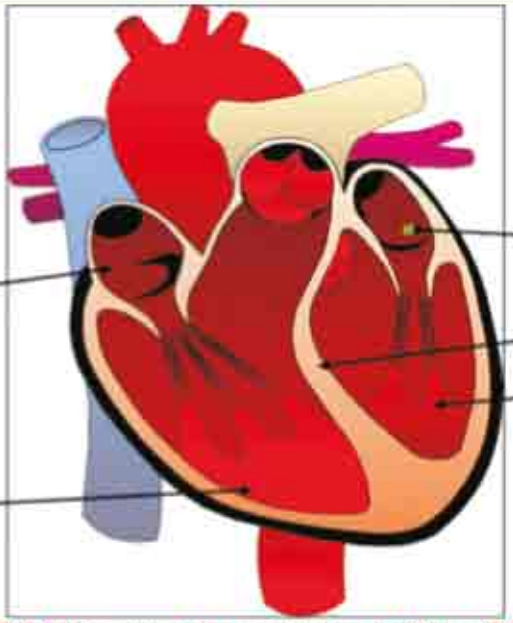

Fig7.8 Diagrametic representation of Heart

Just imagine of a pump that works for years nonstop. It appears to be impossible. But still our heart pumps the blood nonstop for life long. Let us find out more about the heart.

Heart is present in the thoracic cavity. Fold your fingers inside to form fist. Your heart is of the size of your fist.

What happens if oxygenated and deoxygenated blood mix together in heart? To avoid such condition heart is divide into four chambers. The upper two chambers are called auricles and the lower two chambers are called ventricles. The division between chambers prevents the mixing of oxygenated and deoxygenated blood. Heart contracts and expands respectively and thus the blood is pumped into the vessels. The blood from the various body parts enter into the heart via veins which contains more of carbon dioxide and is called impure blood. The impure blood from the heart goes into the lungs and becomes oxygenated. This oxygenated blood re-enters the heart and then to the cells of various organs of the body.

One contraction and one expansion of heart is called heart beat.

Doctors get an idea of health of a person by counting his pulse rate or heart beat.

Also know this-

In 1816 a doctor named R. Laennec in France invented stethoscope used to measure heart beat.

Fig 7.9 Stethoscope

Let us learn to make a model of stethoscope with the materials available near by.

Activity - 2

Aim: To measure heart beat and compare heart beats of different people.

Materials required: Watch with second's needle, paper, pen, funnel, rubber tube.

Process: Connect funnel with the long rubber tube. Place open end of the tube on the ear and funnel on the heart. We can hear a sound on listening carefully. This is the heart beat. It can also be felt by placing thumb on the wrist. Count the number of heartbeats in a minute by watching the watch and list it down.

Fig7.10 man made Stethoscope

The pulse rate or heartbeat changes according to the age. This can be better understood by following table.

Table 7.4 Pulse rate according to the age

Age	Pulse rate (approx.)	Age	Pulse rate (approx.)
1year	120 times	2 years	110 times
3 to 6 years	95 times	7 to 13 years	80 to 85 times
Young age	70 to 80 times	Old age	60 to 70 times

Have a look at this : A doctor named William Harvey (1518- 1657) discovered blood circulation. He was awarded for this and was called circulator.

7.4 Diseases caused by Blood infection :

Deficiency of blood or infection in blood causes many diseases like: Anemia, polycythenia, Blood cancer, Hepatitis B, AIDS etc.

AIDS is spreading as an epidemic in India and is still incurable. Its virus is called HIV. It is an incurable syndrome. Prevention is the cure.

Do you know?

- 1st December is World's AIDS Day.
- AIDS can be detected by ELISA test.
- Full form of AIDS is Acquired Immuno Deficiency Syndrome.
- AIDS is spread by HIV virus.

What have you learnt

- The blood flowing in the body of organisms is red due to the presence of haemoglobin pigment.
- Blood has plasma, Red blood cells (RBC), White Blood cells (WBC) and Platelets. (thrombocytes)
- Heart of an adult person beats on an average of 72 times per minute, called heart beat.
- Arteries take pure blood from the heart to all parts of the body.
- Veins bring back impure blood from all the body parts to the heart.
- Blood transports Food, hormones and gases.
- Scientist named Karl Landsteiner discovered blood groups.
- Contraction and expansion of heart is called heart beat. It is measured by Stethoscope.
- Blood infection causes diseases like AIDS, anemia, poly cythenia,hepatitis etc.
- Blood has four groups A,B,AB,O.
- AIDS is spread by HIV virus.

EXERCISES

Mark the correct option:

1. Amount of water in the blood plasma is about:
   a) 70% b) 90%
   c) 10% d) 45% ( )
2. Red blood corpuscles are also known as :
   a) RBC b) WBC
   c) Platelets d) Pulse ( )
3. Which of the following causes red colour of the blood?
   a) Fibrin b) Antigen
   c) Haemoglobin d) Platelet ( )

4. How many times does the heart of an adult man beats?
   a) 50 times b) 72 times
   c) 110 times d) 120 times ( )

Fill in the blanks:

1) _____ kills the bacteria that enters into the body.
2) There are _____ groups of blood.
3) Impure blood is brought back to the heart by _____
4) Blood containing carbon dioxide is purified in the _____

Answer in one word:

1) Name the corpuscles that clots the blood.
2) What keeps the blood in liquid form?
3) How many chambers are there in the heart?
4) How many types of antigens are there?

Short answer type questions:

1) Name the various blood vessels.
2) How many types of blood corpuscles are there?. Name them.
3) Why are White blood cells called the soldiers of body?
4) Write the functions of blood.
5) What will happen if clot is not formed on injury?

Long answer type question:

1) Describe the structure of heart with diagram.
2) Write a short note on
   a) Blood group b) Blood Bank

Activity work:

1) Visit blood bank near your area and check your blood group.
2) Make a chart of blood groups.
3) Make a chart of heart with the help of thermocole or hardboard.
4) Make a modal of stethoscope.
5) How many times your heart does beats in a minute, calculate.
6) There is no harm in blood donation. Find out the importance of blood donation from a doctor, make a list and paste in your classroom.

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