

**DAY 19 - 22**

**TOPIC: THE HUMAN BODY**

**The Circulatory system.**

**Aim:**

- Identify the different parts of the human heart.
- Differentiate between pulmonary and systemic circulation.
- Differentiate between the different blood vessels.
- Identify the different components of blood.
- Explain blood transfusion.

**Activities 1:**

- Study pages 15-22 attached below.
- Watch video V.1 and V.2
- Do the review questions on page 22 attached below.

## SECTION 2: THE CIRCULATORY SYSTEM

We shall now examine the circulatory system in more detail: the organs, tissues and cells it contains, their structure and function.

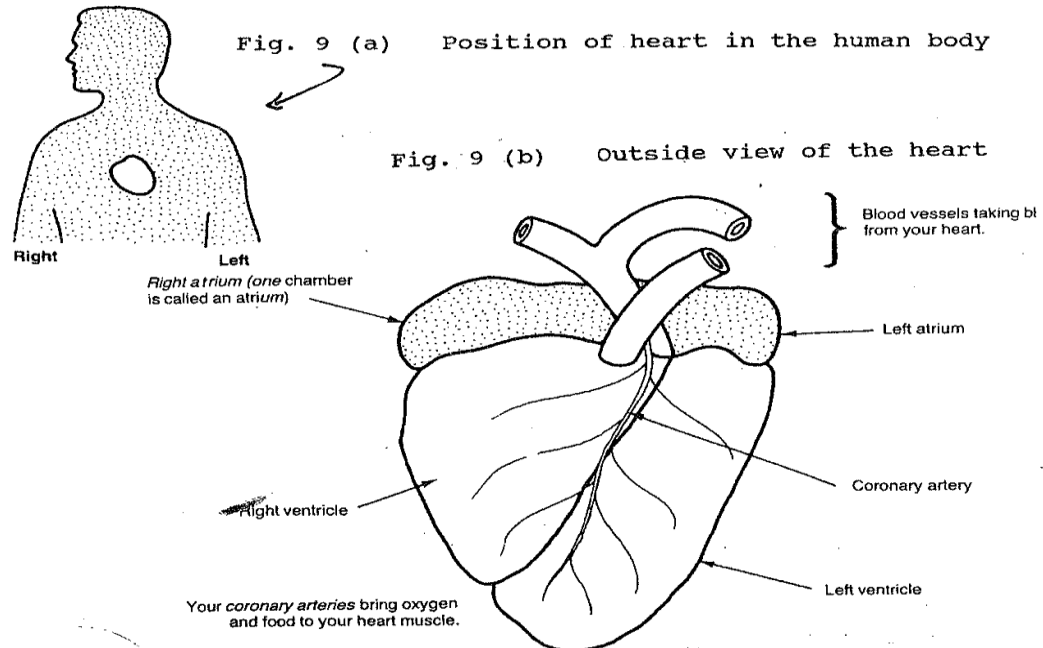
The circulatory system is a complex network of blood vessels (tubes) that branch throughout the body. Blood is forced through these blood vessels by the pumping action of the heart. The blood supplies every cell in the body with food and oxygen and removes waste.

### 1. THE PARTS OF THE CIRCULATORY SYSTEM

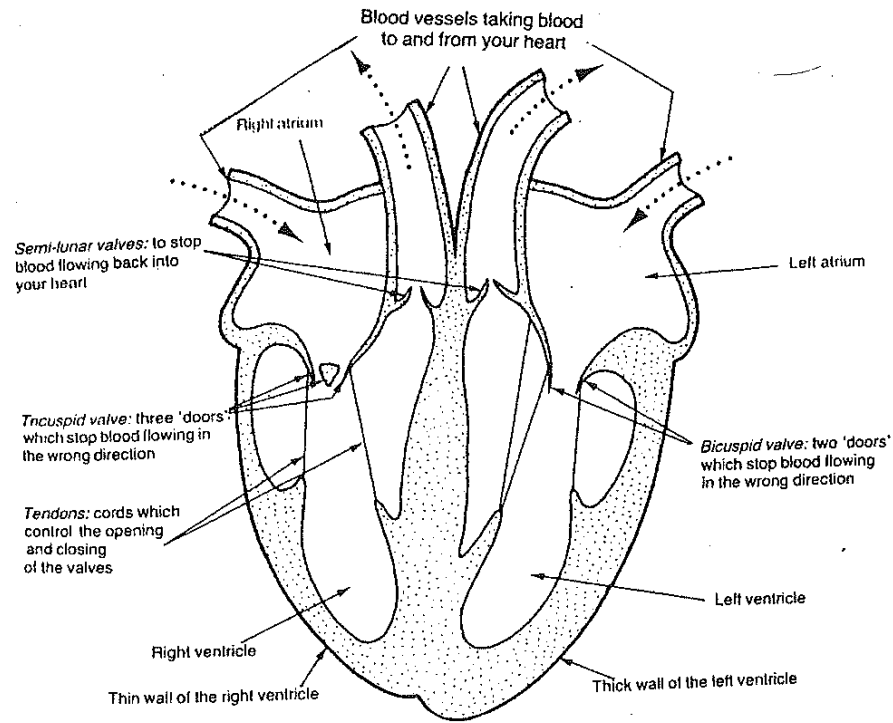
#### (a) The Heart

Make your hand into a fist and look at its size. Your heart is about the same size. It is made of special muscle tissue called cardiac muscle which alternately contracts and relaxes (expands). Its job is to pump blood around your body. It pumps about 40 million times a year and weighs about as much as a grapefruit (pamplemousse). Figure 9 a shows the position of the heart in your body.

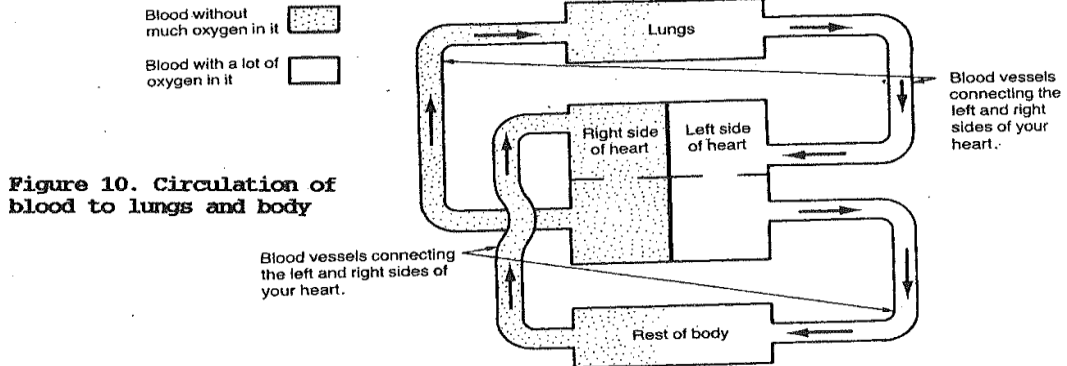
The space inside the heart is divided into four chambers or 'rooms'. The top two have thin walls and collect the blood returning to the heart. Each of these chambers is called an atrium. The two lower chambers have much thicker walls. They pump the blood through large blood vessels (called arteries) out of the heart. These two chambers are called ventricles. Look at figures 9b and 9c which show the outside of the heart and an inside view after it has been cut open.



**Figure 9c. Inside of the heart.**



The heart pumps blood to the lungs and the rest of the body at the same time but through a different set of blood vessels. This means that there are two circulations in and out of the heart at the same time. (see Figure 10)



In the first circulation, blood is pumped from the heart to the lungs and back again. This is the pulmonary circulation. With your finger, trace the path of the blood in the pulmonary circulation in Figure 10.

As the blood passes through the fine network of blood vessels that surround the airsacs (alveoli) of the lungs, it picks up oxygen and releases carbon dioxide and water. This is shown in Figure 11 a.

In the second circulation, blood is pumped from the heart to the body and back again. This is the systemic circulation. With your finger, trace the path of the blood in the systemic circulation in Figure 10. The tissues of the body need a lot of energy. The blood flowing to the body in the systemic circulation supplies these tissues with food and oxygen for respiration to produce energy. It also removes the carbon dioxide and water produced. This is shown in Figure 11 b.

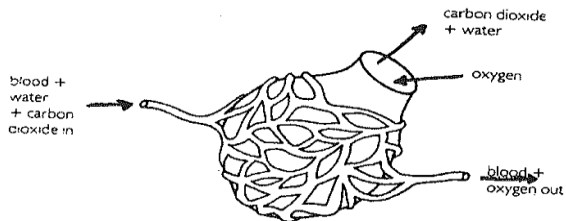


Figure 11a. Blood flowing through the lungs

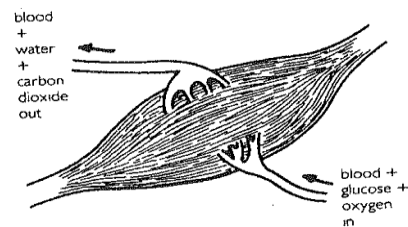


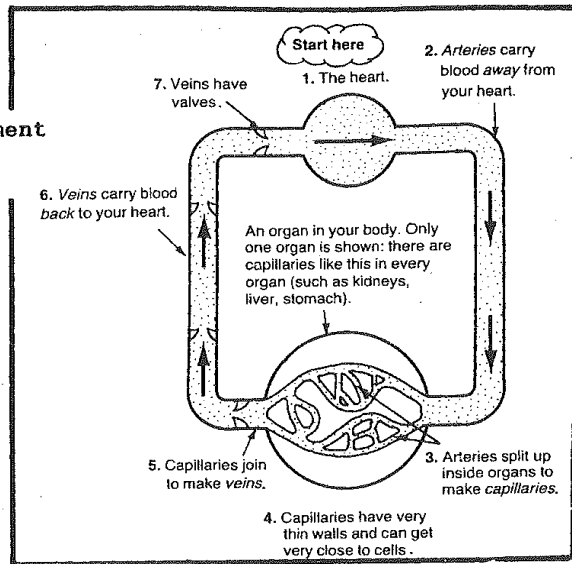
Figure 11b. Blood flowing through the body

This means that the blood passes through your heart twice on its way round your body. This is called a double circulation.

(b) The Blood Vessels.

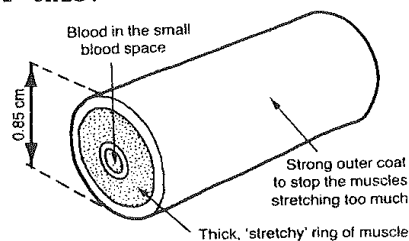
When the powerful muscles of your heart contract they force blood out and away into tubes called arteries. The arteries branch many times and finally become the tiny little tubes called capillaries. The capillaries join together to form small veins. These come together to make bigger and bigger veins. The veins carry blood back to the heart. The path of the blood through these blood vessels can be seen in Figure 12.

Figure 12. Blood movement in the blood vessels

Arteries

Arteries have thick walls containing muscle and elastic fibres to withstand the high pressure of blood (see Figure 13a). They carry blood away from the heart to all parts of the body including the lungs. Look back at Figure 9 (c). Two of those blood vessels are arteries. One carries blood from the heart to the lungs, the other from the heart to the rest of the body. They are thick and have elastic walls. If you cut them the artery stays open because of this.

Figure 13. Part of an artery



Using your first and second fingers find the "pulse" in your wrist by putting your fingers around your wrist and placing the tips of your fingers over the inside centre of your wrist. Using the same two fingers, find the pulse in your neck. Feel to the side of your windpipe.

Question: What causes this pulse?

**Answer:** Blood moves in one direction through your blood vessels. Blood is pumped into arteries by the heart. This stretches the muscles in the walls of your arteries (see Figure 13) and they expand. As your blood moves on, the muscles in the arteries 'bounce back' again (contract). This squeezes the blood and pushes it towards the smaller arteries and finally to the smallest blood vessels called capillaries. This stretching and bounce back causes a beat or pulse in your arteries. This is the pulse that can be felt in your wrist and neck.

### Veins

Veins have wider openings than arteries and have thinner walls. The blood they carry is at a low pressure and travels through them more slowly. Figure 14a shows the structure of veins. There is less muscle to squeeze the blood in your veins than in your arteries. Look again at Figure 9(c) - the remaining 2 blood vessels entering the heart are veins. They have thin non-elastic walls. If you cut them, they will not stay open.

Veins carry blood back to the heart. Veins have valves in them to make sure the blood flows in one direction only - back to the heart - and stop the blood flowing the wrong way (see Fig. 14b). There are many large veins inside the muscles of the legs and arms. When these muscles contract they squeeze the veins. This squirts blood towards the heart.

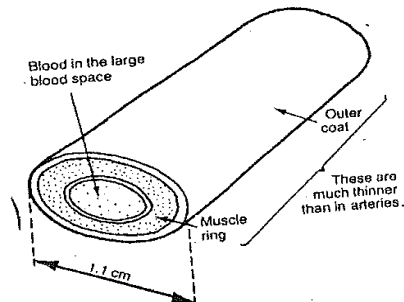


Figure 14a. Part of a vein

The valves are like doors which only open one way

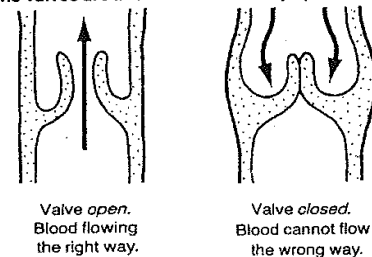


Figure 14b. Valves in veins

### Capillaries

Capillaries are tiny blood vessels. They are very narrow (only one red blood cell can fit down them at a time). They have very thin walls, only one cell thick. Substances in the blood can easily get through these walls (see Figure 15a). Food and oxygen are taken to the cells of the body in capillaries. They also take away carbon dioxide and other wastes (see Figure 15b). Capillaries connect the arteries and veins together (see Figure 12).

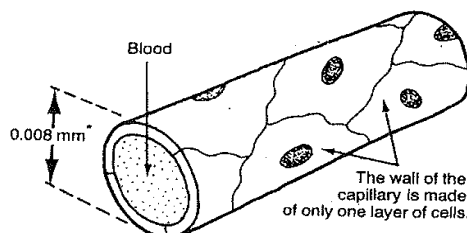


Figure 15a. Part of a capillary

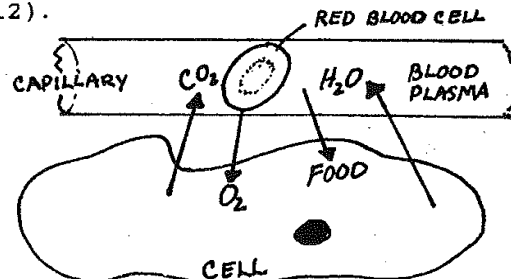


Figure 15b. Exchange of materials between blood and cells

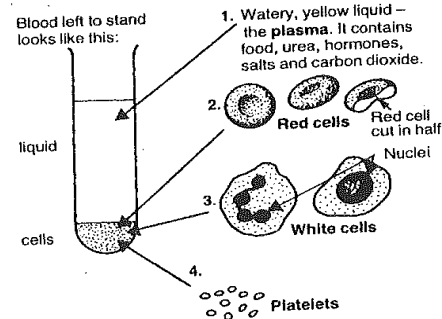
(c) The Blood

Blood is a liquid which carries food, oxygen and waste substances quickly round your body. All the cells in your body must have a supply of blood or they will die.

You have nearly half a bucket of blood (5.5 litres) in your body. If blood is left standing for a time in a test-tube the solid particles start settling to the bottom of the test-tube. This is shown in Figure 16.

**Figure 16.**  
**Components of blood**

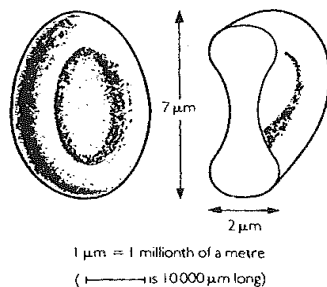
The lower layer is made up of red blood cells, white blood cells and platelets. The upper layer is a watery yellow liquid called plasma. It contains food, urea, hormones, salts and carbon dioxide.

Red Blood Cells

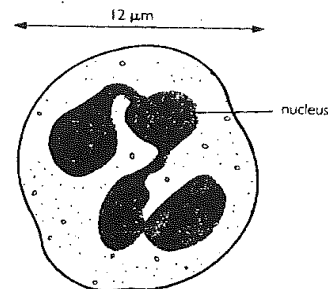
Red blood cells are wheel shaped (see Figure 16a). They have no nucleus. They are red in colour because of a protein called haemoglobin inside them. Red blood cells are the body's oxygen carriers. They carry oxygen from the lungs to all the cells of the body. They also carry the carbon dioxide from the cells to the lungs.

White Blood Cells

White blood cells are larger than red blood cells. They all have a nucleus (see Figure 16 (b)). They can change shape. White blood cells protect us from disease. White cells called phagocytes can eat up the germs that cause disease. Other white cells make chemicals called antibodies. These chemical destroy germs that get into the body by making them stick together, or by dissolving them.



**Figure 17a. Red blood cells**



**Figure 17b. White blood cells**

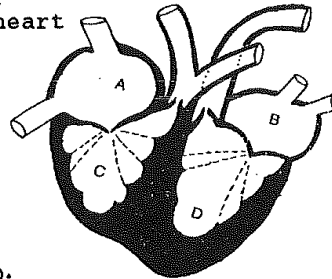
The body replaces this in about 24 hours. Donating blood is a safe and socially useful thing to do - your blood may save someone else's life.

### Review Questions

1. Fill in the missing words from those given in the box. Some words may be used more than once.

atrium, ventricle, thicker, thinner, veins, arteries

- (a) Each of the top two chambers in your heart is called a/an \_\_\_\_\_.
  - (b) Your left \_\_\_\_\_ has the thickest wall of the four chambers.
  - (c) Your atria have \_\_\_\_\_ walls than your ventricles.
  - (d) Your \_\_\_\_\_ bring blood to your heart from your lungs and body.
2. The diagram shows a mammalian heart



- (a) Identify the parts A to D.
  - (b) Which chamber of the heart received blood from the lungs.
  - (c) Why is the wall of chamber D thicker than the wall of chamber C.
  - (d) The heart is made of a special type of tissue. What is this tissue called?
3. (circle the correct answer). Arteries/Veins/Capillaries carry blood back to the heart.
4. Why are capillaries only one cell thick?
5. What happens to blood which is pumped to the lungs?
6. Match the component of blood with its function.

|                  |  |
|------------------|--|
| plasma           | destroys germs by sticking them together |
| red blood cell   | carries oxygen                           |
| antibodies       | eats germs that cause disease            |
| white blood cell | carries food, hormones, etc.             |

- (a) When are blood transfusions necessary?
- (b) Why is donating blood a good thing to do?
- (c) Is donating blood a safe thing to do?
- (d) If you wanted to donate blood, who would you see?