

### Blood circulation in human body

Roshani's grandfather was suffering from knee pain. When he consulted the doctor and started taking medicine, the problem was reduced. Based on this context, discuss the following questions in class:

- i. How does the medicine taken orally reach the knees?
- ii. Which body system is involved in this process?
- iii. What is the main organ of this system?

#### Observe the picture and discuss:

- i. What happened to the man in the picture?
- ii. How can this patient be helped in this situation?

There are various organ systems in the human body. Each system performs function of its own.



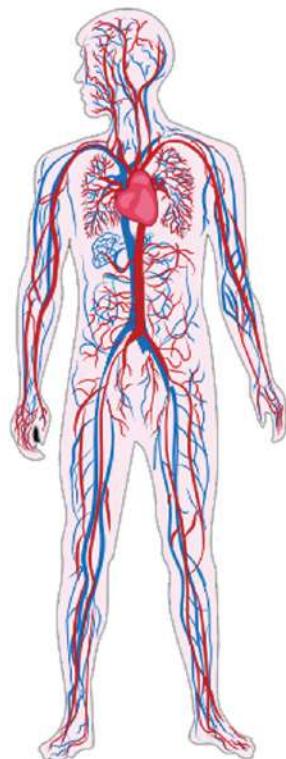
Figure 5.1

In digestive system, food is digested and converted to simpler and soluble forms. These simplest forms, such as glucose, are transported to every cell of the body by the help of circulatory system. In the same way, oxygen, medicine, and hormones are transported from one part of the body to another. Blood circulation has main role in the transportation of substances in the human body. Blood is composed of blood corpuscles and plasma and it flows in the single direction in our body due to the pressure created by the pumping action of heart. Such a pressure created by heart is blood pressure which can be felt in the artery. Sometimes, blood pressure may be high than the normal due to various factors. Various problems in the heart are because of high blood pressure and by the deposition of cholesterol on the wall of artery and the heart. There are various modern technologies for the treatment of heart problems. For example, Angioplasty, open heart bypass surgery, etc. There are four blood groups in human body which include A, B, AB, and O, and each group can be either Rh positive or

Rh negative, hence there are altogether eight blood group including Rh positive and Rh negative.

## 5.1 Human blood circulatory system

The blood circulatory system is one of the nine systems in the human body. This system also connects with other systems. The chief organ of the blood circulatory system is the heart which pumps the blood collected from various parts of the body. The blood pumped by the heart flows through blood vessels and it reaches all cells of our body. It transports nutrients and inhaled oxygen to all the cells of the human body. Similarly, blood carries carbon dioxide produced in the cells to the lungs and other wastes to excretory organs. Heart, blood vessels, and blood are the main parts of the circulatory system.



**Figure 5.2 Human blood circulatory system**

## 5.2 Blood

About 5.5 litres of blood is present in the body of a healthy adult person. Blood transports essential nutrients, oxygen, hormones, etc. to all the cells of the body. It also transports unnecessary harmful wastes to the excretory organs. Blood is alkaline in nature, and its pH value ranges from 7.35-7.45.

### Structure of blood

#### Activity 5.1

**Objective:** To study the components of blood

**Material required:** Compound microscope, permanent slide of blood smear

#### Method

- i. Observe the permanent slide of blood smear under a compound microscope.

- ii. Observe in high power to identify all the components of blood.
- iii. Draw a neat diagram of all the components of blood that you have seen.
- iv. Based on observation, discuss the structure of blood inside the class.

Blood is the red-coloured connective tissue that is a thick fluid. It consists of 55% plasma and 45% blood cells. Blood contains three types of blood corpuscles or blood cells. They are Red blood cells, White blood cells, and Platelets.

### Plasma

Have you ever seen blood being collected after a goat is cut? After some time, the collected blood coagulates and is separated into a water-like liquid. This liquid part is known as plasma. It comprises 55% of total blood volume.

Plasma is pale yellow coloured transparent liquid. It is composed of 80%-90% water and 10-20% dissolved substances such as carbohydrates, proteins, fats, and salts. Additionally, three types of proteins, namely albumen, globulin, and fibrinogen are also found in plasma.

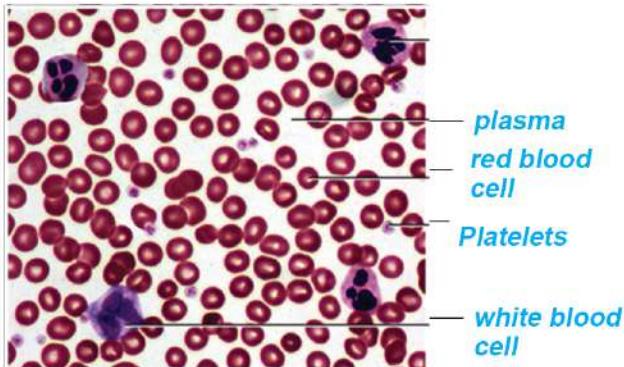


Figure 5.3 Composition of blood

### Functions of plasma

1. It regulates the amount of water in the blood.
2. It transports nutrients and unnecessary wastes from one place to another.
3. Plasma also transports enzymes and hormones secreted by glands to various parts of the body.
4. Fibrinogen present in plasma helps in the clotting of blood.
5. Plasma regulates the temperature of our body.

- It also maintains the chemical composition of blood and its pH.
- When fibrinogen is removed from plasma, it is called serum. Serum is used to diagnose various diseases.

## Blood corpuscles

### a. Red Blood Cell

Red blood cells are red coloured, biconcave, round shaped and without nucleus. They are also called erythrocytes. These cells contain a pigment called haemoglobin, which makes blood red. Haemoglobin is made up of iron and a protein called globin. Iron present in haemoglobin is responsible for the transportation of abundant oxygen to the cells. Haemoglobin also transports carbon dioxide produced by the cells to the lungs. Haemoglobin combines with oxygen to form oxyhaemoglobin, and with carbon dioxide to form carboxy-haemoglobin.

Number of red blood cells ranges from about 45 lakhs to 50 lakhs per cubic millimetre of blood. Their life span is 90-120 days. About 20 lakhs red blood cells are formed per second and the same number are destroyed. Red blood cells are formed in the bone marrow of spongy bone and are destroyed in the liver and spleen. A deficiency of red blood cells in the blood leads to a disease called anaemia. An anaemic person feels tired even after a short walk. Similarly, excess red blood cells in the blood causes a disease called polycythemia. The process of formation and destruction of red blood cells occurs in the body throughout life. Iron produced after the breakdown of old red blood cell is reused.



Figure 5.4 Red blood cells

### b. White Blood Cell

White Blood Cells have no definite shape but they are larger than red blood cells. They possess nucleus and other cellular components, but they do not have haemoglobin. They are also called leucocytes. White blood cells are of two types: granular and non-granular. White blood cells that contain granules (non-living particles) in their cytoplasm

are called granular leucocytes. Neutrophil, eosinophil, and basophil are granular leucocytes. White blood cells that do not contain granules (non-living particles) in their cytoplasm are called non-granular leucocyte. Lymphocytes and monocytes are non-granular leucocytes.

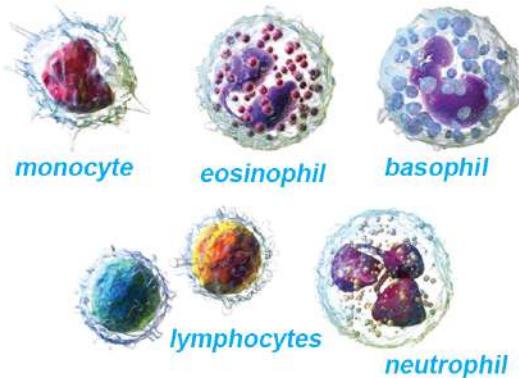


Figure 5.5 White blood cells

The lifespan of white blood cells is about two weeks. Number of white blood cells ranges from about 4 thousand to 11 thousand per cubic millimetre of blood. They are formed in bone marrow and are destroyed in the spleen. When there is an abnormal increase in the number of white blood cells in the blood, then they destroy other blood cells, resulting in a disease called leukemia or blood cancer.

White blood cells fight against disease-causing germs that enter the body from outside and destroy them. So, these cells are referred to as the soldiers of the human body. These cells increase the immunity of our body. An abnormal decrease of white blood cells leads to a disease called leukopenia.

### c. Platelet

Platelets are the smallest-sized, round, and non-nucleated blood cells in the human body. They are microscopic blood cells. Per cubic millimetre of blood contains about 2 to 4 lakhs platelets.

They are formed in the red bone marrow. Their life span is about 2 to 3 days, and they are also destroyed in the spleen. Platelets combine with fibrinogen to clot blood during cut and injuries. Blood will not clot even in small wounds or cuts if the platelet count becomes low. This is called haemophilia. An abnormal increase of platelets in blood results in thrombocytosis, which causes heart attack and stroke.

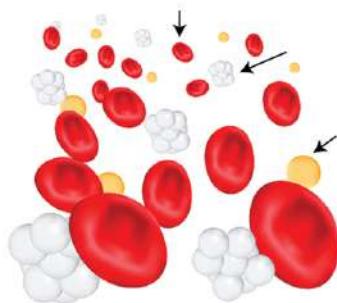


Figure 5.6 Platelets

## Functions of blood

### 1. Transportation

Blood transports carbon dioxide and oxygen to the required sites. It also transports nutrients, enzymes, hormones and other essential substances from one part of the body to the other parts.

### 2. Regulation

Blood regulates the temperature of the human body. It also controls the amount of water, salts, etc. in the body in a constant amount.

### 3. Protection

White blood cells in blood protect us from various infectious diseases by fighting against germs. Similarly, platelets in blood help to stop bleeding at injuries and cuts. Antibodies, which maintain the immunity of our body, are produced in the blood.

## 5.3 Blood group

**Activity 5.2** Keeping the record of human blood group

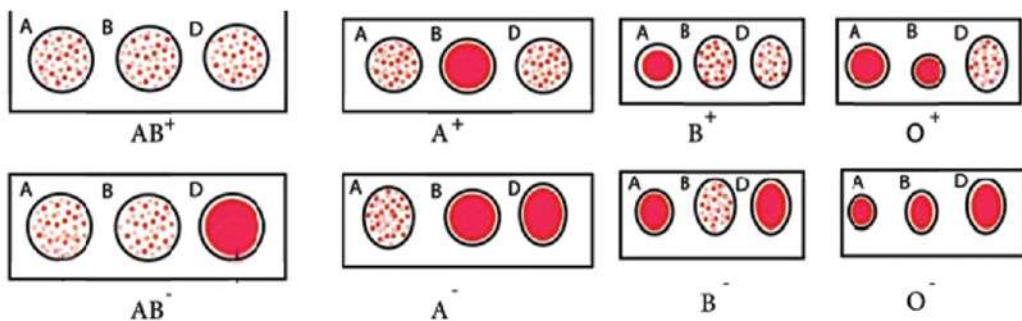
**Objectives:** To make a record of the blood group of students of class ten

**Materials required:** Chart paper, pencil and marker

### Method

1. Take a chart paper.
2. Make a table in the chart paper as shown below.
3. Fill the information of the blood group of each student of your class in tabulated form and paste it on the board.

S.N.	Name of students	Blood group
1.		
2.		
3.		



**Figure 5.7 Test of human blood group**

In the red blood cell (RBC) of human blood, various types of antigens are present. Antigen A and antigen B are found on the surface of RBC of blood. Human blood grouping is based on the inheritance of these red blood cells. On the basis of presence or absence of antigen on the red blood cell, blood is distinguished into different blood groups, such as A, B, AB and O. So, a human blood group may be type A, type B, type AB or type O. Blood which contains antigen A on the surface of red blood cell is called type A blood group. Type B blood group is the blood which contains antigen B. If the surface of RBC contains both antigen A and antigen B, it is called type AB blood group. If the surface of RBC does not contain any antigen, antigen A or antigen B, then it is called type O blood group. Blood group O is the most common blood group in the world. Apart from antigen A and Antigen B, blood may also contain D antigen or Rh factor (Rh factor).

Blood group is either positive or negative on the basis of presence or absence of D-antigen or Rh factor. If Rh factor is present, it is positive and if Rh factor is absent, it is negative blood group. If a person has blood group A+ve, his/her blood contains both the antigen A and Rh factor on the RBC. For example, if a person's blood does not contain any antigens, it is O-ve blood group. Blood group should be confirmed before blood transfusion. If a patient is given blood that does not match their blood type, intra-venous clumping can occur in the patient's blood which is fatal. Therefore, before donating blood to the patient, it is important to check whether the patient's own blood and donor's blood are compatible or not.

## **Project work**

Organize a visit to the health post near your school with the help of your science teacher to collect materials related to blood and blood circulation system. If you are unknown of your blood group, then test your blood there. Based on the collected materials, prepare a report on human blood and blood circulation. Take help from the internet if required. Present the report in the classroom and discuss.

### **5.4 Heart**

#### **Activity 5.3 Observation of heart**

**Objective:** To observe the heart and draw it.

**Materials required:** Heart of a goat or buffalo, dissection tray, dissection box, chart paper, etc.

#### **Method**

- i. Take a heart of goat or buffalo from a butcher's shop.
- ii. Wear gloves and observe the structure of the heart thoroughly.
- iii. Identify all its external parts with the help of your teacher.
- iv. Draw its external structure on the chart paper.
- v. Now put that heart on a dissection tray.
- vi. Take a vertical section of it by cutting in a vertical plane.
- vii. Observe and identify the internal parts of it with your teacher.
- viii. Draw its internal structure on the chart paper.
- ix. Discuss the structure of the heart in the classroom. Take the help of your teacher if required.

The heart is the central organ of the circulatory system. It pumps blood to each cell and tissue of our body. The heart is made up of cardiac

muscle and is situated inside the thoracic cavity, between two lungs. It is slightly tilted towards the left side. The heart is enclosed within a double-layered protective membrane called pericardium. The space between these two layers is filled with fluid, called pericardial fluid. It protects the heart from external shocks and injuries. The size of the human heart is the size of the owner's closed fist, and it weighs about 300 grams on average.

The heart is a triangular or conical muscular organ composed of cardiac muscles. It contracts and expands regularly to pump blood throughout the body. Blood is pumped through blood vessels and reaches each cell and tissues of body. About two-thirds of the heart lies to the left of thoracic cavity. A hair-like, very fine network of capillaries surrounds the heart. The coronary artery supplies oxygenated blood to the heart, while the coronary sinus vein transports deoxygenated blood to the right auricle of heart.

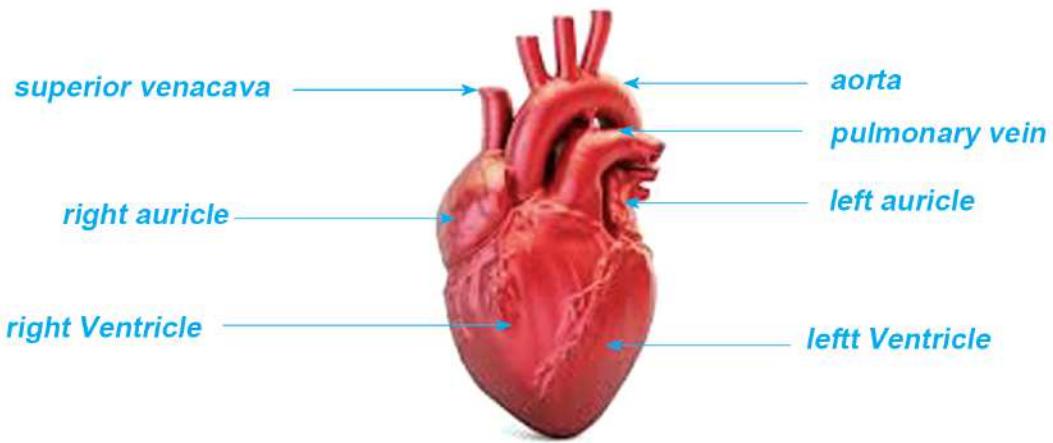


Figure 5.8 External structure of human heart

## Internal structure of the heart and blood circulation

The human heart is four-chambered. The upper two chambers are called auricles or atria, while the lower two are called ventricles. There is a thick muscular septum in the middle of the heart that divides the heart into left and right parts and also prevents the mixing of oxygenated and deoxygenated blood in the heart. The four chambers

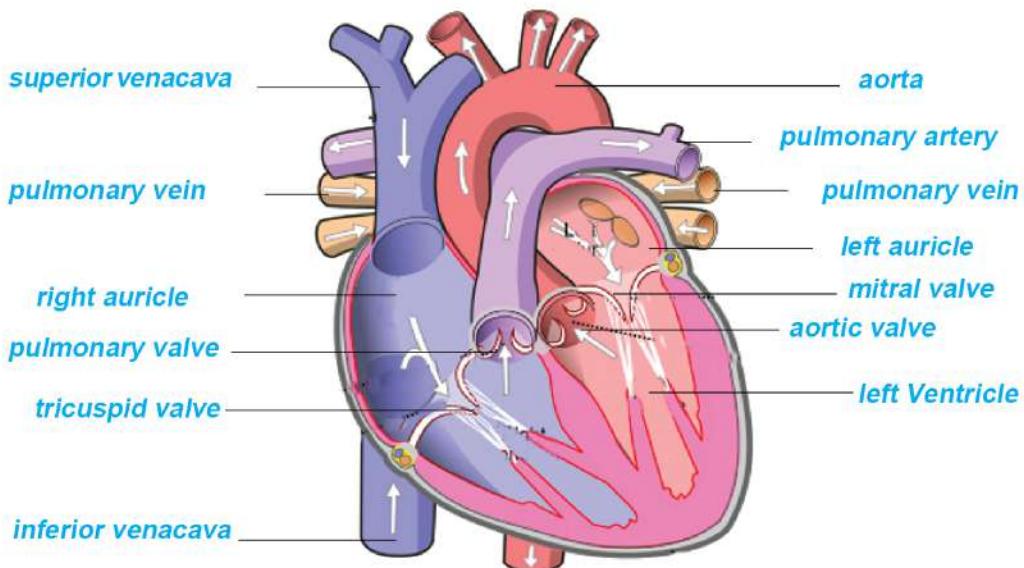
in the heart are named right auricle, right ventricle, left auricle, and left ventricle. Blood vessels are connected to these chambers through which the heart supplies and receives blood. The auricles receive blood from various parts of the body, but the ventricles send blood to various body parts. The heart pumps blood to different part of the body with great pressure. To withstand such pressure, the walls of the ventricles are thicker than those of auricles. The right ventricle pumps blood only up to the lungs, but the left ventricle pumps blood to various organs with great pressure. Therefore, the wall of the left ventricle is thicker than the wall of the right ventricle.

The blood vessels that bring deoxygenated or impure blood to the right auricle of the heart are the superior vena cava and inferior vena cava. The superior vena cava brings impure blood from the upper parts of the body, while the inferior vena cava brings impure blood from the lower parts of the body. When the auricles contract, impure blood from the right auricle is passed to the right ventricle, and pure blood from the left auricle to the left ventricle. The pulmonary artery transports deoxygenated blood to the lungs for oxygenation, while the pulmonary vein transports oxygenated blood to the left auricle of the heart. The only artery that transports oxygenated blood in the human body is the pulmonary artery, and the vein that transports oxygenated blood is the pulmonary vein. After the pure blood is passed from the left auricle to the left ventricle, blood from the left ventricle is pumped to various parts of the body through the aorta.

There are four valves in the heart. The valve situated between the right auricle and right ventricle of the heart is called the tricuspid valve. By opening this valve, blood passes from the right auricle to the right ventricle. The valve situated between the left auricle and left ventricle of the heart is called the bicuspid valve or mitral valve.

Pure blood from the left auricle flows to the left ventricle by opening this valve. Both valves open simultaneously when the auricles contract together, and the contraction of the auricles is followed by the contraction of both ventricles. When the right ventricle contracts, the tricuspid valve is closed, and the pulmonic valve between the right ventricle and pulmonary artery opens, and deoxygenated blood is pumped to the lungs through the pulmonary artery for oxygenation.

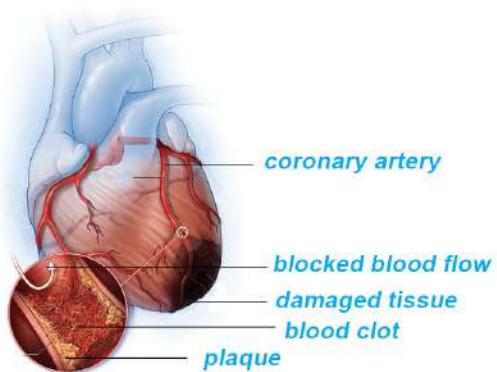
Similarly, when the left ventricle contracts, the bicuspid valve is closed, and the aortic valve between the aorta and left ventricle opens, and oxygenated blood is pumped to the various organs of the body through the aorta.



*Figure 5.9 Internal structure of the human heart*

## 5.5 Heart attack

In general, the process that continues in the heart is blood coming to the heart from various parts of the body, and blood going to various organs from the heart. But sometimes, the flow of blood to the heart tissues is suddenly reduced or blocked, and in this situation, the heart cannot do its work properly, and the person feels extreme difficulty. This condition is called heart attack. This is a serious and emergency condition.



*Figure 5.10 Condition of a heart attack*

This problem may arise when the coronary artery that supplies pure blood to the heart becomes narrower due to the excess deposition of fat or cholesterol on the inner wall of the artery. Such a deposit of fat or cholesterol on the inner wall of the artery is called plaque. Sometimes, these plaques break down and form thrombi, which may also block capillaries, damaging certain tissues of the heart. A heart attack is also called myocardial infarction, and immediate treatment is required to save the life of a person suffering from a heart attack.

## Risk factors of heart attack

### Age

Male above 45 years and female above 55 years of age are at the risk of heart attack than the youths.

### Consumption of tobacco products

Chewing tobacco and its products and smoking cigarettes are also the causes of heart attack.

### High blood pressure or hypertension

A person whose blood pressure is high for a long time is also at the risk of heart attack.

### High cholesterol and triglycerides

Arteries become narrower due to the deposition of high level of bad cholesterol on their inner wall. Such cholesterol resists the flow of blood through the artery and increases the chance of a heart attack. Similarly, high levels of triglycerides in the blood also increase the risk of heart attack.

### Diabetes

Diabetes is a disorder in which blood sugar level increases in the body. This condition also increases the risk of heart attack.

## **Family history**

If someone has a family history of heart attack, s/he is also at risk of heart attacks.

## **Lack of regular exercise and unhealthy diet**

Consumption of foodstuffs containing more trans-fat, salt, and sugar, animal fat, and processed foods and lack of regular exercise also increases the risk of a heart attack.

## **Stressful life**

Emotional stress, like excessive anger or excessive negative thinking, etc. also increases the risk of a heart attack.

## **Consumption of illegal drugs**

Habits such as taking drugs like cocaine and amphetamines as stimulants affect the coronary artery and increase the chance of a heart attack.

## **Symptoms of a heart attack**

Symptoms of a heart attack vary among people. General symptoms of a heart attack are given below:

- a. Sudden pain and discomfort in the centre of the chest which slowly spreads to shoulder, hand, neck, jaw, and sometimes the stomach
- b. Cold sweat, fatigue, shortness of breath
- c. Headache or sudden dizziness, nausea
- d. Some people have sudden heart attacks. But most people experience warning signs of a heart attack a few hours, days, or weeks earlier, such as: regular discomfort or pressure in the chest region that does not get reduced even after taking a rest. These are the initial symptoms and insufficient blood flow to the heart tissues may be the cause of discomfort in the heart.

## **Preventive measures**

- a. Maintain healthy lifestyle.
- b. Do not consume alcohol and give up smoking.
- c. Keep a healthy body weight.
- d. Consume a healthy and balanced diet.
- e. Exercise regularly.
- f. Manage the stress.
- g. High blood pressure and diabetes increases the risk of heart attack. So, these conditions should be treated and managed.
- h. Go for regular health check-ups.

## **Diagnosis of heart attack and treatment**

For the diagnosis of a heart attack, the blood pressure, pulse, and temperature are checked. Diagnosis also involves overall tests related to the heart, heartbeat, etc.

A heart attack is tested using various techniques, including Electrocardiogram, blood test, Echo, Angiography, CT Coronary Angiogram, and MRI.

### **Angiography**

Angiography is a type of fluoroscopy X-ray used to test blockages in blood vessels. In general, X-ray images of blood vessels are not viewed clearly. However, in this process, a special dye called contrast medium is injected into the blood. This process highlights blood flow and provides a clear view of problems in blood vessels. The X-ray image formed in angiography is called angiogram.

During a heart attack, many tissues of the heart are destroyed per minute. So, immediate treatment is essential to restore blood flow and oxygen levels. For this, immediate supply of oxygen to the patient is required. Especially, the treatment of a heart attack depends on whether there is a partial or complete blockage of blood flow. The

patient should be immediately taken to the hospital for treatment, where doctors' instructions are followed. In general, when angiogram and angioplasty equipment are not available, doctors start treatment by using blood thinners. In places where angiogram and angioplasty are available, a surgical procedure is required to open the blocked artery.

Medical procedures such as Coronary angioplasty and stenting, coronary artery bypass surgery, etc., are used to open blocked arteries.

### Coronary angioplasty and stenting

This medical procedure is used to open the clogged coronary artery of the heart, also called percutaneous coronary intervention (PCI). During angioplasty, a cardiologist puts a long, thin, flexible tube called a catheter into a blood vessel of the hand or leg and guides it to the narrowed artery of the heart. A stent (a small metal mesh tube) is often placed during angioplasty. The stent helps to open narrowed or blocked blood vessels and normally widens the blood vessels and stays open. The stent may be coated with a medicine.

### Coronary artery bypass surgery

This is also called open-heart surgery and is the emergency surgical procedure adopted during a heart attack. This method involves surgery by taking a healthy blood vessel from the leg area and making a new pathway to improve blood flow to the heart muscle. Then, heart tissues get nutrient and oxygen-rich blood through a new pathway.

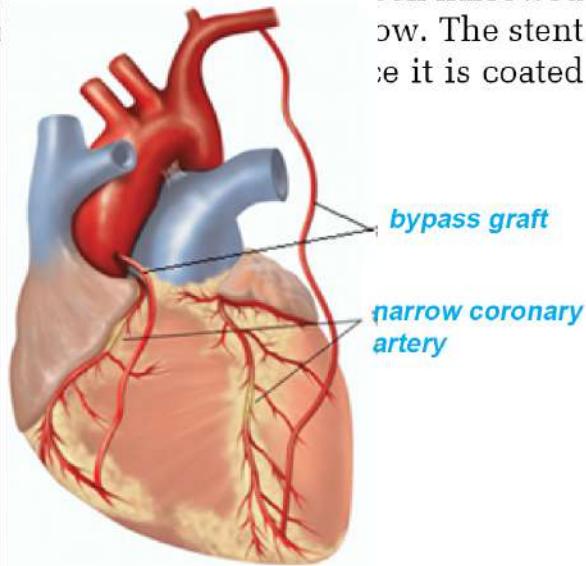


Figure 5.11 Coronary artery bypass surgery

## **Project work**

Use the internet to learn about angiography and open-heart surgery and prepare PowerPoint slides for a presentation in class and discuss.

### **5.6 Heart beat, pulse rate or heart rate**

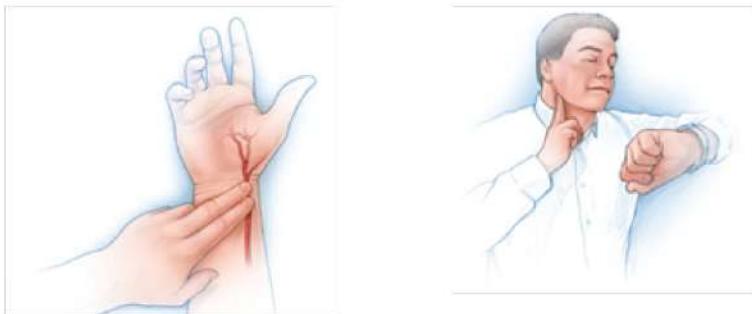
A heartbeat is the sound of the heart due to the regular and rhythmic contraction and relaxation of the heart muscle. Heartbeat varies with the physical condition of the body. A stethoscope is the device used to measure heartbeat. At resting condition, heartbeat of a healthy adult person is 60-100 times per minute. This is called the heart rate. A slow heartbeat, which is less than 60 times per minute, is called bradycardia or slow heart. A fast heartbeat, which is more than 100 times per minute, is called tachycardia or fast heart.

Because of the regular and rhythmic contraction and relaxation of the heart muscle, blood is pumped to various cells and tissues through arteries. While blood is flowing through the artery, the pressure exerted by blood on arteries can be felt from the outside. This is called the pulse. In general, heart rate and pulse rate are equal. So, these terms are used synonymously. In a healthy adult person, the normal pulse rate ranges from 60 to 100 times per minute. With the help of the fingers placed on the throat or arm, pulse rate of a person can be felt.

#### **Activity 5.4 Measurement of the pulse rate**

**Objective:** To measure pulse rate

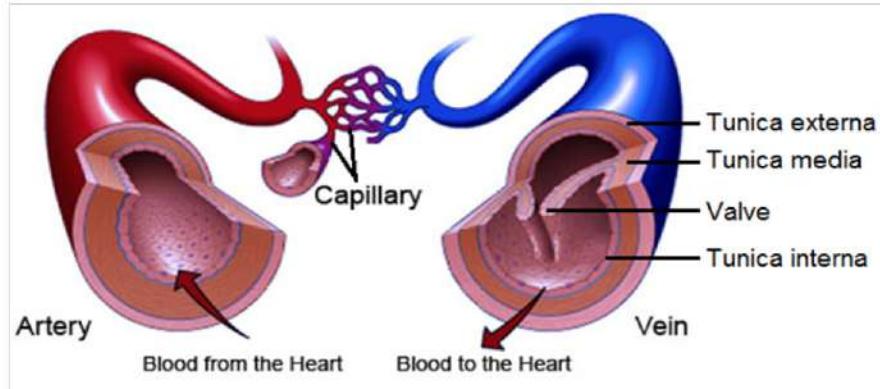
1. Sit in a normal posture.
2. Place two fingers on the thumb side of your arm where radial artery is situated between radius bone and tendon. Feel pulse of this artery carefully. Count the number of beat or pulse for one minute. Record the pulse rates of your classmates in the same manner. Compare the data and discuss.
3. Similarly, place your finger on the carotid artery located beneath your lower jaw and measure your pulse rate.



**Figure 5.12**

## Blood vessel

Blood vessels are the flexible, muscular tubes which transport blood to various cells and tissues of the body. Arteries, veins, and capillaries are the three types of blood vessels.



**Figure 5.13 Types of blood vessels**

## Artery

The blood vessel that transports blood from heart to the various parts of the body is called an artery. Arteries are highly muscular blood vessels. Such muscular wall helps to withstand the pressure of blood. There are no valves in arteries. The aorta is the largest artery in the human body, and it divides to give off numerous small arteries. Arteries, in turn, divide to give off arterioles. Each arteriole, again, divides to form a fine network of blood capillaries.

## Capillaries

Arterioles divide to form a network of fine, thread-like or hair-like

blood vessels called capillaries. Blood capillaries supply nutrients, oxygen, hormones, enzymes, etc. dissolved in blood to the cells and receives the wastes like carbon dioxide, urea and other unnecessary substances produced in the cells to transport them up to excretory organs. After receiving wastes from the cell, capillaries unite subsequently to form venules and veins.

## Vein

The blood vessel which transports blood from various organs of the body to the heart is called vein. Their wall is composed of three layers as found in artery but they have a thinner layer of smooth muscles. So veins are thin-walled blood vessels. Veins carry carbon dioxide and waste-rich blood collected by venules to the heart, so there is less speed and pressure of blood in veins and also the probability of blood flow in reverse direction. To prevent the blood flow in the opposite direction, veins have valves at frequent intervals. Venules, veins, and venacava have the same function, but their size differs and numbers.

## 5.7 Blood circulation

The process by which blood is transported from the heart to various body parts and from the various body parts to the heart is called blood circulation. The heart pumps about 5-6 litres of blood per minute in an adult human. The circulation of blood in the human body can be divided into two ways:

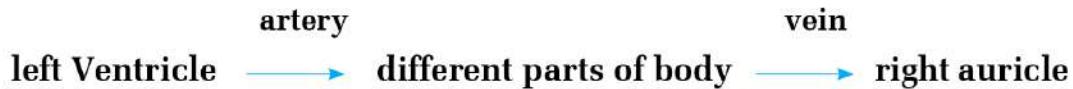
1. Systemic blood circulation
2. Pulmonary blood circulation

### Systemic blood circulation

The process of blood circulation in which oxygenated blood from the left ventricle flows through the aorta and its branches (arteries) to various parts of the body, and the deoxygenated blood from these organs returns to the heart through veins is called systemic circulation.

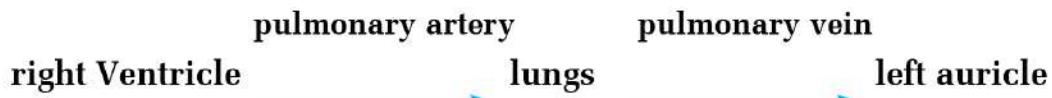
When the left ventricle contracts, pure blood flows from the heart into the aorta. From the aorta to the small arteries and arterioles, blood reaches to the cells through capillaries. In this way, nutrients, oxygen and other essential substances are supplied to each cell of

the body. When these substances are utilized in the cells, carbon dioxide gas and other wastes are produced, which are then transported by blood through veins. These veins, in turn, unite to form the venacava, and hence blood rich in carbon dioxide (impure blood) is transported to the right auricle through the venacava. In this way, the process in which blood from the left ventricle goes to various parts through arteries and then returns to the right auricle through veins is called systemic blood circulation.



### Pulmonary blood circulation

The circulation of blood between the heart and lungs through the pulmonary artery and pulmonary veins is called pulmonary circulation. When the right ventricle contracts, the pulmonic valve opens and deoxygenated blood (carbon dioxide-rich blood) flows through the pulmonary artery and finally through the capillaries network surrounding the millions of alveoli of the lungs. Then, carbon dioxide is left in the alveoli where oxygen is picked up by the blood, which becomes pure or oxygenated. The pure blood is carried to the left auricle through the pulmonary veins. Therefore, the process in which impure blood flows from the right ventricle to the lungs and pure blood flows from the lungs to the left auricle of the heart is called pulmonary blood circulation.



## 5.8 Blood pressure

When the left ventricle contracts and pumps pure blood into arteries, pressure is exerted on the inner walls of the arteries. Such pressure created by the blood on the wall of blood vessels, especially arteries, is called blood pressure. Blood pressure depends on the size of the blood vessel, blood flow, the amount of blood, and the force created during ventricular contraction. Blood pressure is measured in the unit 'mmHg'. Blood pressure is expressed in two values or readings. The upper reading or value is systolic blood pressure, which is created due to the ventricular contraction. The lower value or reading is diastolic blood pressure, which is created due to ventricular relaxation or when the ventricle comes to its original position. Systolic blood pressure in an adult is 90mmHg to 130 mmHg. Similarly, diastolic pressure in an adult person is 60mmHg to 90mmHg. Nowadays, blood pressure is also measured by digital methods.

The device used to measure the blood pressure of a human is called a sphygmomanometer. Blood pressure depends on the mental state, age, sex, and physical state of an individual. The normal blood pressure of an adult person is 120/80 mmHg, where 120 mmHg is systolic blood pressure and 80 mmHg is diastolic blood pressure.

### High blood pressure or hypertension

If the blood pressure of an individual exceeds 140/90 mmHg, such a condition is called high blood pressure or hypertension. Symptoms of high blood pressure are given below:

- Headache, shortness of breath
- Nose bleeding
- Sweating, fatigue
- Face becomes red
- Sleeplessness, anxiety

### Causes of high blood pressure

Blood pressure is caused due to various reasons. Some are mentioned below:

- a. Lack of regular physical exercise
- b. Hereditary occurrence of high blood pressure
- c. Smoking and drinking alcohol regularly
- d. Excessive body weight
- e. Physically and mentally stressful life
- f. Excess consumption of salty and fatty food items

### **Preventive measures of blood pressure**

High blood pressure leads to various physical and mental problems. Therefore, high blood pressure can be avoided by paying attention on time. Following are the ways to avoid blood pressure:

- a. Pay attention to the kind of daily meal that you consume. Consume less salty and oily food items.
- b. Avoid smoking and drinking alcohol.
- c. Take balanced diet in food.
- d. Daily physical exercise is essential.
- e. Do yoga, meditation and pranayama.
- f. Take precautions by checking blood pressure frequently.
- g. Live a stress-free life.
- h. Participate in various recreational activities.

### **Diabetes**

Due to various causes, the insulin hormone that helps in the management and utilization of glucose obtained from our food becomes low, and blood sugar level rises. A condition in which the amount of glucose in the blood is more than required is called diabetes. It is also called hyperglycemia.

### **Symptoms of high glucose level in blood**

- a. Excessive thirst and hunger

- b. Frequent dizziness and unconsciousness
- c. Frequent urination
- d. Blurred vision
- e. Person becomes thin and fatigued
- f. Muscular spasms and numbness in the hands and legs
- g. Slow healing of wounds, etc.

### **Reasons for high glucose levels in blood:**

- a. Insufficient secretion of insulin hormone
- b. Obesity and inactive lifestyle
- c. Imbalanced diet
- d. Excessive consumption of fat- and carbohydrate-rich food
- e. Heredity

### **Preventive measures of high blood glucose level**

- a. Consume green vegetables and fruits abundantly.
- b. Regular physical exercise.
- c. Maintain proper weight.
- d. Maintain an active lifestyle.
- e. Live a stress-free life.
- f. Go for morning walk daily.
- g. Eat balanced diet.

### **Uric acid**

When purine-containing foods are consumed in excess amounts and during the metabolism of purine within the body cells and digestion, they break down and form a type of acid called uric acid. Uric acid is mainly produced in the intestine and liver and, for its excretion, reaches the kidney through the blood. In its way, it helps remove

other toxic substances, including plaque deposited on the walls of blood vessels, and makes the blood circulation smooth.

Purine is the source of uric acid, which the body continuously requires for the synthesis of DNA and RNA. Excessive consumption of purine-rich foods leads to the rise of uric acid levels in the blood and brings serious health problems. The problem caused due to the increase of uric acid levels in the blood is called hyperuricemia. Following are the problems of hyperuricemia:

### Symptoms of high uric acid

- a. Pain in joints
- b. Deep pain in muscles
- c. Increased chance of kidney stones
- d. Reddening, swelling, and burning sensation in skin
- e. Excessive pain in the joints of toes
- f. Difficulty in walking and movements

### Reasons for high uric acid levels in the blood

- a. Due to diabetes or any other disease, the kidneys are unable to function perfectly and cannot excrete uric acid.
- b. Excess consumption of purine-rich food
- c. Habit of drinking less water

### Control and preventive measures of high uric acid

- a. Exercise regularly.
- b. Drink sufficient water, multiple times a day in small amounts.
- c. Avoid drinking alcohol and smoking.
- d. Consume baking soda.
- e. Eat cherries (they contain anthocyanin, an antioxidant which helps to reduce uric acid in blood)

- f. Reduce the consumption of fatty red meat, sea foods, pulses, etc.
- g. Consume fewer amount of purine-rich food.

### ***Project work***

- a. Visit a nearby hospital and inquire about high blood pressure, diabetes, and uric acid with the doctors and other health workers there. Prepare a short report and discuss it in class.
- b. Inquire about the condition, causes, and measures taken for high blood pressure, diabetes, and high uric acid in your family members, and present a report prepared for class discussion.

## Exercise

### 1. Choose the correct option for the following questions.

- a. Which of the following sets of organs belong to the circulatory system?
  - i. heart, blood, and lung
  - ii. heart, blood, and blood vessel
  - iii. heart, liver, and lung
  - iv. heart, blood vessel, and liver
- b. Which of the following blood cells is without a nucleus?
  - i. neutrophil
  - ii. lymphocyte
  - iii. monocyte
  - iv. platelet
- c. Which disease is caused due to the deficiency of haemoglobin?
  - i. diabetes
  - ii. haemophilia
  - iii. anaemia
  - iv. leukemia
- d. How many chambers are there in the human heart?
  - i. 2
  - ii. 3
  - iii. 4
  - iv. 5
- e. What is the cause of systolic pressure on the wall of the artery during the contraction phase of the ventricle?
  - i. Excessive pressure is created inside the heart.
  - ii. Pressure produced in the left ventricle of the heart is transmitted to the artery.
  - iii. The artery also contracts at the time of contraction of the left ventricle.

- iv. Blood becomes thicker at the time of contraction of the left ventricle.
- f. The results of Rohit's blood test for blood group identification are shown in the table below.

Antigen	A	B	O	D
Blood clot	Seen	Seen	not seen	not seen

What is his blood group?

- i. A positive                                    ii. O positive
- iii. AB positive                                iv. B positive
- g. A person feels thirstier, hungrier, dizzy, and sometimes faints, has frequent urination, blurred vision, etc. What is his/her problem?
- i. high blood pressure    ii. high blood sugar in blood
- iii. problem of uric acid    iv. anaemia
- h. Which of the following tests is appropriate to identify the blockage in a coronary artery during the pain in the heart?
- i. test of blood pressure of heart    ii. angiogram
- iii. ECG    iv. measuring heart beat
- i. Saambhawi hurt on her leg when she hit a stone while playing in school. Despite various efforts, her bleeding did not stop. What is the reason for this?
- i. lack of haemoglobin in blood
- ii. lack of white blood cells in blood
- iii. lack of platelets in blood
- iv. lack of red blood cells in blood

- j. Rasmila's grandfather has a problem of swelling of the joints and pain in the body when he eats red meat, legumes and fried foods. What is his problem?
- i. high blood pressure                      ii. high blood glucose level  
iii. problem of uric acid                iv. anaemia

## 2. Write differences:

- a. Red blood cell and White blood cell
- b. Auricle and ventricle
- c. Artery and veins
- d. Pulmonary blood circulation and systemic blood circulation
- e. Systolic blood pressure and diastolic blood pressure
- f. Anaemia and haemophilia
- g. Angiogram and open heart surgery
- h. Platelets and white blood cell

## 3. Give reason

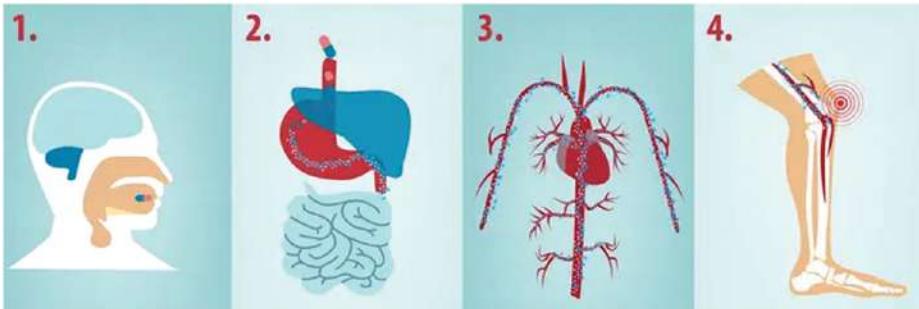
- a. Blood is red.
- b. WBCs are like the soldiers of body.
- c. Wall of ventricle is highly muscular or thicker than the wall of auricle.
- d. Wall of left ventricle is thicker than the wall of right ventricle.
- e. Arteries do not have valve but veins have valves.
- f. A person with anaemia feels tired after a short walk.

- g. Arteries are deeply seated inside the muscles but veins are superficial.
- h. Blood group should be tested before transfusion.
- i. Blood coagulates slower or does not coagulate in haemophilic person.

#### 4. Answer the following questions.

- a. Describe the main parts of the human circulatory system.
- b. Write the main function of blood.
- c. When any part of the body is injured, the bleeding stops after a while. Why?
- d. Ramila gets tired even after walking a short distance and also feels difficult to breathe? What is the reason for this? Explain.
- e. A person has blood pressure 130/90 mmHg. What does this mean?
- f. Which device is used to measure blood pressure?
- g. Before the transfusion of blood to a patient, blood group of donor and receiver patient is checked by the doctor. Why?
- h. Sarita's grandmother shows the symptoms like frequent urination, tiredness, muscular spasm and numbness in hands and legs, and thirst. What is the problem with her?
- i. Mention the effect and preventive measures of high blood pressure.
- j. Respiratory system, digestive system and circulatory system in human body are interrelated. Explain this statement with reasons.
- k. How is high or low blood pressure detected?

- l. What process in the body is represented by the given figure? Which systems are involved in this process? If the organ system shown in figure 3 were absent, how would the medicine ingested in figure 2 still be able to reach the knee? Explain with reasons.



- m. Answer the following questions on the basis of the information given on the table.

Name of blood cell	Shape	Nucleus	Area of production	Area of destruction
X	Biconcave	absent	Bone marrow	Liver and spleen
Y	Irregular	present	Bone marrow and lymph node	Liver, spleen and at the site of infection
Z	Round and spherical	absent	Bone marrow	Spleen

- i. Which blood cell deficiency causes anaemia in a person?
- ii. What will be the problem when the number of Y blood cells increases beyond normal?
- iii. If blood coagulates slower or does not coagulate in the injured or cut part of a person, which blood cells are below the normal count in that person? What is this condition called?
- n. While Sarita was walking on the road, she saw an old man suffering from chest pain. She rushed him to the hospital.

The initial examination suggested that he might have a heart problem. Which test would be appropriate to identify his heart condition? Explain with reason.

- o. Explain the blood circulation in the human body with a diagram.
- p. Write the preventive measures for hyperuricemia.
- q. Explain the internal structure of the human heart with a neat and labelled diagram.
- r. Explain the main causes of a heart attack.
- s. Introduce angiogram and its importance.
- t. Give a brief introduction to open-heart surgery.
- u. When Samip's blood was tested, the number of white blood cells was found to be more than 3000. Which symptoms may appear in his body in this situation? Give a reason.
- v. The level of fibrinogen was found to be high in the plasma of Harish at the time of the blood test. Does this affect his blood circulation or not? Explain with a reason.
- w. Study the given table and answer the following questions.

Person	injury	Flow of blood from injured part
X	Superficial	Bleeding continuously, it was not stopped by general treatment
Y	Deep	Bleeding with high pressure, it was stopped by general treatment
Z	superficial	Bleeding for a while and stopped.

- i. Which person suffers from haemophilia?
- ii. In which person is the artery injured?
- iii. Which injury, Y or Z is more dangerous? Give a reason.

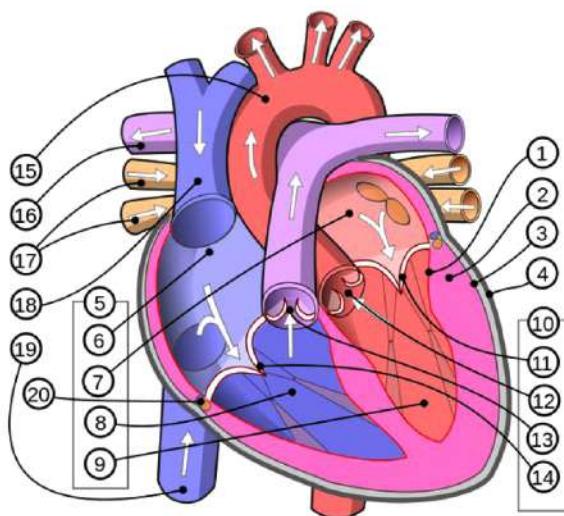
- x. Study the concept map given below and answer the following questions.

**Left Ventricle**

**Kidney**

**Left Auricle**

- What type of blood circulation is shown in the concept map?
  - In which parts of the concept map do arteries and veins play a role in blood circulation?
- y. Look at the diagram given below and answer the following questions.



- Differentiate the blood vessel 15 and 18.
  - Write the function of valves 11 and 13?
  - What happens in the absence of part 4?
  - Label the part 6, 7, 8 and 9.
- z. Draw neat and labelled diagram of:
- External structure of the human heart
  - Internal structure of the human heart
  - Arteries, veins, and capillaries
  - Pulmonary blood circulation
  - Systemic blood circulation