

## 11. Human Body and Organ System



**Can you recall?**

1. From what the organs and organ systems are made up of?
2. Which organ systems are present in human body?

In the last class, we have studied some characters of living organisms. All the vital processes which are essential properties of living beings, are collectively called as life processes.



**Can you tell?**

1. Which processes occur in our body during sound sleep?
2. Which life processes occur continuously in our body?

Different organs in our body are working in group so as to smoothly carry out various life processes. These life processes take place in various steps. Specific organs carry out the specific steps. Group of organs working together to perform a specific function is called as organ system. Various organ systems like digestive, respiratory, circulatory, nervous, excretory, reproductive, skeletal, muscular, etc. are functioning in our body.



**Can you recall?**

Which different organs perform the function of breathing in the body of animals?

Energy is essential to operate all the life processes in human body. Energy production occurs within the cells. Cells need the supply of soluble nutrients and oxygen for this purpose. This supply takes place with the help of respiratory and circulatory systems. Respiration is carried out through following three steps.

### 1. External Respiration:

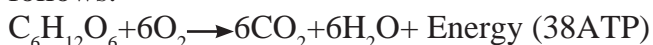
**A. Inspiration / Inhalation :** Air is taken in through nose and sent towards the lungs through trachea (wind pipe).

**B. Expiration / Exhalation :** Oxygen from the inspired air goes into blood. Blood carries the  $\text{CO}_2$  from various parts of body towards lungs. This air is given out by exhalation.

Both of these processes occurring with the help of lungs are collectively called as external respiration.

**2. Internal Respiration :** Exchange of gases between cells and tissue fluid is called as internal respiration. Oxygen moves from blood into tissue fluid and carbon dioxide moves from tissue fluid into blood.

**3. Cellular Respiration :** Dissolved nutrients like glucose are slowly burnt (oxidized) with the help of oxygen and energy is released in the form of ATP. Waste materials like  $\text{CO}_2$  and water vapours are produced during this process. Cellular respiration can be summarized as follows.



**Use your brain power**

How do the organisms like amoeba, earthworm, cockroach, plants, various aquatic animals, birds respire? Prepare a chart.



**Think about it.**

Along with the heat; sound and light are also produced during burning of fuel. Similarly, whether the sound and light are produced during oxidation of nutrients in cell?



**Can you tell?**

1. Which organs are present in the respiratory system?
2. One should not talk while eating. Why is it so?

## Respiratory system : Structure and function

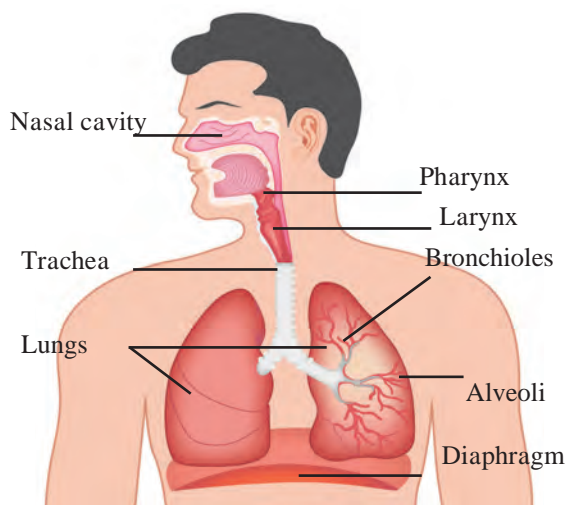
**1. Nose :** Respiratory system and respiration begins with nose. Air is filtered with the help of hair and mucus present in the nose.

**2. Pharynx :** Food pipe and wind pipe originate in the pharynx. Wind pipe is present in front of the food pipe. There is a lid at the beginning of wind pipe. This lid closes the wind pipe during passing of food into food pipe and thereby normally prevents the entry of food particles into wind pipe. Otherwise, wind pipe remains open. Hence air passes through pharynx into wind pipe.

**3. Wind pipe :** Wind pipe is swollen at the beginning due to sound box. Wind pipe bifurcates in the thorax. One branch enters the right lung and the other into left lung.

**4. Lungs :** A lung is present on either sides of heart in thoracic cavity. Maximum area of thoracic cavity is occupied by lungs and they cover the maximum part of heart. Each lung has double layered covering. It is called as pleura. Lungs are elastic like a sponge. Lungs are made up of many small compartments, called as alveoli. Rich network of capillaries is present around each alveolus.

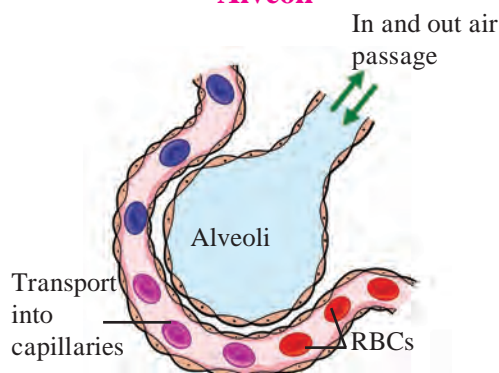
Walls of alveoli and capillaries are extremely thin. Gaseous exchange can easily take place across these thin walls. As large number of alveoli is present in lungs, larger surface is available for gaseous exchange.



**Respiratory system**



**Alveoli**



### 11.1 Human Respiratory System and Alveoli

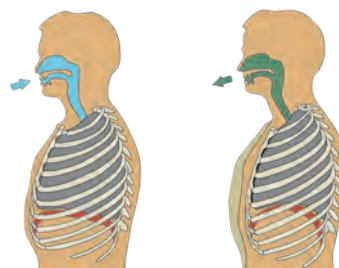
**Exchange of gases in lungs :** Gaseous exchange occurs continuously while blood is circulating around the alveoli. An iron containing protein- hemoglobin is present in the RBCs of blood. Hemoglobin absorbs the oxygen from air within alveoli. Simultaneously,  $\text{CO}_2$  and water vapours move from blood into the alveoli. Thus, oxygen is taken into the blood and  $\text{CO}_2$  and water vapours are removed from the blood and given out by exhalation.

**5. Diaphragm :** A muscular partition is present at the base of thoracic cage. This partition is called as diaphragm. It is present between the thoracic cavity and abdominal cavity. Simultaneous rising up of ribs and lowering of diaphragm causes the decrease in pressure on lungs. Due to this, air moves into the lungs through nose. When ribs return to their original position and diaphragm rises up, pressure on the lungs increases. Due to this, air moves out from it through nose. Continuous upward and downward movement of diaphragm is necessary to bring about the breathing.



### Observe and discuss.

Observe the movements in the region below the thoracic cage, occurring during breathing and discuss in the class.



## 11.2 Breathing movements

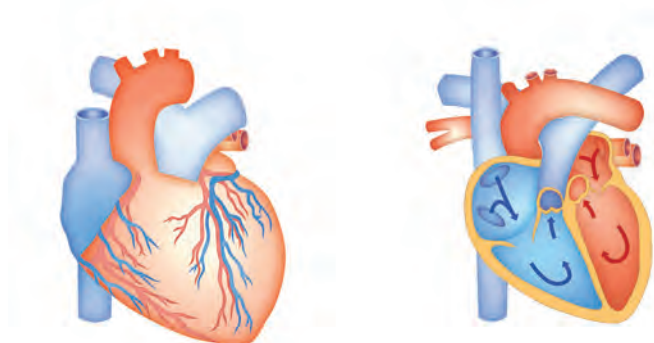


### Can you recall?

1. What is meant by blood circulation?
2. Which organs are present in blood circulatory system?

## Blood circulatory system

Circulatory system performs the function of transport of various substances like water, hormones, oxygen, soluble nutrients, and waste materials through different organs. An independent system for blood circulation is present in humans and higher animals. It consists of heart, blood vessels and capillaries.



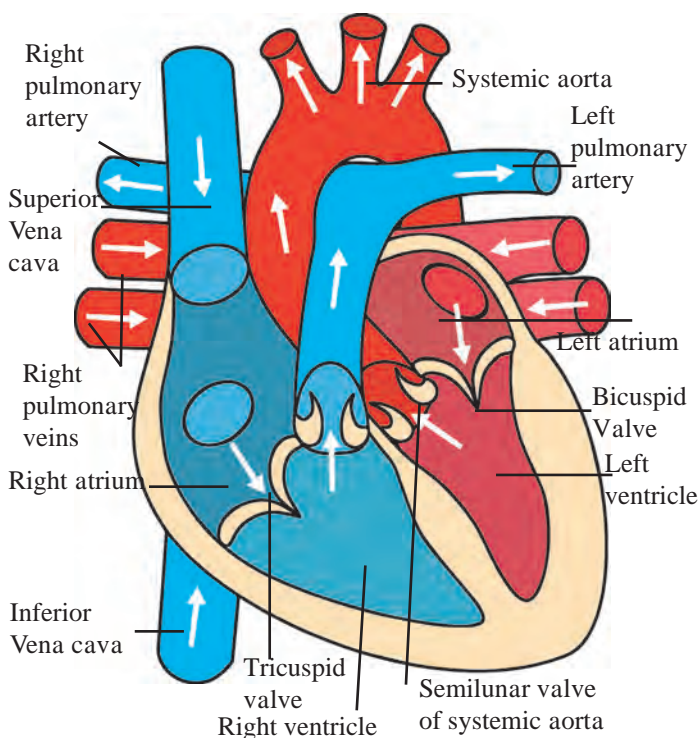
## Heart: Structure and Functions

Heart is present almost at centre in thoracic cage. It is present behind the ribs, between two lungs and slightly inclined on left side.

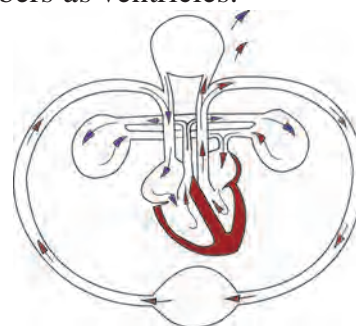
Size of our heart is equal to one's own fist and its weight is about 360 gram. It is covered by a double layered peritoneal membrane. A fluid is present between two membranes due to which heart is protected from friction and mechanical shocks.

Human heart is a muscular organ. It is made up of involuntary cardiac muscles. They contract and relax with a definite rhythm. This is called as beating of heart.

Internally, heart is divided into left and right compartments by a vertical partition. Each of those compartments is again divided into two chambers. Thus, in all, heart consists of four chambers. Upper chambers are called as atria (singular - atrium) and lower chambers as ventricles.



## 11.3 Structure of heart and blood circulation

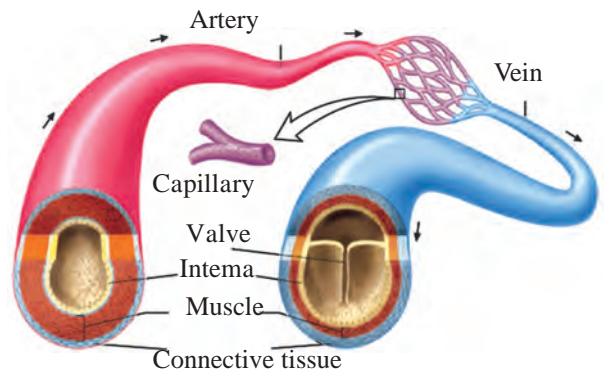




**Blood vessels - Structure and functions :** Heart is beating continuously. Due to this, blood continuously circulates through blood vessels. There are two main types of blood vessels.

**Arteries :** Blood vessels which carry the blood away from heart are called as arteries. Except the one carrying blood towards lungs, all carry oxygenated blood. These are deeply located in the body and their walls are thick. These vessels do not have valves.

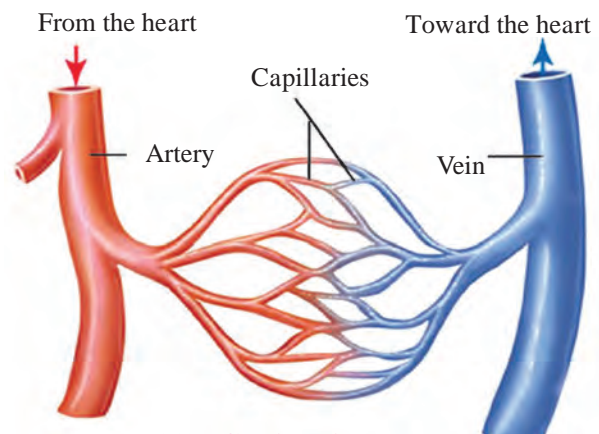
**Veins :** Vessels carrying the blood towards the heart from various parts of body are called as veins. All veins except the one carrying blood from lungs transport deoxygenated blood. Most of the veins are superficially located in the body. Their walls are thin and these are provided with valves.



**11.4 Structure of Artery and Vein**

### In History ...

In 1628, William Harvey described the mechanism of circulation in the body. He proposed a theory that our heart is a muscular pump by which blood is circulated in the body. He discovered the working mechanism of valves of the heart.



**11.5 Capillaries**



**Think about it.**

Why the veins are provided with valves? Why the arteries have thick wall?

**Capillaries :** Arteries gradually branch out with decrease in their diameter as they spread in the body and finally form fine hair-like vessels called as capillaries. Walls of capillaries are extremely thin and made up of single layer of cells. Due to this, exchange of materials between capillaries and cells becomes easy. During the exchange, the oxygen, nutrients, hormones, vitamins, etc. are sent towards the cells and waste materials of the cells move into blood.

Capillaries unite together to form the vessels of more diameter, called as veins. Capillary network is present in each organ.



**Do you know?**

In case of a healthy person, there are 72 beats of heart per minute. Rate of heart beat increases due to physical exercise and emotions. Similarly, it has been observed that it decreases during rest and sleep. Number of beats is more in case of infants.

Two types of sounds are heard during heart beat. One is described as 'lubb' and other as 'dub'. Heart pumps about 75 ml of blood during each beat.

## Blood circulation through heart / Functioning of Heart

Process of pumping the blood towards various parts of the body and bringing it back towards the heart is called as blood circulation. So as to maintain the continuity in circulation, heart alternately contracts and relaxes. Consecutive single contraction and relaxation of heart constitutes a single heart beat.



### Try this

**Material :** Two feet long rubber tube with small aperture, stop watch, funnel.

1. Fit a funnel at one end of rubber tube.
2. Keep the wide mouth of funnel on left side of thorax.
3. Bring the other end of tube near the ear to hear the sound.
4. Record the number of beats per minute using stop watch.



### Think about it.

**Pulse :** Find correlation between heart beats & pulses felt at wrist.



### Can you tell?

1. We can feel the pulse behind the ears and near the heel of foot. How these pulses occur?
2. What flows out when we have an injury?

## Blood

Blood is a red colored fluid material. It is fluid connective tissue. The oxygenated blood is deep red colored, salty in taste and its pH is 7.4. Blood is composed of mainly two components.

Plasma	Blood cells
<p>A. Plasma is pale yellow, clear, and slightly alkaline fluid. It contains</p> <ul style="list-style-type: none"> <li>90 -92 % water</li> <li>6 - 8 % proteins</li> <li>1 - 2 % inorganic salts and other components</li> </ul> <p>B. Albumin - Distributes the water all over the body.</p> <p>C. Globulins - Protection.</p> <p>D. Fibrinogen &amp; prothrombin help in blood clotting process.</p> <p>Inorganic ions - Ca, Na, K - control the function of muscles and nerves.</p>	<p><b>1. Red Blood Corpuscles (RBCs)</b></p> <p>Small, circular, enucleated cells. These cells appear red due to hemoglobin. Oxygen dissolves in blood due to hemoglobin.</p> <p>50 - 60 lakh RBCs are present in each cubic millimeter of blood. RBCs are produced in red bone marrow and live for about 100 - 127 days.</p> <p><b>2. White Blood Cells (WBCs)</b></p> <p>These are large, nucleated and colorless cells. 5000-10000 WBCs are present per mm<sup>3</sup> of blood.</p> <ul style="list-style-type: none"> <li>- 5 types of WBCs are present - basophils, eosinophils, neutrophils, monocytes &amp; lymphocytes.</li> <li>- WBCs are produced in red bone marrow.</li> <li>- WBCs act as soldiers in our body.</li> </ul> <p><b>Function</b> - These cells attack the pathogens entering our body. They protect us from the microbial diseases.</p> <p><b>3. Platelets</b></p> <ul style="list-style-type: none"> <li>- These are extremely small and disc-shaped.</li> <li>- 2.5 - 4 lakh platelets are present per mm<sup>3</sup> of blood.</li> </ul> <p><b>Function</b> - Platelets participate in blood clotting process.</p>

### Functions of Blood

- 1. Transport of gases :** Oxygen is carried via blood from lungs to cells in various parts of body and carbon dioxide from tissues to lungs.
- 2. Transport of nutrients :** Simple nutrients like glucose, amino acids, fatty acids are taken up by blood from wall of alimentary canal and transported up to each cell in the body.
- 3. Transport of waste materials :** Nitrogenous wastes like ammonia, urea, creatinine are released by tissues into blood which carries those to kidney for excretion.
- 4. Protection :** Antibodies are produced in the blood and they protect the body from microbes and other harmful particles.
- 5. Transport of enzymes and hormones :** Blood transports the enzymes and hormones from the site of their production to the site of their action.
- 6. Thermoregulation :** Body temperature is maintained constant at  $37^{\circ}\text{C}$  by vasodilation and vasoconstriction.
- 7. Maintaining the balance of minerals like Na, K in the body.**
- 8. If bleeding occurs at the injury, platelets and a protein called fibrinogen of the blood form a clot and seal the injury.**

### Human Blood Groups

Depending upon the proteins like antigens and antibodies, different blood groups are formed. There are four main groups of human blood as A, B, AB and O. Besides, there are two types as 'Rh' negative and 'Rh' positive of each of those four groups. Thus, in all eight blood groups are formed. (Eg. A Rh +ve & A Rh -ve).

**Blood Donation :** If a person meets an accident, bleeding occurs through wounds. Many times, blood transfusion is necessary during the surgical operation. Similarly, blood is transfused in case of patients of anemia, thalassaemia, cancer too. Blood transfusion is carried out to compensate the blood shortage in body. This is called as blood transfusion.

### From where the blood is supplied for blood transfusion?

**Blood banks :** Blood is collected in blood banks by specific method from the healthy persons and supplied to the needful persons. If the collected blood is not to be used immediately, it can be stored for some days in refrigerator.

**Blood donor :** Person who donates the blood is referred as blood donor.

**Blood recipient :** Person who receives the blood is referred as recipient.

Person of the blood group 'O' can donate the blood to the person having any other blood group whereas the person with 'AB' blood group can receive the blood from the person with any other blood group. Hence, person of blood group 'O' is called as universal donor and the person with blood group 'AB' is called as universal recipient.

Blood groups are hereditary and depend upon the genes inherited from parents. Blood transfusion is performed only after the blood group matching. If it is done without matching, it may prove fatal for the patient. Person who donates the blood may be recipient in future. Blood donation without any expectation is always life saving. Blood is required in various situations like accidents, bleeding, parturition, surgical operations, etc. Blood donated by healthy person is used to save the life of needful person. Hence blood donation is considered as the best donation.



### Collect information

Visit the blood bank in your area and collect more information about blood donation.

**Blood Pressure :** Blood is continuously kept flowing through blood vessels due to contraction-relaxation of the heart. Due to contraction of the heart, pressure is exerted on the wall of arteries and it is called as blood pressure. Proper blood pressure is necessary to supply the blood in all parts of the body. Pressure recorded during the contraction of heart is called as 'systolic pressure' and that one recorded during relaxation is called as 'diastolic pressure'. Blood pressure of a healthy person is about 120/80 mm to 139/89 mm of Hg. It is measured with the help of sphygmomanometer'.



### 11.6 Sphygmomanometer

#### Hypertension (High Blood Pressure) :

High blood pressure than the normal is referred as hypertension. In arteries of the person with hypertension, unnecessary tension develops. Heart needs to perform more function than the normal condition in case of hypertension. Both, systolic and diastolic pressures are high in hypertension.



### Always remember

- \* Blood production occurs continuously in our body.
- \* About 350 ml of blood is collected from a person during donation and our body restores the fluid part of it within 24 hrs.
- \* Pregnant and breast feeding women cannot donate the blood.
- \* There is no trouble during or after the blood donation.
- \* 1<sup>st</sup> October is observed as National Voluntary Blood Donation Day.
- \* Healthy person of age more than 18 years can donate the blood for 3 - 4 times a year.

Type	Systolic pressure	Diastolic pressure
Normal Blood Pressure	90 - 119 mm	60 - 79 mm
Primary Hypertension	120 - 139 mm	80 - 89 mm
Hypertension stage-I	140 - 159 mm	90 - 99 mm
Hypertension stage-II	> 160 mm	> 100 mm

A, B, O blood groups were discovered by Carl Landsteiner in 1900. He won the Nobel Prize of 1930 for this discovery. Blood group AB was discovered by Decastello and Sturli in 1902.



### Do you know?

**Hematology:** Branch of medical science that deals with the study of blood, hematopoietic organs and blood diseases is called as hematology. Research of diagnosis and remedies of blood diseases is also performed in this branch.





## Collect information

Visit a clinic nearby your place and collect information about measurement of B.P. with the help of B.P. apparatus.

## Exercises

### 1. Find out my partner.

#### Group 'A'

1. Heart beats
2. RBC
3. WBC
4. Blood donation
5. Normal body Temperature
6. pH of oxygenated blood

#### Group 'B'

- a. 350 ml
- b. 7.4
- c. 37 °C
- d. 72
- e. 50 - 60 lakh/mm<sup>3</sup>
- f. 5000-6000 per mm<sup>3</sup>

### 2. Complete the following table.

Organ systems	Organs	Functions
1. Respiratory system		
2. Circulatory system		

### 3. Draw neat and labeled diagrams.

- a. Respiratory system
- b. Internal structure of heart.

### 4. Explain with reasons.

- a. Human blood is red coloured.
- b. Upward and downward movement of diaphragm occurs consecutively.
- c. Blood donation is considered to be superior of all donations.
- d. Person with 'O' blood group is considered as 'universal donor'.
- e. Food must have limited amount of salts.

### 5. Answer the following questions in your own words.

- a. Explain the functional correlation of circulatory system with respiratory, digestive and excretory system.
- b. Explain the structure and function of human blood.
- c. Explain the importance and need of blood donation.

### 6. Explain the differences.

- a. Arteries and veins.
- b. External and internal respiration.

### 7. Which health parameters of blood donor should be checked?

### 8. Fill in the blanks using appropriate words given in the bracket.

(hemoglobin, alkaline, diaphragm, red bone marrow, acidic, voluntary, involuntary.)

- a. RBCs of the blood contain -----, an iron compound.
- b. ----- is present between thoracic and abdominal cavity.
- c. Cardiac muscles are -----.
- d. pH of oxygenated blood is -----.
- e. Production of RBCs occurs in -----.

### 8. Find odd one out.

- a. A, O, K, AB, B.
- b. Blood plasma, platelets, blood transfusion, blood corpuscles.
- c. Trachea, alveoli, diaphragm, capillaries.
- d. Neutrophils, globulins, albumins, prothrombin.

### 10. Read the following paragraph and identify the disease.

Today, her child became one and half year old. However, that child does not seem to be healthy and happy. It was continuously crying and gradually becoming weak. It has shortness of breath. Its nails have become blue.

### 11. Your neighboring uncle has been diagnosed with hypertension. What should he do to keep his blood pressure within normal range?

### Project :

Collect information about various modern treatments on heart diseases.

