



What Is This Module About?

Have you ever cut yourself accidentally? What came out of the wound?

The fluid that came out of your wound is blood. Blood is red and quite viscous (thick). Blood is called the fluid of life. If you had no blood, you would not be alive. Blood reaches the different parts of your body, through your circulatory system.

In this module, you will study the parts of the circulatory system. You will also know more about the functions of the circulatory system. You will also find out some injuries and diseases that can affect the circulatory system and ways by which to take care of this system.

This module is divided into four lessons. These are:

Lesson 1 – *The Circulatory System*

Lesson 2 – *Blood*

Lesson 3 – *Diseases That Can Affect The Circulatory System*

Lesson 4 – *Taking Care Of The Circulatory System*



What Will You Learn From This Module?

After studying this module, you should be able to:

- ◆ describe the parts of the circulatory system;
- ◆ understand the functions of the circulatory system of the human body;
- ◆ explain the functions and properties of blood;
- ◆ cite some diseases that can affect the circulatory system; and
- ◆ practice proper care of the circulatory system.



Let's See What You Already Know

To find out what you already know about the topics to be discussed in this module, answer the questions below. Write your answers on the blank lines.

1. Enumerate the two components structures of the circulatory system.
 - a. _____
 - b. _____
2. State the functions of blood.
 - a. _____
 - b. _____
 - c. _____
3. What produces the sound of a heartbeat?

4. Name three diseases that can affect the circulatory system.
 - a. _____
 - b. _____
 - c. _____
5. What is hypertension?

6. State five ways to take care of the circulatory system.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____

Well, how was it? Do you think you fared well? Compare your answers with those found in the *Answer Key* on page 40 to find out.

If all your answers are correct, very good! This shows that you already know much about the topics in this module. You may still study the module to review what you already know. Who knows, you might learn a few more new things as well.

If you got a low score, don't feel bad. This means that this module is for you. It will help you to understand some important concepts that you can apply in your daily life. If you study this module carefully, you will learn the answers to all the items in the test and a lot more! Are you ready?

You may go now to the next page to begin Lesson 1.

The Circulatory System

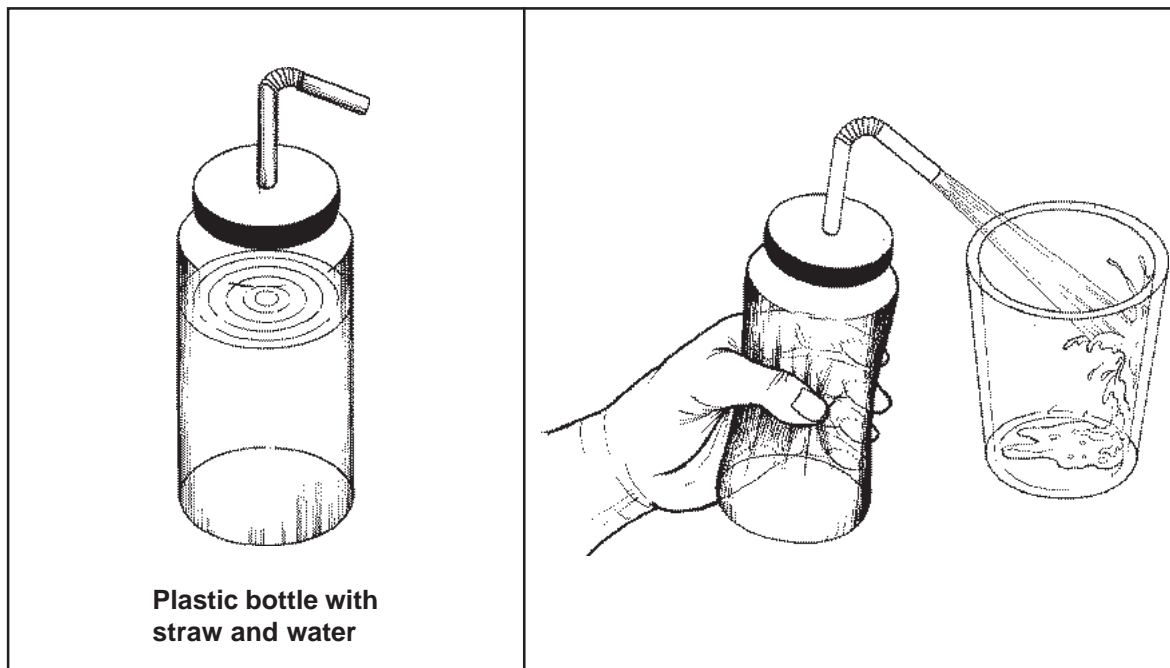
Without your being aware of it, your organ systems are working continuously to keep you alive. One of these organ systems is the **circulatory system**.

In this lesson, you will study the parts and functions of the circulatory system. You will discover the many wonderful things it does to keep you alive. The heart never stops beating as long as a person is alive. It starts beating when a child is still inside its mother's womb. When you are excited your heart beats faster. Can you feel it beating now? Are you ready to learn more about your circulatory system?



Let's Try This

You will need a plastic bottle with straw for this activity. If you can't find one, just use your imagination. The picture below can help you visualize what will happen.



Fill the bottle with water. Then, fill a small empty cup with water from the bottle. Determine how long it takes you to fill the cup. Then, return the water to the bottle. Fill the cup again with water but this time, do it faster. Note what action you do in order to accomplish this.



Let's Think About This

Answer the following questions:

1. What action did you make in order to let the water out of the bottle?

2. How long did it take you to fill the cup at a normal pace?

3. What did you do in order to fill the cup faster?

Compare your answers with those found in the *Answer Key* on page 41.

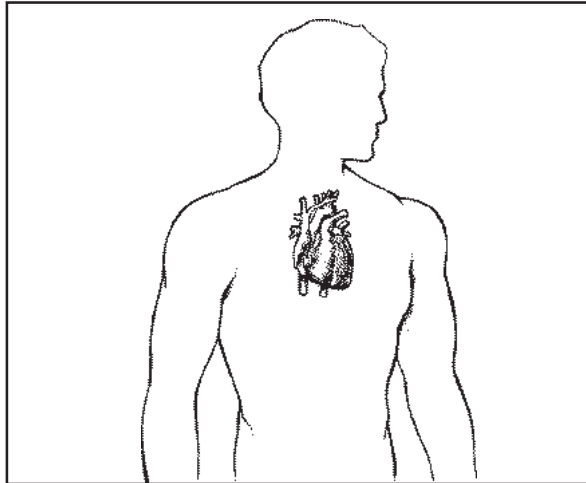


Let's Learn

In the previous activity you used a plastic bottle as a container for water. In order for the water to pass from the plastic bottle to the empty cup, you had to squeeze the bottle. In order to fill the cup faster, you had to squeeze the bottle even harder.

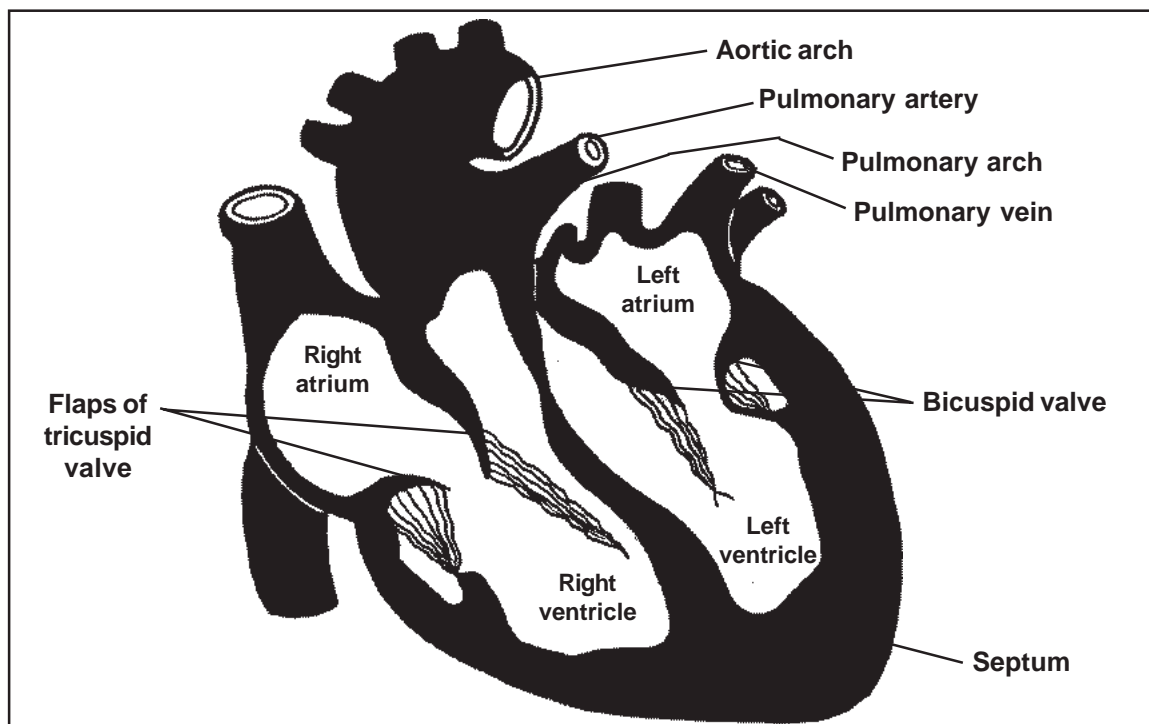
The action that you did can be likened to the action of the heart, which continuously pumps blood throughout the body. Indeed, the heart is the most hardworking organ of the body. Consider the following facts:

- ◆ The heart pumps approximately 70 times a minute. In this period, it is able to pump around 5 liters of blood. That is about 100,800 times each day!
- ◆ When you are exercising rigorously and your body cells need a higher rate of blood flow to obtain more oxygen, nutrients and food, the heart pumps more rapidly to force more blood around your body faster. The heart will pump up to 200 times per minute to move 40 liters of blood around your body if it has to.



The heart is the most important organ of the circulatory system.

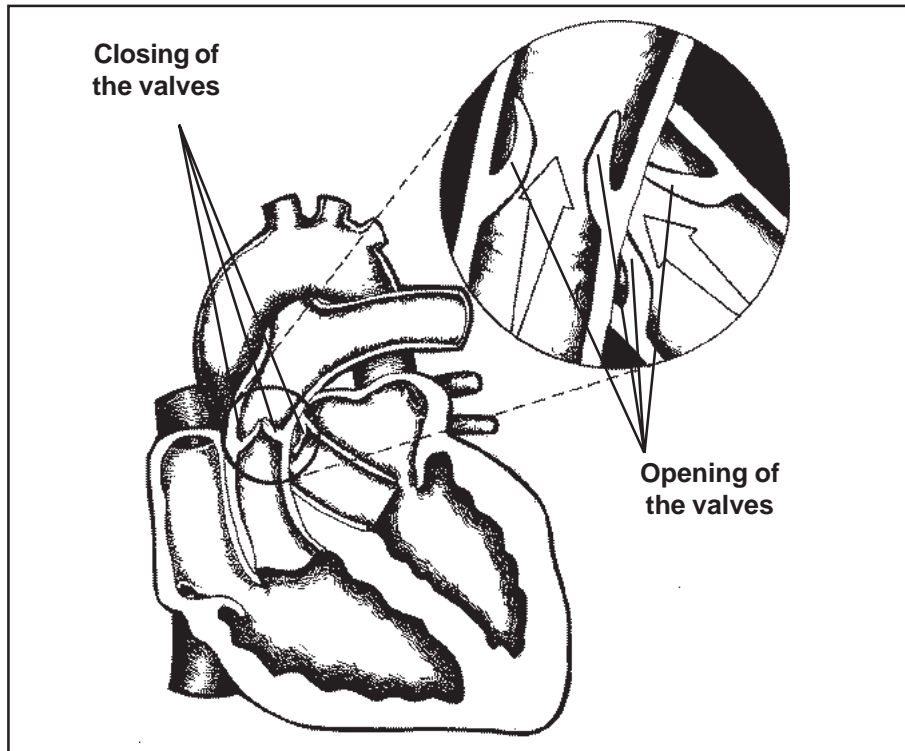
Do you know what your heart looks like? Clench your fist and look at it. That's approximately the same size as your heart. Your heart is a pear-shaped organ that lies between your lungs. It is slightly tilted to the left. Look at the picture below. It shows the major parts of the heart.



The heart is actually made up of two pumps that work together. These two pumps are separated by a muscular wall called **septum**. The right pump collects blood from the body and sends it to the lungs. The left pump collects blood from the lungs and sends it to the rest of the body.

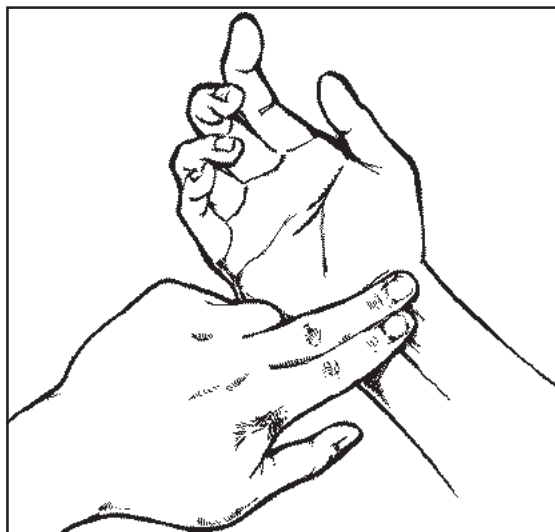
Each pump has two chambers: the **atrium** and the **ventricle**. The atrium has a thin wall while the ventricle has a thick one. Each atrium receives and stores blood. Each ventricle, on the other hand, pumps blood away from the heart. The atria and the ventricles are separated by one-way valves.

Do you know how a heartbeat sounds? It usually sounds like **lub-dub**. This sound is produced by the closing and opening of the valves in the heart.



Let's Try This

1. The rate at which the heart beats can be determined by taking the pulse. To take your pulse, place the middle and index fingers of one hand on the wrist of the other hand. Move your fingers slightly until you feel a throbbing point. See the picture below.



2. Count the number of beats in 15 seconds. Multiply this number by 4. The value you will get is the number of times your heart beats per minute. For example, if you counted 17 beats in 15 seconds and multiplied this by 4, this means that your heart beats 68 beats per minute.
3. Sit quietly on a chair. Take your pulse.
4. Walk briskly around the room for around one minute. Then immediately take your pulse. What did you notice? Is it faster or slower than the one you took previously?

Why do you think your heart rate changed?

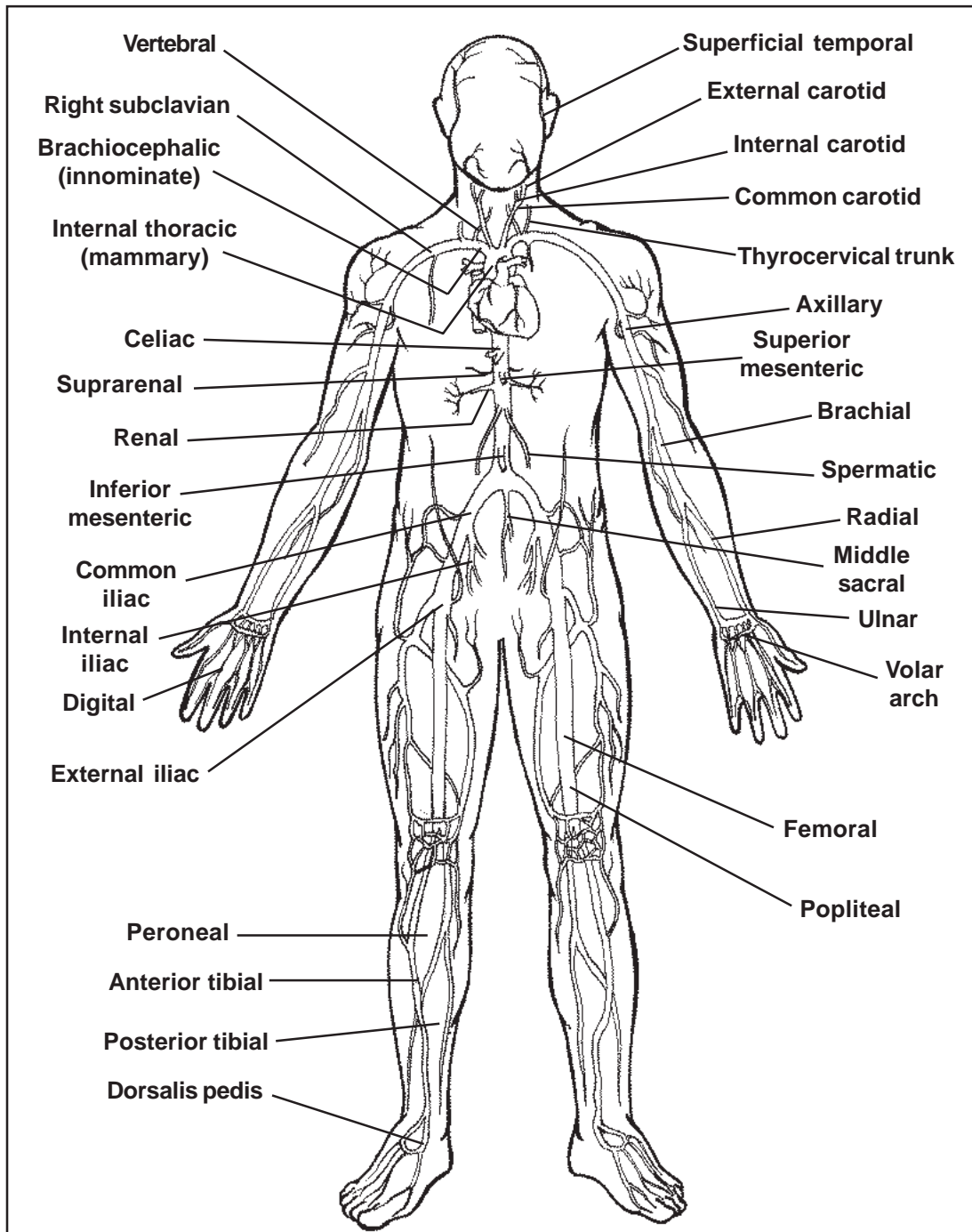
Compare your answers with those found in the *Answer Key* on page 41.



Let's Learn

How does blood travel throughout the body? There is a network of small tubes that carries blood through the body. These tubes are called **blood vessels**. Do you know that if you were to take out all your blood vessels and line them up end to end, they would be able to go around the earth twice?

There are three types of blood vessels in the body: the arteries, veins and capillaries. **Arteries** are what we call **efferent vessels** because they carry blood away from the heart. Every time your heart beats, blood is pumped into your arteries. The walls of the arteries stretch as the blood comes in. As it passes by, the walls relax. The stretching and relaxation of the artery wall is the **pulse**. You feel your pulse at your temples, neck and wrists.



The Blood Vessels of the Human Circulatory System

Each of the blood vessels listed in the above diagram bring blood to the parts of the body through the arteries and bring back blood from the body to the heart through the veins.

Example: Dorsalis Pedis Artery bring blood to the foot.

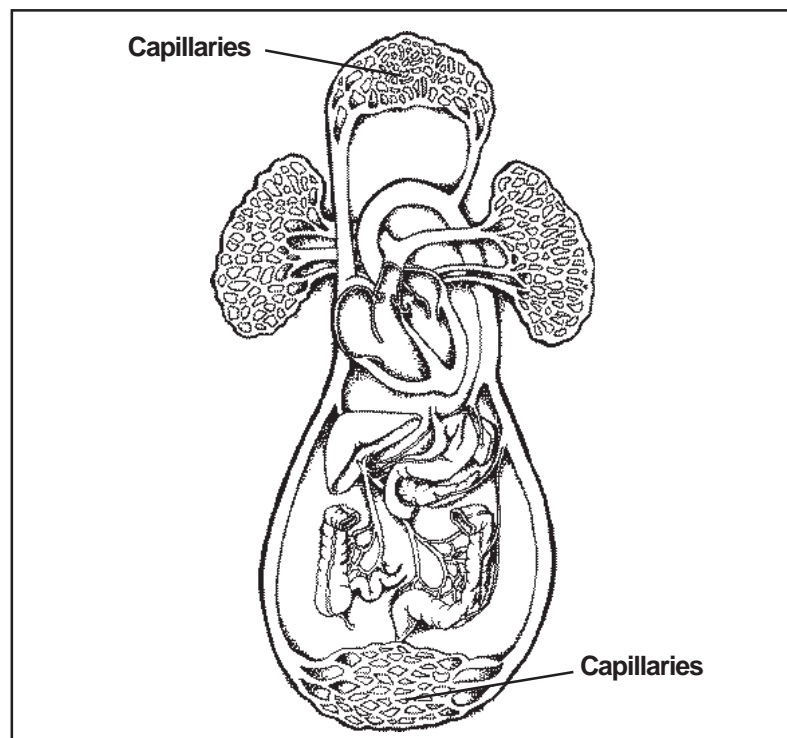
Renal Artery bring blood to the kidneys.

Most arteries carry oxygenated blood (blood containing a large amount of oxygen) except the pulmonary artery, which carries deoxygenated blood (blood containing little oxygen) from the heart to the lungs.

The veins are called **afferent vessels** because they bring back blood toward the heart. Most veins carry deoxygenated blood except for the pulmonary vein which carries oxygen-rich blood from the lungs to the heart.

Look at the table below. It is a comparison of the properties and functions of the arteries and veins.

Arteries	Veins
<ul style="list-style-type: none"> ♦ Carry blood away from the heart ♦ Blood is under great pressure here, hence it flows fast and in spurts, reflecting the rhythmic pumping action of the heart ♦ Have thick and elastic muscular walls ♦ Have no valves ♦ Carry red oxygen-rich blood (except pulmonary artery) 	<ul style="list-style-type: none"> ♦ Carry blood toward the heart ♦ Blood is not under great pressure here, so it flows more slowly and smoothly ♦ Have relatively thin, slightly muscular walls ♦ Have valves that prevent blood from flowing backward ♦ Carry bluish-red oxygen-depleted blood toward the heart (except for the pulmonary vein)



Large arteries branch into smaller arteries called **arterioles**; large veins branch into smaller veins called **venules**. These arterioles and venules lead into **capillaries**, the smallest of all blood vessels. Capillaries, as you can see in the picture above, are located mostly between the veins and the arteries. Their job is to distribute oxygen-rich blood that comes from the arteries out into the tissues of the body. Then, they move the oxygen-depleted blood from the tissues back into the veins.



Let's Try This

Do you have any idea how your veins look? Some of your veins lie close to your skin. Look at your hands and arms carefully. Do you see the bluish green vessels just beneath the surface of your skin? These are some of your veins. Why do they appear bluish green? That's because they carry oxygen-depleted blood. Oxygen-depleted blood is blue, oxygen-rich is red.



Let's Remember

- ◆ The circulatory system carries blood to all parts of the body. This function allows cells to receive oxygen, an important source of energy. It also allows waste products to be removed from the body.
- ◆ The heart is a hollow muscular organ located between the lungs. It is a tireless pump, which provides pressure to propel blood through the circulatory system.
- ◆ The blood vessels are hollow tubes that serve as passages for blood.
- ◆ Arteries carry blood away from the heart. Veins bring blood to the heart.
- ◆ Capillaries are the smallest vessels of the circulatory system.



Let's See What You Have Learned

In the space provided before each statement, write **True** if the statement is correct. Write **False** if the statement is incorrect.

- _____ 1. The circulatory system is composed of the heart and blood vessels.
- _____ 2. The heart is located in the abdomen.
- _____ 3. The heart is the most hardworking organ in the body.
- _____ 4. The heart stops beating every now and then.
- _____ 5. The heart pumps about 5 liters of blood every minute.
- _____ 6. The heart is made up of two pumps that work together.
- _____ 7. Arteries bring blood to the heart.
- _____ 8. Capillaries are efferent vessels.
- _____ 9. The pulse is the stretching and relaxing of the artery wall.
- _____ 10. The heart has four chambers.

Compare your answers with those found in the *Answer Key* on page 41. If your score is 7 or higher, congratulations! You are getting to know your circulatory system better. Review the parts you missed to refresh your memory. You may proceed to the next lesson afterward.

If your score is 5 or below, you need to study this lesson again. After doing so, you may proceed to the next lesson.

Blood

Blood is called the fluid of life. Without blood, human life would not be possible. The sight of blood might make a lot of people feel sick or scared, but you shouldn't be afraid of blood. This is the fluid needed by every cell in your body in order to live.

In this lesson, you will learn more about blood. You will discover its components that enable it to perform its functions. Are you ready to know more about the fluid of life?



Let's Try This

Do you know what fresh blood looks like? You can visit the meat section of a market. Ask the seller to show you some blood from a newly slaughtered animal. Study the appearance of the blood. Smell and touch it as well. Afterward, answer the questions in the next section.



Let's Think About This

1. What was the color of the blood?

2. How did it smell? Where do you think this odor came from?

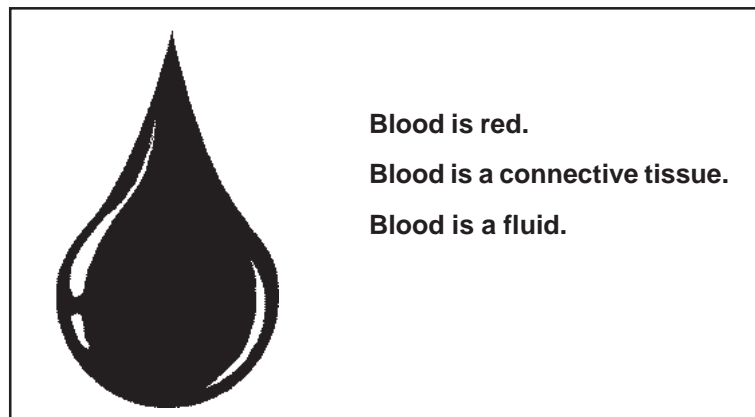
3. Does blood flow as easily as water does?

Compare your answers with those found in the *Answer Key* on page 41.



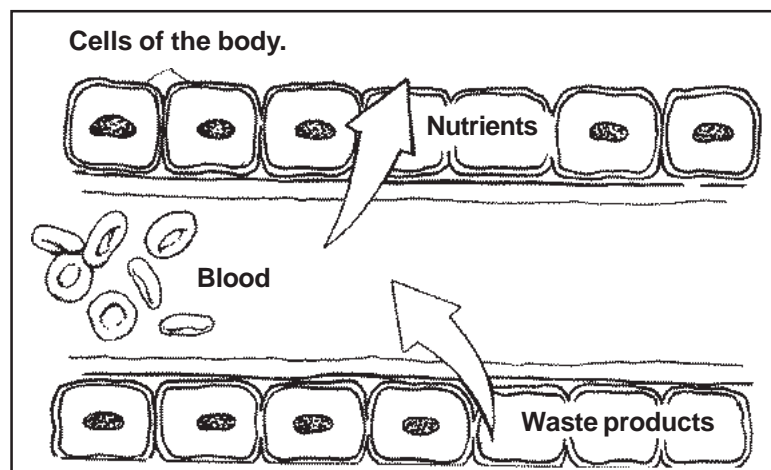
Let's Learn

Blood is the red fluid circulated throughout the body by the circulatory system. In human beings, blood is considered a connective tissue. It is a connective tissue because it is produced by the bone marrow inside bones, which are connective tissues. However, compared to other connective tissues, like ligaments and cartilages, blood is liquid. This enables blood to have special properties that other connective tissues do not have.



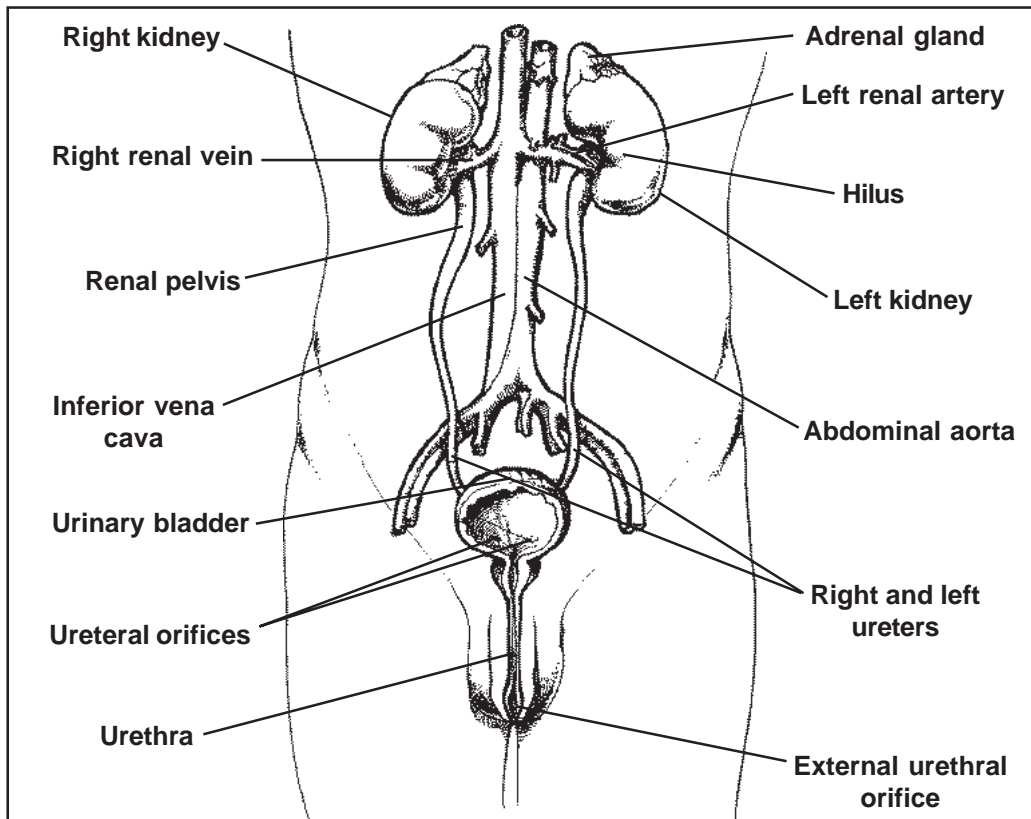
Blood contains substances needed by the body to maintain normal cell function. The lives of all the cells in your body depend on the jobs done by your circulatory system.

The blood exchanges nutrients and water with all the cells found in the body. Study the diagram below.



In the above diagram, nutrients carried by the blood pass through blood vessels and go to the cells of the body. Conversely, waste products from these cells enter through the blood vessels to be transported out of the body.

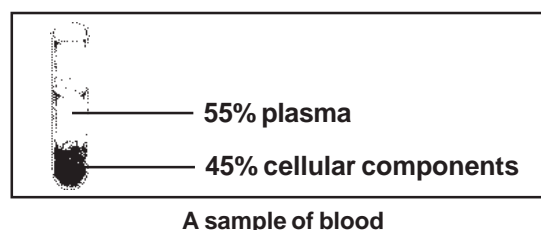
Blood also serves as the carrier of waste products to be transported out of the body through the urinary or excretory system.



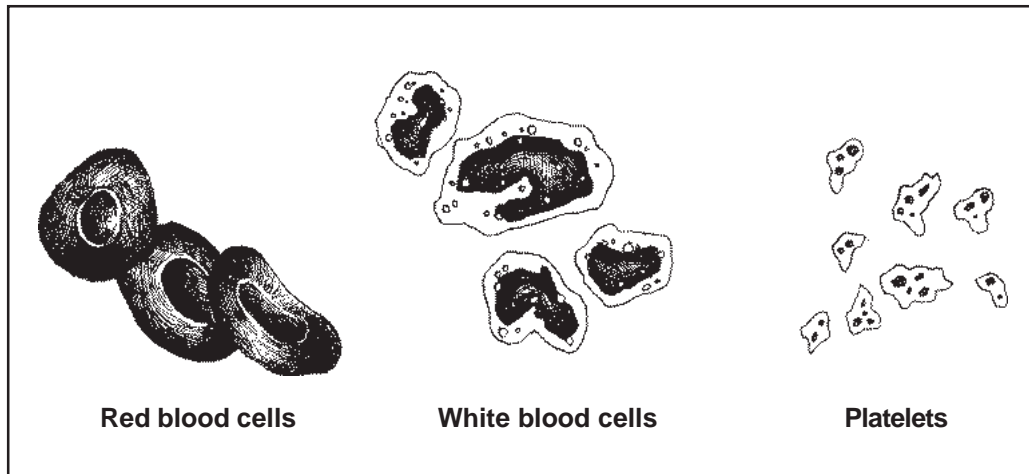
The above diagram shows the urinary system. Blood, containing waste products, enters the kidneys through the renal arteries where it is filtered. “Clean” blood re-enters bloodstream through the renal vein. Filtered waste travels downwards as urine, to be ultimately excreted out of the body through the other parts of the urinary system.

An average of 5 to 6 liters of blood flows through the body at any one time. This blood is composed of several kinds of cells suspended in **plasma**. Plasma makes up 55% of the volume of the blood. Hence, if 100 milliliters (ml) of blood is extracted from the human body, 55 ml of it would be plasma. Plasma is composed mostly of water, proteins, oxygen, carbon dioxide and other substances such as sodium, potassium and calcium. The water in plasma serves as a carrier for ions such as sodium, chloride and potassium. It also dissolves nutrients like simple sugar and vitamins. The substances in plasma are also important for maintaining the chemical balance inside the body and help in fighting off diseases.

We can easily separate blood into its separate components by taking a small amount in a test tube and allowing the heavier components to settle to the bottom. The plasma remains above. The components that settle are the blood cells and platelets.

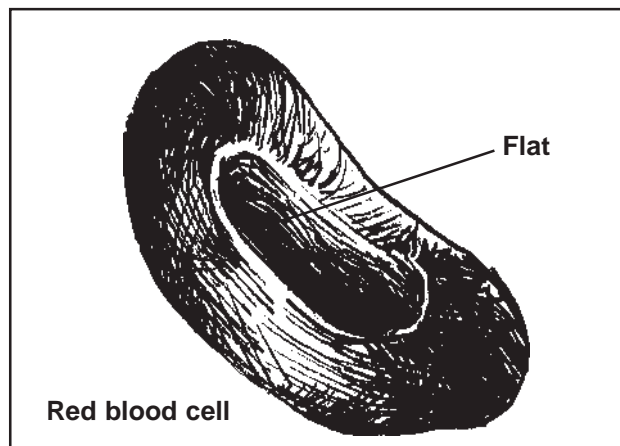


The red blood cells, white blood cells and platelets are the three major components of blood.



The Red Blood Cells

The red blood cells (RBCs) are also called **erythrocytes**. These cells form the largest group of cells in the blood. There are about 25 trillion of these tiny cells in the human body. If you would look at red blood cell under a microscope, this is how it would look.



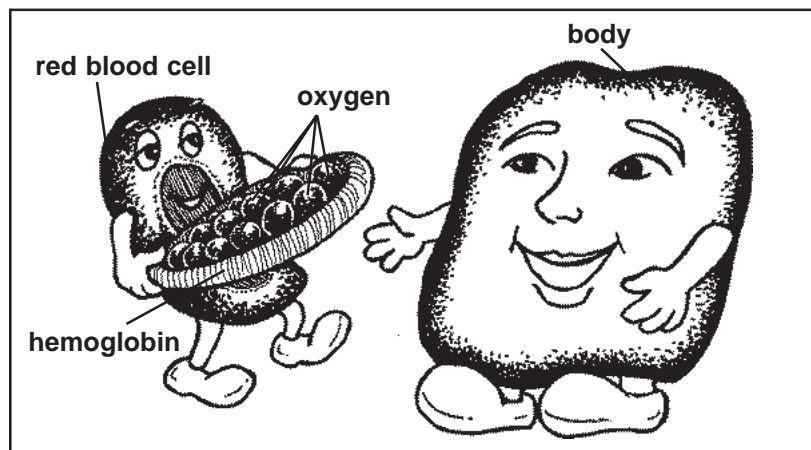
What do you notice about the red blood cell? Write down your observations on the line below.

If you noted that the red blood cells are disc-shaped, you are correct. These cells are **biconcave**, meaning, they have a slight depression in the center.

If you wrote that the red blood cell has no nucleus, that's very good! Erythrocytes are unusual because unlike other cells, they do not have nuclei. In fact, only human beings have red blood cells without nuclei. This is so because, having a nucleus decreases the surface area where oxygen can come in to be transported by the cells.

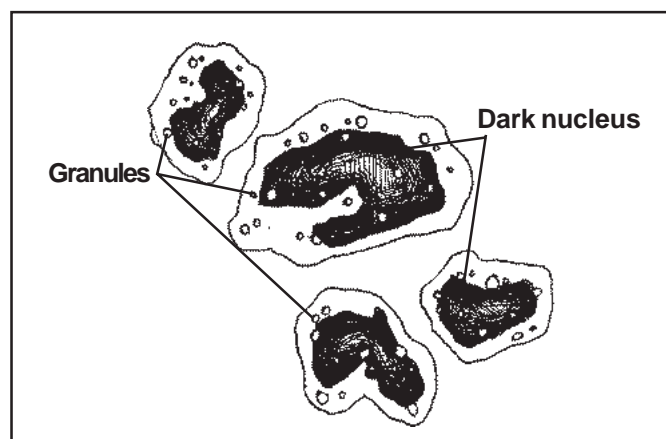
If you observed that the red blood cells look uniform all throughout, you're right again. This characteristic is due to the very thin membrane or covering of the red blood cells. Because of this, oxygen can come in quite easily.

The function of the erythrocytes is primarily to carry oxygen to the cells of the body. Small as the red blood cells are, each one carries about 250 million molecules of hemoglobin. **Hemoglobin** is a special substance that attracts oxygen and keeps it inside the erythrocytes. When erythrocytes reach the capillaries, the oxygen they carry is given up and transferred to the cells of the body.



Red blood cells carry oxygen to the cells of the body

The other group of cells found in blood are the **white blood cells** (WBCs) which are also called **leukocytes**. Unlike red blood cells, white blood cells contain nuclei. They defend the body against invading harmful microorganisms. Most white cells carry out **phagocytosis**, that is, they gather at the site of infection and engulf and eat up bacteria. They also dispose of dead cells.



White blood cells



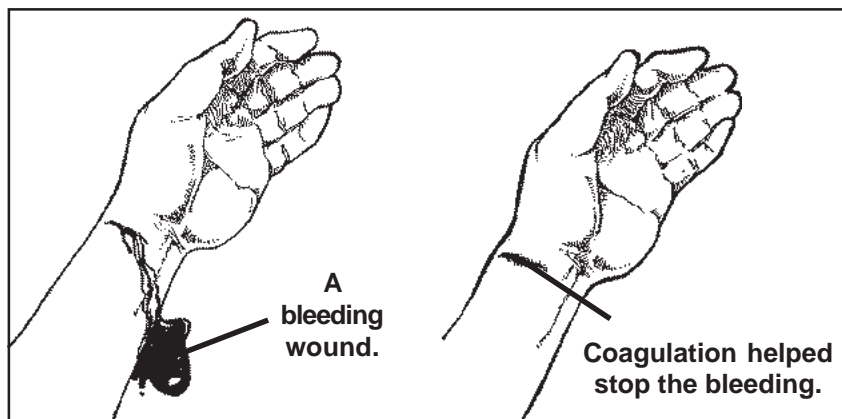
Let's Think About This

If you did not have leukocytes in your blood, what would happen to your body? What would be the effect of not having a functioning or disease-fighting immune system in the body?



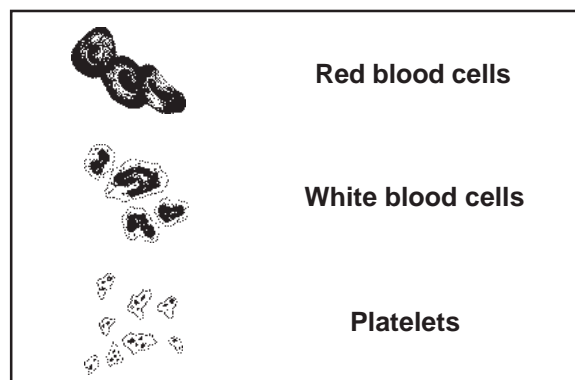
Let's Learn

The third group of cells are the **platelets**. Actually, platelets are not real cells. They are fragments of cell materials that come from certain bone marrow cells. Platelets play an important part in blood clotting.



Blood clotting is also known as blood coagulation. This process helps stop bleeding. Suppose you cut yourself. As the blood escapes from your wound, the platelets stick to the edges of the broken blood vessels, and a complex series of steps begins.

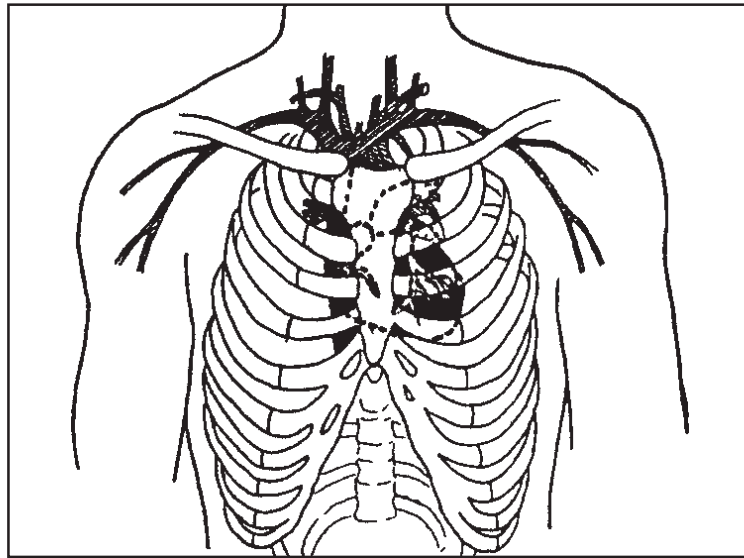
The platelets pile up and break apart. Chemicals are released from the broken platelets and damaged blood vessels. These chemicals trigger the growth of a threadlike material called **fibrin**. This material forms a net that traps red blood cells. As it traps more cells, a clot is formed, which seals off the damaged blood vessel and stops the bleeding.



So far you have learned about the cellular components of human blood — the red blood cells (erythrocytes), the white blood cells (leukocytes) and the platelets. These cells float in plasma.

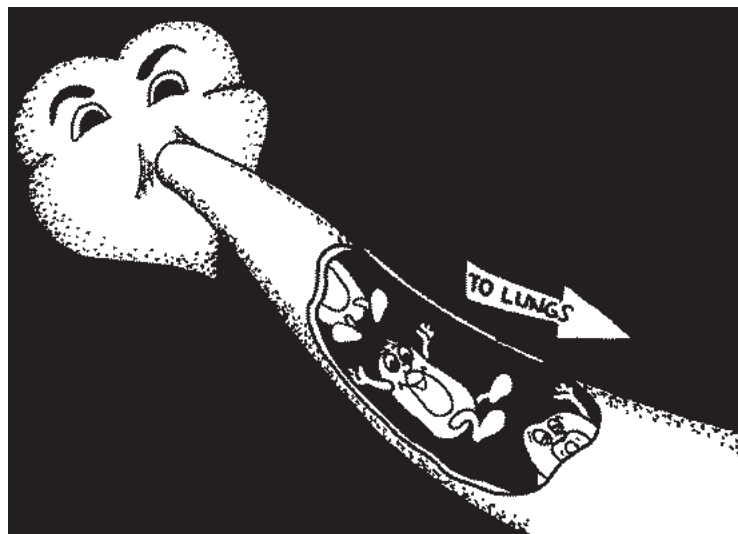
Now it's time for us to trace the path of blood through the body. We'll do this by joining a red blood cell named Hardy in his journey through the body.

Hardy was born inside the **bone marrow**, along with trillions of other red blood cells. Hardy starts working immediately. He feels himself being dragged toward the heart as he floats in the plasma.

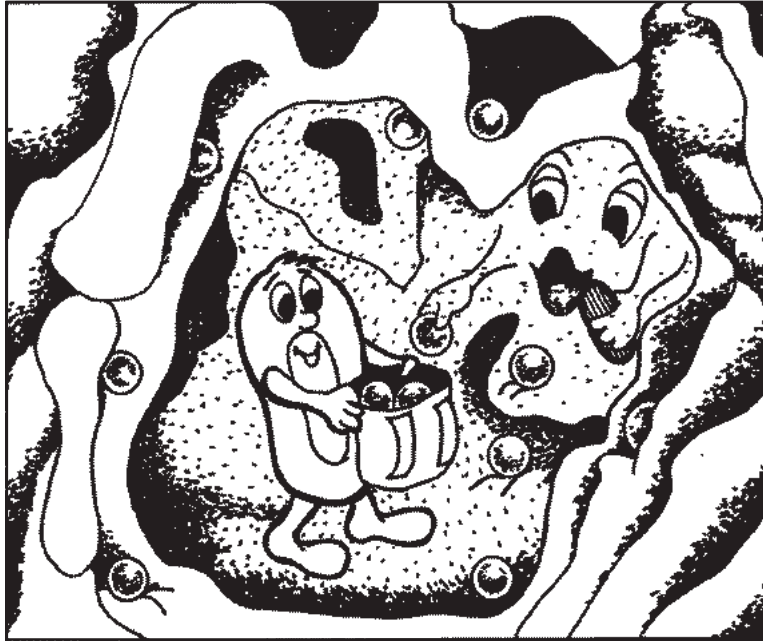


The dotted line shows the outline of the heart beneath the bones of the ribcage.

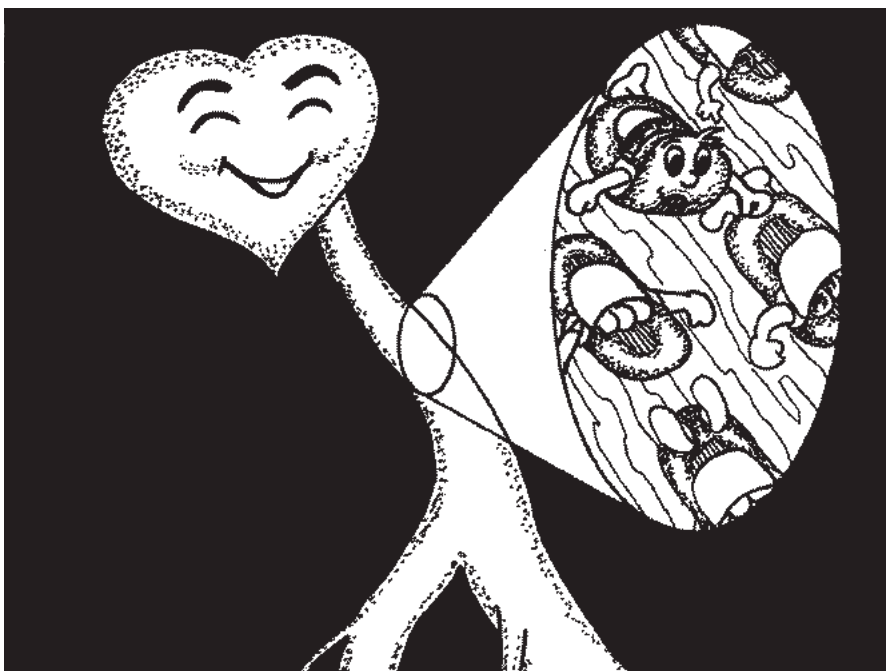
Hardy reaches the heart. He does not yet have oxygen to bring to the cells of the body. He first enters the right atrium, which passes him through a valve into the right ventricle. The right ventricle then pumps him and his brothers through the pulmonary artery towards the lungs.



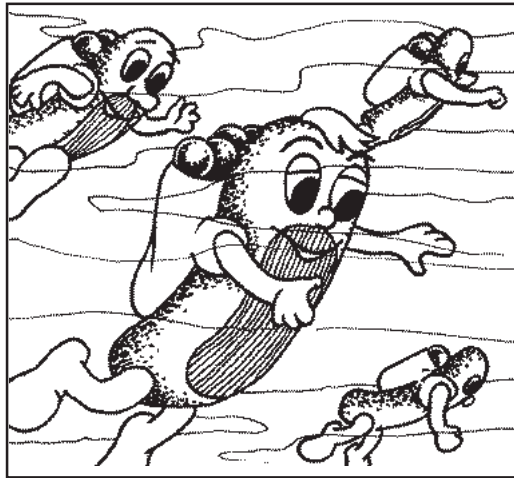
Hardy then passes through the capillaries of one of the lungs. These capillaries are close to the air sacs, which are called **alveoli**. Inside the lung, Hardy passes through the alveoli where gas exchange takes place. Remember that red blood cells, like Hardy, contain hemoglobin that picks up oxygen as it passes through the alveoli. The cells also discard carbon dioxide, which passes through the alveoli into the lungs to be excreted out of the body.



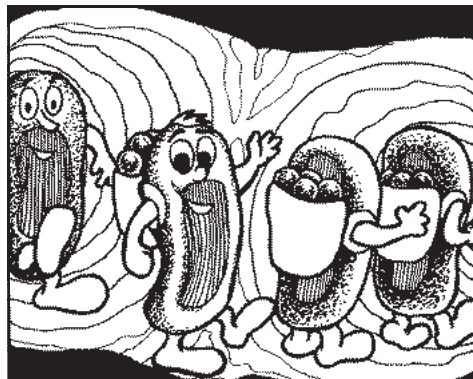
Now that he already carries oxygen, Hardy has turned bright red. He now travels back toward the heart, this time, passing through the pulmonary vein to the left side of the heart. The left atrium receives Hardy, then he passes through a valve into the left ventricle. This is the most powerful chamber of the heart.



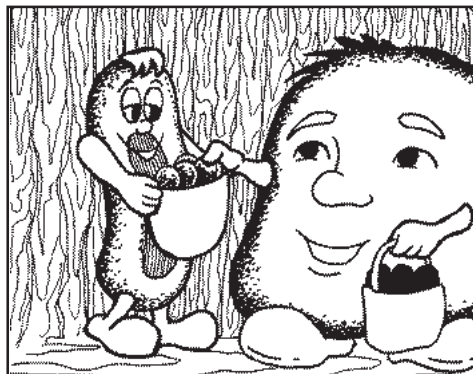
The left ventricle contracts, giving Hardy a powerful push into the **aorta**, the largest artery in the body. He is then dragged into the smaller arteries. Hardy now carries a heavy pack of oxygen and food.



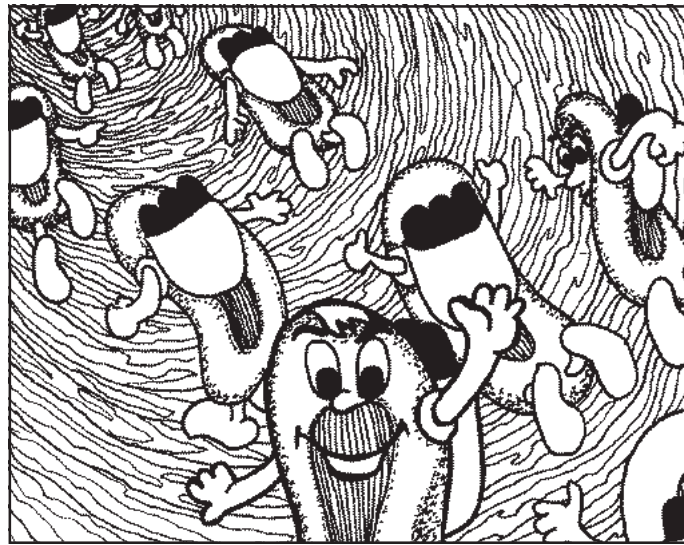
Hardy passes through smaller and smaller arteries until he reaches the capillaries. In the capillaries, he has to fall in line because only one red blood cell at a time can pass through the very small passage.



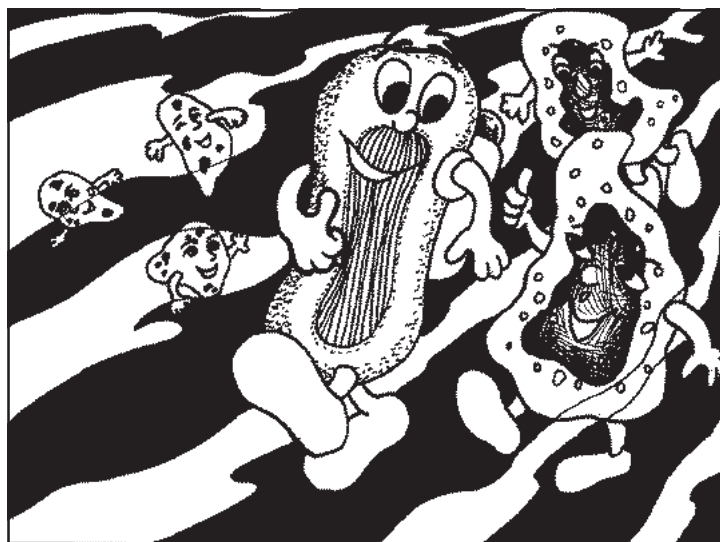
He waits for his turn and when his turn comes, Hardy is very happy to deliver the oxygen to the cell that lies near the capillaries. In exchange for the oxygen, the cell gives him carbon dioxide.



Once more, Hardy finds himself traveling through the veins toward the heart. The whole cycle is repeated again and again.



Hardy will live for only 120 days, but he is very happy. He knows that he is doing a very important job in bringing life to the body. He also meets friends along the way — the white blood cells and platelets.



You have just discovered through Hardy's adventures how the parts of your circulatory system work together to keep all the cells of your body alive. How do you feel now about your circulatory system? Remember that it is a very hardworking system that keeps you alive. All day long, Hardy and other cells like him work tirelessly to keep life going.



Let's See What You Have Learned

Fill in the blanks.

1. Blood is a type of _____ tissue.
2. Red blood cells are also called _____.
3. Red blood cells are formed in the _____.
4. The white blood cells are also known as _____.
5. _____ is the primary function of white blood cells.
6. Platelets are needed for _____.
7. A red blood cell only survives for _____ days.
8. _____ is the liquid part of the body.
9. The largest artery in the body is the _____.
10. Red blood cells contain _____, which picks up oxygen.

Compare your answers with those found in the *Answer Key* on page 42. If your score is 7 or higher, congratulations! You have done well. You learned a lot from this lesson. Review the parts that you missed to refresh your memory. You may proceed to the next lesson afterwards.

If your score is 6 or lower, you need to study this lesson again. Don't worry. You just need to put in more time and effort in studying. Go back to the parts you missed and study them again. If you think you have already learned the lesson well, proceed to Lesson 3.



Let's Remember

- ◆ Blood is the fluid of life. It is a kind of connective tissue produced by the bone marrow inside bones. It is composed of 55% plasma and 45% cellular components.
- ◆ Plasma is the liquid part of blood. It contains water that serves as a carrier for substances such as sodium, potassium and chloride and it dissolves nutrients such as simple sugar and vitamins.
- ◆ The cellular components of blood are the red blood cells, white blood cells and platelets.
 - Red blood cells or erythrocytes are the largest group of cells in the blood. They contain hemoglobin, which picks up oxygen. RBCs have no nuclei.
 - White blood cells or leukocytes defend the body against harmful microorganisms through phagocytosis. They engulf and eat up bacteria that invade the body cells.
 - Platelets are not real cells; they are fragment of cell material from bone marrow. They play an important role in blood clotting, which is a series of steps taken by blood cells in order to stop bleeding.
- ◆ Deoxygenated blood first enters the heart through the right atrium. It then passes through a valve into the right ventricle, which pumps it toward the lungs through the pulmonary artery. It then enters the lungs through capillaries, which are close to the alveoli. Oxygen diffuses through the alveoli and is picked up by hemoglobin in the RBCs. Carbon dioxide diffuses from the blood into the alveoli, from which it is expelled into the environment.
- ◆ Oxygenated blood now returns to the heart via the pulmonary vein. It enters the left atrium and passes through a valve into the left ventricle. The left ventricle contracts powerfully to push the blood into the aorta, which then leads it into smaller arteries. The smaller arteries then lead to capillaries that lie close to different cells of the body. Blood delivers oxygen and food into these cells. Then, it returns once more to the heart and the cycle is repeated.

Diseases That Can Affect The Circulatory System

In the previous lessons, you learned about the parts of the circulatory system and their functions, as well as the properties and components of blood. You discovered how the circulatory system works tirelessly to deliver blood to and remove wastes from the different parts of your body. This hardworking system is very important to the human body. However, it is prone to a lot of diseases that can cause it to break down. This could affect the rest of the body as well.

In this lesson, you will study some diseases that can affect the circulatory system and how to best take care of it. If you feel your heart beating fast, don't worry. It just means that you are excited to know more.



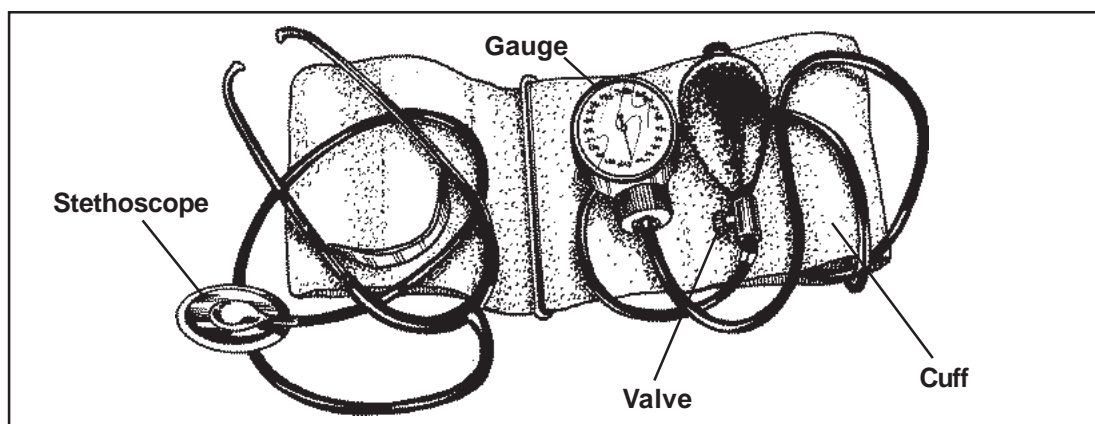
Let's Read

Mely Goes to the Doctor

Mely paid her doctor a visit. "I haven't been feeling well lately," she said to Doctor Reyes. "I feel tired most of the time."

"You must be working too hard," Doctor Reyes said as she prepared to take Mely's blood pressure.

Doctor Reyes brought out a **sphygmomanometer**, an instrument for measuring blood pressure. A sphygmomanometer looks like this:



Doctor Reyes wrapped the blood pressure cuff around Mely's left upper arm. She then inflated the cuff.

“This is to stop the flow of blood in your artery for a few seconds,” she explained to Mely. She then opened the valve, which released the air from the cuff. She listened to the sound of blood rushing through Mely’s artery by using the stethoscope, which she placed over the cuff.

The first sound Doctor Reyes heard and which registered in the gauge was Mely’s systolic blood pressure. The value was 131. The last sound the doctor heard as more air was released from the cuff was Mely’s diastolic blood pressure. The value was 85.

“Your blood pressure’s 131/85, Mely,” Doctor Reyes said. “It’s normal, but it would be better if it was lower.”

“What should I do, Doctor?” Mely asked.

“Try not to tire yourself out. And check what you eat as well; too much salt is not good for your health.”



Let’s Think About This

1. What do you think is the importance of knowing your blood pressure? If we say a person has “high blood,” what does this mean?

Compare your answers with those found in the *Answer Key* on page 42.



Let’s Learn

What is blood pressure? **Blood pressure** is the force of the blood pushing against the walls of the arteries. Each time the heart beats, it pumps blood out into the arteries. The blood pressure is at its greatest when the heart contracts and is pumping blood. This is called **systolic pressure**. When the heart is at rest, the blood pressure falls. This is the **diastolic pressure**.

Blood pressure is always given as two numbers, the systolic and diastolic pressures. For example, if your blood pressure is 120/80, that means your systolic pressure is 120 and your diastolic pressure is 80.

If your blood pressure is lower than 140/90, it is considered normal. It is better though to have a blood pressure lower than 120/80. When the blood starts pushing against the walls of the arteries with higher-than-normal force, the blood pressure turns higher.

High blood pressure or **hypertension** is caused by many factors. Having too much salt in the diet increases blood pressure. Being overweight also increases one's chances of having high blood pressure and so does old age. Too much stress can also lead to this condition.

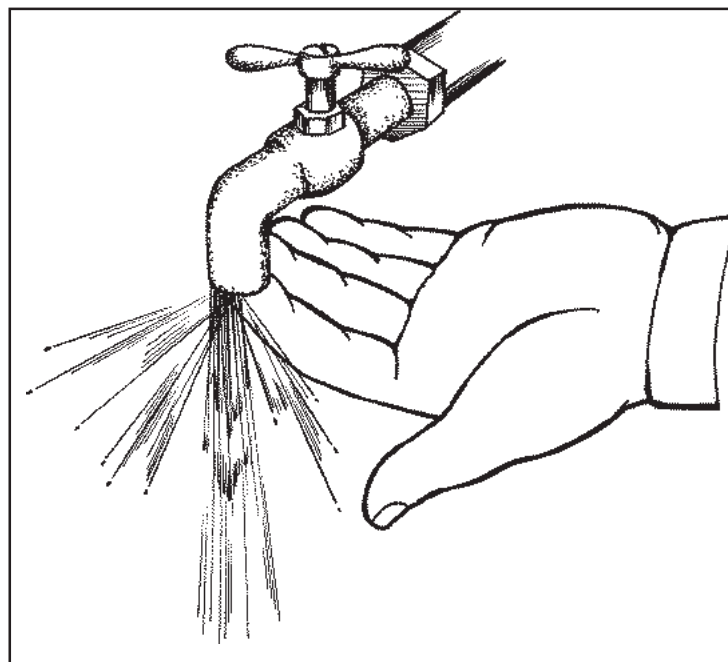
If left untreated, hypertension can lead to serious medical problems such as:

- ◆ **Arteriosclerosis** — literally means “hardening of the arteries.” High blood pressure makes the arteries thick and stiff. This leads cholesterol and fats to build up in the blood vessels. This then prevents blood from flowing through the body that can lead to a heart attack or stroke.
- ◆ **Enlarged heart** — High blood pressure causes the heart to work harder. This causes the heart to thicken and stretch over time. Eventually, the heart fails to function normally. This then causes fluids to flow back into the lungs.



Let's Try This

Go to the kitchen sink in your house. Turn on the faucet so that water flows smoothly. Then cover half the opening of the faucet with your finger. What do you notice about the pressure or force of the water coming out of the faucet?



Think of the faucet as a blood vessel. When it is clogged (usually with fatty deposits), the pressure of the blood increases. This causes blood to surge downward because it is forcing itself through a small opening. This pressure is too much for the tissues of the body. Sooner or later, damage can occur. Blood pressure also increases when there is an increase in the pumping action of the heart. In the example, this is similar to attaching a pump to the waterpipe. Even if the blood vessel is wide enough, if the heart is pumping too strongly, hypertension still occurs, leading to organ damage. A stressful life can increase the pumping action of the heart. This is the reason why relaxation is important.



Heart Attack

Mr. Jose was 60 years old. He was fond of eating fatty foods, although he did not really get fat. Mr. Jose stayed home most of the time and hated exercise. One day, he suddenly felt a squeezing pain in his chest. He perspired profusely and was unable to breathe. He lost consciousness. By the time he was brought to a hospital, it was already too late.

Mr. Jose suffered from a condition called **myocardial infarction** or what we commonly know as heart attack. A heart attack is a potentially fatal condition that is caused by blockage of arteries. A person experiencing a heart attack feels sudden chest pain, usually radiating to the left shoulder and arm, and even to the back, accompanied by sweating and difficulty in breathing. The patient can also experience jaw pain and nausea. A person who shows these symptoms must be brought to a hospital immediately.

Angina Pectoris

Kardo weighed almost 200 pounds. He drank and smoked a lot. His doctor warned him that he should take things slowly, because his blood pressure had climbed over the past few months. However, he went on with his habits, until one day, after a heavy meal, he felt a crushing, squeezing pain in his chest. The pain radiated to his jaw, neck, shoulders, back and arms. He went to his doctor, who gave him some medicine that eased the pain after a while.

Angina pectoris, or simply angina, is a recurring pain in the chest caused by a lack of blood flow to the heart. It is often triggered by physical exertion, but can also be brought on by extreme heat and cold, heavy meals, cigarette smoking, excessive alcohol consumption and emotional stress. The symptoms of angina are similar to those of heart attack, but an attack of angina eases after some time or after medication. However, when one suffers from angina, it usually means that he/she is suffering from a heart disease and therefore, must see a doctor immediately for diagnosis.

Varicose Veins

Sally works as a saleslady in a popular department store. She stands all day at work while wearing high-heeled shoes. One day, her friend noticed bluish lumps on her legs.



Varicose veins are large, twisted, swelled up and bulging blood vessels, which usually occur on the inside of the legs and the back of the calf. They are usually caused by the slow blood flow in the veins of the legs, causing the veins to pile up with blood. They can also be caused by malfunctioning valves in the veins. These valves are supposed to help blood flow upward to the heart, but because of malfunction, some of the blood flows back down into the legs — the wrong direction. Over a period of time, the additional pressure of blood causes the veins to bulge and become visible.

Varicose veins are usually hereditary, but are also common among obese people and pregnant women. This disorder is treated either through the injection of a chemical into the affected veins or by surgical removal of the larger veins.

Rheumatic Heart Disease

Anna is 14 years old. She is very thin and weak. When she was younger, she suffered from a throat infection from which she never recovered. Her chest heaves even when she is resting. Anna was diagnosed to have a rheumatic heart disease.

Rheumatic heart disease is a condition in which the heart valves are permanently damaged due to rheumatic fever. The disease usually starts as a throat infection caused by a kind of bacteria called streptococcus. This then leads to rheumatic fever.

Rheumatic fever is more common among children 5 to 15 years old. It affects the connective tissues of the body, especially those of the heart, joints, brain and skin. If untreated, the disease can damage the heart valves. A damaged heart valve doesn't completely close or doesn't completely open. Rheumatic heart disease can lead to disabling problems and can even cause heart failure.

Anemia

Aling Selya is thin and pale. She often feels tired and breathless. Her heart rate is also rapid. When she consulted a doctor, she found out that she has anemia.



Anemia occurs when the concentration of red blood cells or hemoglobin in the body falls from the normal level. There are many types of anemia, but the most common is iron deficiency anemia. This is caused by the lack of iron in the diet, which is needed in the production of hemoglobin.

Leukemia

Nena is 10 years old. Lately, she has grown pale and weak. She also bleeds and bruises easily. She also often suffers from bouts of fever and chills. She throws up a lot and complains of headaches. When her parents brought her to a doctor, they found out that she has leukemia.

Leukemia is a type of cancer that affects the bone marrow. The bone marrow is the spongy center of the bone that produces blood cells. In a leukemia patient, the process of blood cell production gets out of control. The marrow produces too many immature blood cells that are abnormally shaped and cannot perform their usual duties. This explains why the disease is called **leukemia**, which means “white blood.” As these abnormal cells multiply and crowd the bone marrow, they tend to interfere with the production of other blood cells. When they move into the body they collect in different places, causing swelling and pain.



Let's Remember

- ◆ The blood and the circulatory system can be affected by many diseases. Some of these diseases are hypertension, heart attack, angina pectoris, rheumatic heart disease, varicose veins, anemia and leukemia.



Let's See What You Have Learned

Match the items in Column A with those in Column B. Write only the letters in the blanks before the numbers.

Column A

- _____ 1. leukemia
- _____ 2. hypertension
- _____ 3. heart attack
- _____ 4. varicose veins
- _____ 5. rheumatic heart disease
- _____ 7. rheumatic fever
- _____ 8. angina pectoris
- _____ 9. iron
- _____ 10. throat infection

Column B

- a. occurs commonly among children 5 to 15 years old
- b. enlarged leg veins
- c. important for the production of hemoglobin
- d. caused by low iron level in the body
- e. high blood pressure
- f. heart valve defect
- g. usual cause of rheumatic heart disease
- h. cancer of the bone marrow
- i. also known as myocardial infarction
- j. recurring pain in the chest

Compare your answers with those found in the *Answer Key* on page 42. If your score is 6 or higher, very good! You are now familiar with some diseases that can affect the circulatory system. Review the parts you missed to refresh your memory.

If your score is 5 or lower, don't worry. You just need to study the lesson again. You may proceed to the next lesson after you finished going through the items you missed. If you think you have already learned the lesson well, proceed to Lesson 4.

Taking Care of the Circulatory System

In the previous lesson, you learned about the many diseases that can affect the circulatory system. You found out that the circulatory system is a hardworking but fragile system.

In this lesson, you will learn how to take proper care of your circulatory system. Study this topic well so you can keep your heart, blood vessels and blood healthy and functioning well.



Let's Try This

How well do you take care of your circulatory system? Answer the following questionnaire to find out.

Check the box beside the appropriate answer.

1. Are you overweight? Yes ☐ No ☐
2. Do you eat foods low in calories and fats, such as fresh vegetables, plain rice, and fresh or canned fruits? Yes ☐ No ☐
3. Do you eat foods high in starch and fiber, such as fruits, vegetables, rice and dry beans? Yes ☐ No ☐
4. Do you spend most of your time sitting or lying down? Yes ☐ No ☐
5. Do you drink a lot of alcoholic beverages? Yes ☐ No ☐
6. Do you eat foods containing iron, such as beans, nuts and seafood?
Yes ☐ No ☐
7. Do you go to the doctor regularly for a checkup? Yes ☐ No ☐

Here is the score guide:

1. Yes: 3 points; No: 6 points
2. Yes: 6 points; No: 3 points
3. Yes: 6 points; No: 3 points
4. Yes: 6 points; No: 3 points

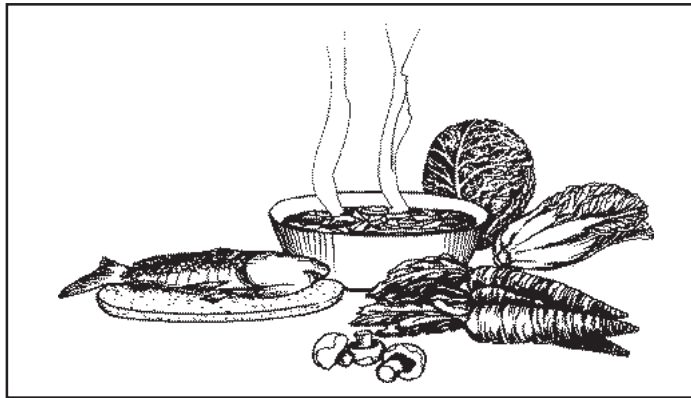
5. Yes: 3 points; No: 6 points
6. Yes: 3 points; No: 6 points
7. Yes: 6 points; No: 3 points

If you got a score of 30 or higher, that means you're taking care of your circulatory system well. If you got a lower score, that means that you might suffer from some disorders in the circulatory system if you don't start practicing good health habits soon. Read on to find out how you can take care of your circulatory system.

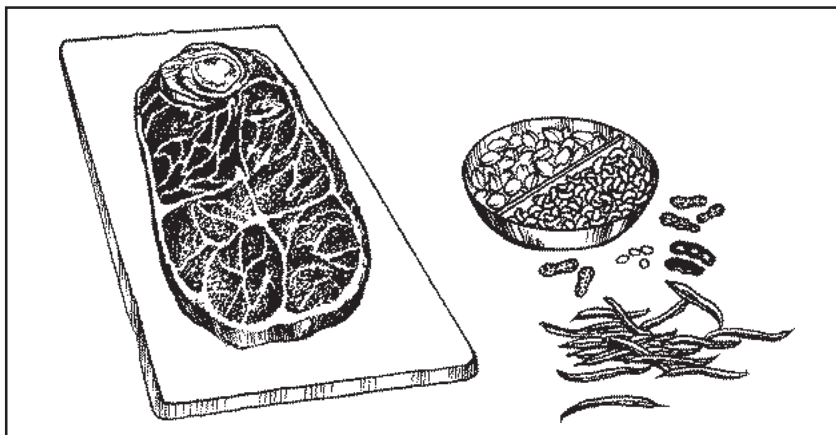


Let's Learn

To maintain a healthy circulatory system, practice the following habits.



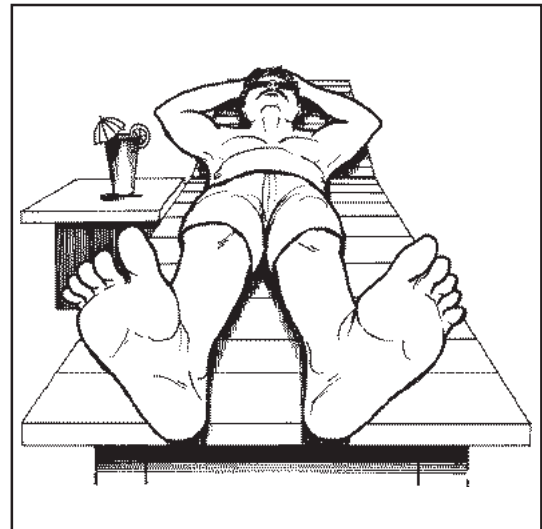
Eat low-fat, low-calorie foods to avoid fat deposits from clogging your blood vessels. Eating vegetables, fruits, nuts, grains and rice can help prevent high blood pressure and other diseases of the circulatory system. Avoid too much salt in your diet as well, because too much salt increases the risk of heart disease.



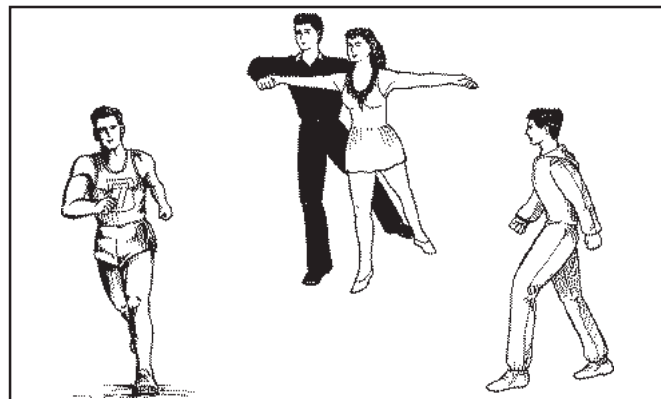
Eating foods rich in iron such as red meat, beans and nuts helps prevent iron deficiency anemia.



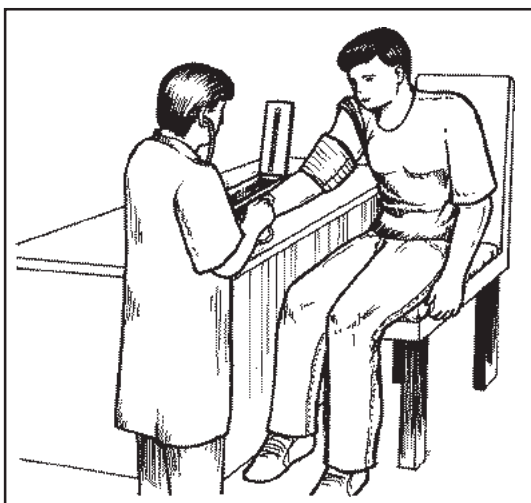
Avoid smoking and drinking too much alcohol. Smoking increases your risk of having high blood pressure, heart attacks or angina.



Learn to relax. Stress puts more work on your heart.



Exercise regularly. Exercise makes your heart stronger. Aerobic exercises such as running, dancing and brisk walking are good for the heart when done correctly.



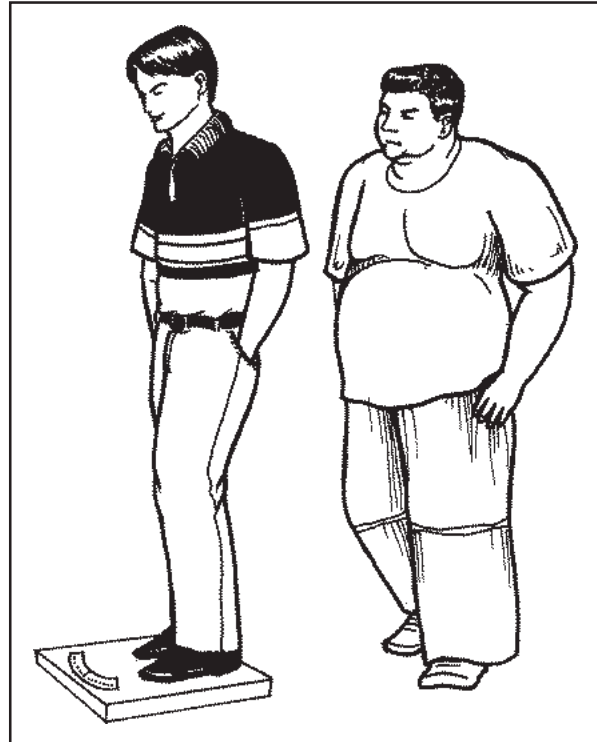
Have your blood pressure checked regularly.



Be wary of throat infections, especially among children. These could develop into rheumatic heart disease. Seek medical attention immediately.



Always maintain proper hygiene.
Infections can affect the circulatory system, too.



Maintain your ideal body weight. Obesity will make you prone to hypertension and other heart problems.



Let's See What You Have Learned

Here's something for you to do: Make a list of the things that you will do in order to take care of your circulatory system. Make a resolution to carry out everything in your list. Show your list to your Instructional Manager or Facilitator.

- A. Write **True** in the blank if the statement is correct and **False** if it is incorrect.
- _____ 1. Eating salted peanuts is healthier than eating unsalted ones.
 - _____ 2. Iron helps you avoid anemia.
 - _____ 3. Smoking is bad for the circulatory system.
 - _____ 4. Infections can cause diseases of the heart.
 - _____ 5. Hypertension and other heart problems are linked to obesity and high-fat diet.

B. Enumerate five ways to take care of your circulatory system.

1. _____
2. _____
3. _____
4. _____
5. _____

Compare your answers with those found in the *Answer Key* on pages 42–43. If your score is 6 or higher, congratulations! You now know how to take care of your circulatory system. Review the points you missed to refresh your memory.

If your score is 5 or below, you need to review this lesson. Go back and study the parts you missed.

You have now reached the end of the module. Congratulations! Did you enjoy studying this module? Did you learn a lot from it? The following are a summary of its main points to help you remember them better.



Let's Sum Up

- ◆ The main function of the circulatory system is to carry blood to all parts of the body. It is made up of the heart and blood vessels.
- ◆ The heart is the most important part of the circulatory system. It is a muscular organ located between the lungs. It pumps blood throughout the body.
- ◆ Blood vessels are tubes, through which blood passes to and from the heart. There are three kinds of blood vessels: arteries, veins and capillaries.
- ◆ Blood is a kind of connective tissue that serves to bring food and oxygen to the cells of the body. It also collects waste products from the cells. It is made up of plasma, the liquid part, and cellular components—red blood cells, white blood cells and platelets.
- ◆ The circulatory system is prone to many diseases. Among these diseases are hypertension, myocardial infarction or heart attack, angina pectoris, varicose veins, rheumatic heart disease, anemia and leukemia.
- ◆ You can take care of your circulatory system by: eating low-fat, low-calorie, low-salt, high-iron foods; avoiding smoking and drinking too much alcohol; finding time to relax and exercise; having your blood pressure checked regularly; seeking medical attention at once in case of throat infections; maintaining proper hygiene; and maintaining your normal weight.



What Have You Learned?

To find out what you have learned from this module, answer the following questions in the blanks provided.

1. What are the three kinds of blood vessels and their functions?
 - a. _____
 - b. _____
 - c. _____
2. Name the three cellular components of blood and their functions.
 - a. _____
 - b. _____
 - c. _____
3. What is plasma?

4. Which of the following is bad for the circulatory system? Encircle the letter before the item that shows an unhealthy practice.
 - a. Smoking
 - b. Eating fish and vegetables
 - c. Exercise
 - d. Tension
 - e. Eating fatty foods
5. Name one disease that can affect the circulatory system. Describe its causes and symptoms.

Compare your answers with those found in the *Answer Key* on page 43.

If your score is:

- | | |
|---------|--|
| 10 – 13 | Congratulations! You learned a lot from this module. |
| 6 – 9 | Well done. A review of the items you missed will help you remember better what you learned from this module. |
| 0 – 5 | You need to study the module again. This time, focus more on the parts that you find difficult. |



Answer Key

A. Let's See What You Already Know (*page 2*)

1.
 - a. heart
 - b. blood vessels
2.
 - a. transports oxygen and food to the cells of the body
 - b. helps fight against harmful organisms like bacteria
 - c. serves to carry waste products to be excreted by the body
3. The sound of a heart beating is caused by the closing of the valves of the heart.
4.
 - a. hypertension
 - b. heart attack
 - c. varicose veins

Other possible answers: rheumatic heart disease, angina pectoris, anemia, and leukemia.

5. Hypertension is another name for high blood pressure. It is caused by the increased pressure of the blood as it passes through the blood vessels. Hypertension is common among the elderly, obese, and physically inactive individuals.
6.
 - a. avoiding fatty and salty foods
 - b. regular exercise
 - c. avoiding stress
 - d. observing proper hygiene
 - e. avoiding smoking and drinking too much alcohol

Other possible answers: Having blood pressure checked regularly, being physically active, maintaining normal weight, and having infections treated at once.

B. Lesson 1

Let's Think About This (page 5)

1. I squeezed the bottle in order to let the water out.
2. (Answers will depend on how long it took the learner to fill the cup.)
3. I squeezed the bottle harder in order to fill the cup faster.

Let's Try This (pages 7–8)

(The values obtained will differ among learners. However, the learner's heart rate after he/she walked briskly should be higher than when he/she sat in a chair.)

My heart rate changed because I exerted more physical effort, my heart worked harder to pump blood that will supply oxygen to the different parts of my body.

Let's See What You Have Learned (page 12)

1. True
2. False. The heart is located in the chest.
3. True
4. False. A healthy heart never stops working.
5. True
6. True
7. False. Veins bring blood to the heart. Arteries carry blood away from the heart.
8. False. Arteries are the efferent vessels, meaning they carry blood away from the heart.
9. True
10. True

C. Lesson 2

Let's Think About This (page 13)

(Answers will depend on the learners' observations. The following are sample answers.)

1. The blood that I studied was reddish brown.
2. The blood had a slightly metallic odor. This was caused by the presence of iron in the blood.
3. No, blood does not flow as easily as water does.

Let's See What You Have Learned (page 23)

1. connective
2. erythrocytes
3. bone marrow
4. leukocytes
5. Defending the body against harmful microorganisms
6. blood coagulation or clotting.
7. 120
8. Plasma
9. aorta
10. hemoglobin

D. Lesson 3

Let's Think About This (page 26)

(Answers will depend on learners' perception. The following, however, is the expected answer.)

Knowing my blood pressure is important for me to find out if I am suffering from any heart disorder. If we say that a person has "high blood," this usually means the person is suffering from a heart disorder, or is in danger of having a heart disease.

Let's See What You Have Learned (page 32)

- | | |
|------|-------|
| 1. h | 6. d |
| 2. e | 7. a |
| 3. i | 8. j |
| 4. b | 9. c |
| 5. f | 10. g |

E. Lesson 4

Let's See What You Have Learned (pages 36–37)

- A. 1. False. Eating unsalted peanuts is a healthier practice than eating salted ones. Too much salt in the diet can cause hypertension.
2. True

3. True
 4. True
 5. True
- B.
1. exercising regularly
 2. avoiding smoking
 3. avoiding stress
 4. having the blood pressure checked regularly
 5. avoiding fatty and salty foods

F. What Have You Learned? (*page 39*)

1. (Answers may be in any order.)
 - a. arteries—carry blood away from the heart
 - b. veins—bring blood to the heart
 - c. capillaries—bring oxygenated blood to the tissues of the body
2. (Answers may be in any order.)
 - a. red blood cells or erythrocytes—contain hemoglobin, which picks up oxygen from the lungs
 - b. white blood cells or leukocytes—defend the body against harmful microorganisms
 - c. platelets—help in blood clotting
3. Plasma is the liquid component of blood.
4. The following letters should be encircled: a, d, e.
5. (Answers will vary according to the learners' choices. The following is a sample answer.)

One disease that can affect the circulatory system is angina pectoris. Angina pectoris is caused by the lack of blood flowing to the heart. Its symptoms include a squeezing, crushing pain in the chest that radiates to the jaw, neck, shoulders, arms and back.



Glossary

- Anemia** A disease that occurs when the concentration of red blood cells or hemoglobin fall below normal; characterized by weakness and paleness
- Artery** A blood vessel that carries blood away from the heart
- Blood** A fluid that is a kind of connective tissue; brings oxygen to the cells of the body and carries away waste products to be excreted from the body.
- Capillary** The smallest type of blood vessel in the body
- Carbon dioxide** A gas produced as waste from the utilization of energy by the cells of the body
- Circulatory system** The organ system that brings blood to the different parts of the body
- Erythrocyte** Red blood cell
- Heart** A muscular organ located between the lungs, which pumps blood throughout the body
- Heart attack** Also known as myocardial infarction, a potentially fatal condition caused by the blockage of the arteries
- Hemoglobin** A substance found inside red blood cells, which picks up oxygen
- Hypertension** High blood pressure
- Leukocyte** White blood cell
- Oxygen** A gas which is needed by the cells in order to utilize energy from food
- Plasma** The liquid component of blood
- Platelet** A component of blood, which comes from fragments of cell material from bone marrow cells; helps in blood clotting
- Pulse** The stretching and relaxation of the walls of the arteries
- Rheumatic heart disease** A condition characterized by malfunctioning heart valves, brought on by rheumatic fever
- Varicose veins** Enlarged, bulging and swelled up veins caused by the slow blood flow in the veins of the legs
- Vein** A blood vessel that brings blood toward the heart



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