

CHAPTER 16 Circulation and Respiration

SECTION

2

Blood



California Science Standards

7.5.a, 7.5.b, 7.6.j

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What is blood?
- What is blood pressure?
- What are blood types?

STUDY TIP

Ask Questions As you read this section, write down the questions that you have. Then, discuss your questions with a small group.

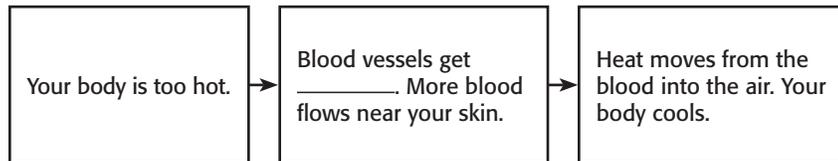
READING CHECK

1. Define What is blood?

What Is Blood?

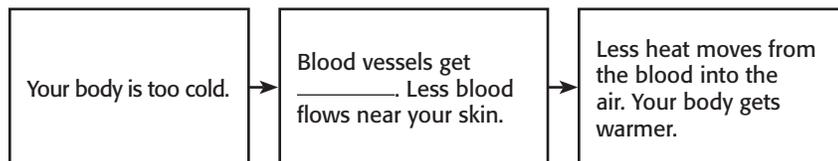
Your cardiovascular system is made up of your heart, your blood vessels, and blood. **Blood** is a connective tissue made up of plasma, red blood cells, platelets, and white blood cells. It moves through miles of blood vessels to reach all the cells in your body. However, an adult human has only about 5 L of blood. Children have even less. That means that all the blood in your body would not even fill up two 3 L soda bottles! ✓

Blood carries important materials to all parts of your body. Your blood also helps to keep your body temperature constant. When you are hot, your blood vessels get bigger. Blood moves closer to the skin. Heat is released into the air, and your body cools. When you are cold, the blood vessels to the skin get narrower. Less blood flows to the skin. This means that less heat is lost through your skin.



TAKE A LOOK

2. Identify Fill in the blank lines to describe how blood vessels change when you are hot or cold.



PLASMA

The fluid part of the blood is called plasma. *Plasma* is a mix of water, minerals, nutrients, sugars, proteins, and other substances. Red blood cells, platelets, and white blood cells are found in plasma, but they are not part of it.

SECTION 2 Blood *continued*

RED BLOOD CELLS

Most blood cells are *red blood cells*, or RBCs. RBCs carry oxygen to all the living cells in your body. Cells have to have oxygen to do their jobs for the body. RBCs use hemoglobin to carry oxygen. *Hemoglobin* is a protein that is found in all red blood cells. It attaches to the oxygen that you breathe into your lungs. RBCs can then move oxygen throughout the body. Hemoglobin is what makes RBCs look red. ✓

PLATELETS

Platelets are pieces of larger cells. They last for only 5 days to 10 days, but they are an important part of blood. When you cut or scrape your skin, you bleed because blood vessels have been opened. As soon as bleeding starts, platelets clump together in the damaged area. They form a plug that begins to stop the blood loss. Platelets also give off chemicals that react with proteins in plasma to form tiny fibers. These fibers make a blood clot.

WHITE BLOOD CELLS

Sometimes, pathogens get into your body. A *pathogen* is a virus, bacterium, or other tiny particle that can make you sick. When these things get into your body, they can meet *white blood cells*, or WBCs. The WBCs help you stay healthy by killing pathogens. WBCs also clean up wounds.

WBCs fight pathogens in many ways. Some WBCs squeeze out of blood vessels and move around in tissues, searching for pathogens. When they find a pathogen, they destroy it. Other WBCs release antibodies. *Antibodies* are chemicals that identify or destroy pathogens. WBCs also keep you healthy by destroying body cells that have died or been damaged.

Most WBCs are made in bone marrow. Some WBCs mature in another system in your body called the lymphatic system. ✓

Component of blood	Function
Plasma	helps cells and other things flow
Red blood cells	carry oxygen
Platelets	help in clotting
White blood cells	help in defense

 **READING CHECK**

3. Explain What does hemoglobin do for red blood cells?

Critical Thinking

4. Infer Consider a person who does not have enough platelets in his or her blood. What will happen if the person gets a cut? Explain your answer.

 **READING CHECK**

5. Identify Where are most white blood cells made?

SECTION 2 Blood *continued*

CALIFORNIA STANDARDS CHECK

7.6.j Students know that contractions of the heart generate blood pressure and that heart valves prevent backflow of blood in the circulatory system.

Word Help: generate
to bring about; to produce

6. Explain How is blood pressure produced?

What Is Blood Pressure?

Whenever your heart contracts, or squeezes, it pushes blood out of your heart and into your arteries. The force of the blood on the inside walls of the arteries is called **blood pressure**. Blood pressure is measured in millimeters of mercury (mm Hg).

Blood pressure is usually given as two numbers, such as 110/70 mm Hg. The first number is the systolic pressure. The *systolic pressure* is the pressure inside large arteries when the ventricles contract. The big push of blood causes the arteries to push out and produce a pulse. The second number is the diastolic pressure. *Diastolic pressure* is the pressure inside arteries when the ventricles relax.

Type of pressure	What it is	Where it is found in a blood pressure measurement
Systolic		It is the top number.
	pressure in the arteries when ventricles relax	

TAKE A LOOK

7. Identify Fill in the blank spaces in the table to describe the two parts of blood pressure.

Say It

Discuss Learn about two ways to maintain healthy blood pressure. In a small group, talk about how you can apply these ideas in your life.

For adults, a blood pressure of 120/80 mm Hg or less is healthy. Remember that hypertension, or high blood pressure, can cause problems in the cardiovascular system. High blood pressure can make a person more likely to have a heart attack or stroke. It can also cause damage to other parts of the body. For example, high blood pressure can cause heart or kidney damage.

What Are Blood Types?

There are special particles on the surface of your RBCs called *antigens*. There are different kinds of antigens, and they determine your blood type. People with different blood types have different antigens on their RBCs. They also have different antibodies in their plasma. These antibodies react against the antigens of other blood types as if the antigens were pathogens. ✓

There are two main systems for grouping blood types. One is the ABO system. The other is the Rh system.

READING CHECK

8. Identify What determines your blood type?

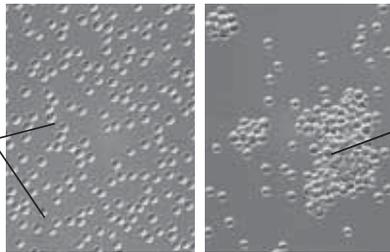
SECTION 2 Blood *continued*

ABO SYSTEM

The ABO system is one way of classifying blood. Every person has one of four blood types: A, B, AB, or O. Type A blood has A antigens; type B has B antigens; and type AB has both A and B antigens. Type O blood has neither A antigens nor B antigens. ✓

Each blood type also has different antibodies. For example, type A blood has antibodies that react against type B antigens. If a person with type A blood is injected with type B blood, the type B antibodies attach themselves to the type B red blood cells. These RBCs begin to clump together. The clumps can block blood vessels. A reaction to the wrong blood type may be fatal.

This picture shows RBCs in a mixture of blood from two people. Both people have the same blood type. Notice that the RBCs are not clumped together.



This picture shows RBCs in a mixture of blood from people with different blood types. The _____ in the blood have reacted with the _____ on the surface of the RBCs. The RBCs have formed clumps.

Rh SYSTEM

Another antigen that may be on the surface of RBCs is the Rh antigen. A person with the Rh antigen is considered Rh-positive (Rh⁺). A person without the Rh antigen is Rh-negative (Rh⁻). If an Rh⁻ person receives a blood transfusion of Rh⁺ blood, antibodies may react and cause the blood to clump.

Usually, the ABO system and the Rh system are combined. People with AB⁺ blood type have A, B, and Rh antigens on their RBCs. People with O⁻ blood have no antigens on their RBCs.

Blood type	Antigens	Antibodies
A	A antigens	B antibodies
B	B antigens	A antibodies
AB	A and B antigens	neither A nor B antibodies
O	neither A nor B antigens	A and B antibodies
Rh ⁺	Rh antigens	no Rh antibodies
Rh ⁻	no Rh antigens	Rh antibodies

READING CHECK

9. Describe What kinds of antigens are found on the RBCs of a person with type AB blood?

TAKE A LOOK

10. Identify Fill in the blank lines to explain what has happened in the right-hand picture.

Critical Thinking

11. Apply Concepts What kinds of antigens are found on the RBCs of a person with A⁺ blood?

SECTION 2 Blood *continued*

Why Are Blood Types Important?

A person can lose blood from an injury or because of surgery. If a person loses too much blood, the person may go into shock. *Shock* happens when a person's cells do not get enough blood. Without blood, the cells do not get enough oxygen and nutrients. Wastes build up. After a time, cells may die. If too many of a person's cells die, the person can die, too. ✓

 **READING CHECK**

12. Define What is shock?

In order to replace the blood that was lost, a person can receive a blood transfusion. A *transfusion* is placement of someone else's blood into a person's blood vessels. The person receiving blood cannot use blood from just anyone. Remember that antibodies in blood can react with antigens on RBCs and cause blood to clump. If a person receives blood with the wrong antibodies in it, the person could die. The table below shows blood transfusion possibilities.

Blood type	Can receive blood from	Can donate blood to
A	types A and O	types A and AB
B	types B and O	types B and AB
AB	types A, B, AB, and O	type AB only
O	type O only	types A, B, AB, and O

TAKE A LOOK

13. Identify Which blood type can receive blood from the most other blood types? Which type can donate blood to the most other types?

What Are Some Blood Disorders?

Sometimes, a person's blood may not be able to do everything it is supposed to do. The person is said to have a *blood disorder*. Two of the most common blood disorders are hemophilia and leukemia.

A person with *hemophilia* is missing a protein that helps blood to clot. Blood clots form in healthy people when a blood vessel has been damaged. A person with hemophilia does not form blood clots normally. Even a small cut can cause a person with hemophilia to lose a lot of blood. ✓

 **READING CHECK**

14. Explain Why can even small cuts be dangerous for people with hemophilia?

Leukemia is a type of cancer that affects blood cells. A person with leukemia may not be able to make enough healthy WBCs or RBCs. Leukemia may be treated with bone marrow transfusions. Bone marrow is taken from the hip bones of donors and given to the sick person.

Section 2 Review

7.5.a, 7.5.b, 7.6.j



SECTION VOCABULARY

<p>blood the fluid that carries gases, nutrients, and wastes through the body and that is made up of platelets, white blood cells, red blood cells, and plasma</p>	<p>blood pressure the force that blood exerts on the walls of arteries</p> <p><u>Wordwise</u> The root <i>press</i> means “to press.”</p>
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1. Identify What are two functions of white blood cells?

2. Describe How is systolic blood pressure different from diastolic blood pressure?

3. List What are three functions of blood?

4. Draw Conclusions Why does your face get redder when you are hot?

5. Explain Why is it important that a person with type O blood only receive a blood transfusion from another person with type O blood?

6. Predict Consequences A person has a disease that causes hemoglobin to break down. What will happen to the person’s RBCs?
