

section 1 The Circulatory System

Before You Read

Explain the function of the plumbing system in your home. Describe how it works.

What You'll Learn

- the differences among arteries, veins, and capillaries
- how blood moves through the heart
- the functions of the pulmonary and systemic circulation systems

Read to Learn

How Materials Move Through the Body

The cardiovascular (kar dee oh VAS kyuh lur) system supplies materials to and removes wastes from your body cells. This system includes your heart, blood vessels, and blood.

Movement of materials into and out of your cells occurs by diffusion (dih FYEW zuhn) and active transport. Diffusion occurs when a material moves from an area where there is more of it to an area where there is less of it. Nutrients and oxygen diffuse from your blood into your body's cells. Active transport is the opposite of diffusion. Active transport needs energy from the cell to occur.

The Heart

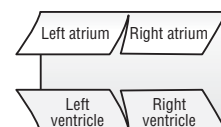
Your heart is an organ made of cardiac muscle tissue. Your heart has four compartments called chambers. The two upper chambers are called the right and left **atria** (AY tree umz). The two lower chambers are called the right and left **ventricles** (VEN trih kulz). During one heartbeat, both atria contract at the same time. Then, both ventricles contract at the same time. A one-way valve separates each atrium from the ventricle below it.

Mark the Text

Identify Main Ideas After you have read the material under each question head, highlight the answer to the question.

FOLDABLES™

A Describe Make a shutterfold book, as shown below. Identify the four chambers of the heart. Include a sketch of the heart and the four chambers.



✓ Reading Check

1. **Identify** What controls the blood flow through the three sections of the circulatory system?

Picture This

2. **Explain** to a partner the flow of blood in pulmonary circulation.

Three Sections of the Circulatory System Scientists divide the circulatory system into three sections: coronary (KOR uh ner ee) circulation, pulmonary (PUL muh ner ee) circulation, and systemic circulation. The beating of your heart controls blood flow through each section. ✓

What is coronary circulation?

Blood vessels supply the heart with nutrients and oxygen and remove wastes. Coronary circulation is the flow of blood to and from the tissues of the heart.

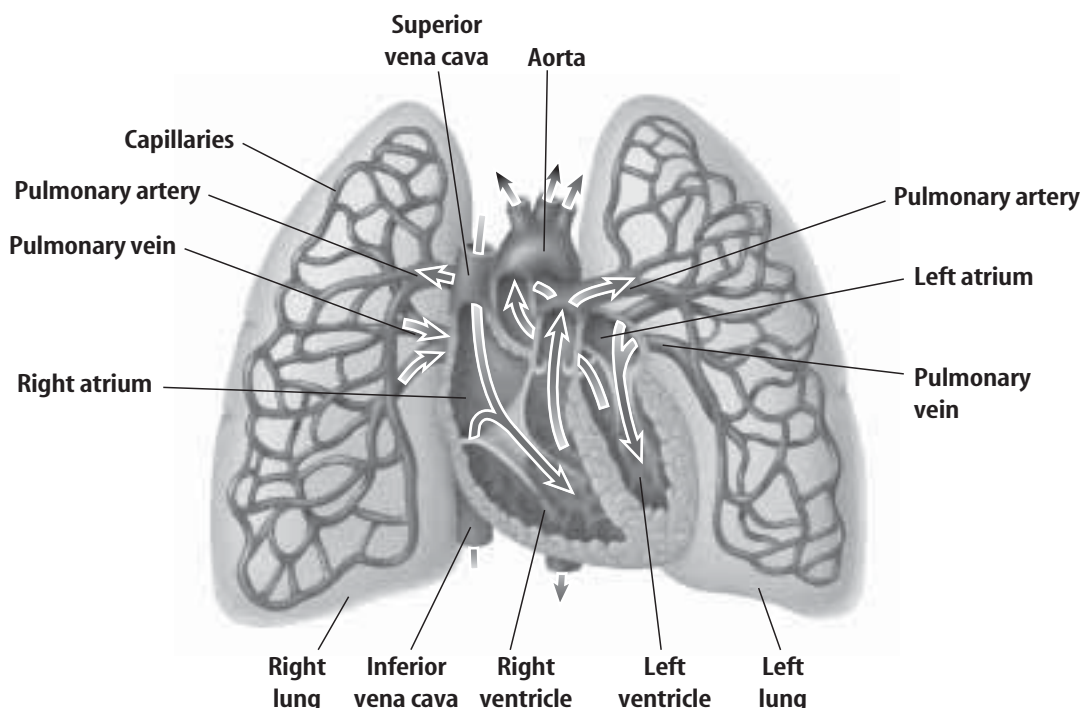
What is pulmonary circulation?

The flow of blood through the heart to the lungs and back to the heart is pulmonary circulation. Use the figure below to trace the path blood takes through this part of the circulatory system.

The blood returning from the body through the right side of the heart and to the lungs contains wastes from the body's cells. Carbon dioxide is one of these wastes.

In the lungs, carbon dioxide and other gaseous wastes diffuse out of the blood, and oxygen diffuses into the blood. Then the blood returns to the left side of the heart.

In the final step of pulmonary circulation, the oxygen-rich blood is pumped from the left ventricle into the aorta (ay OR tuh). The aorta is the largest artery in your body. Next, the oxygen-rich blood flows to all parts of your body.



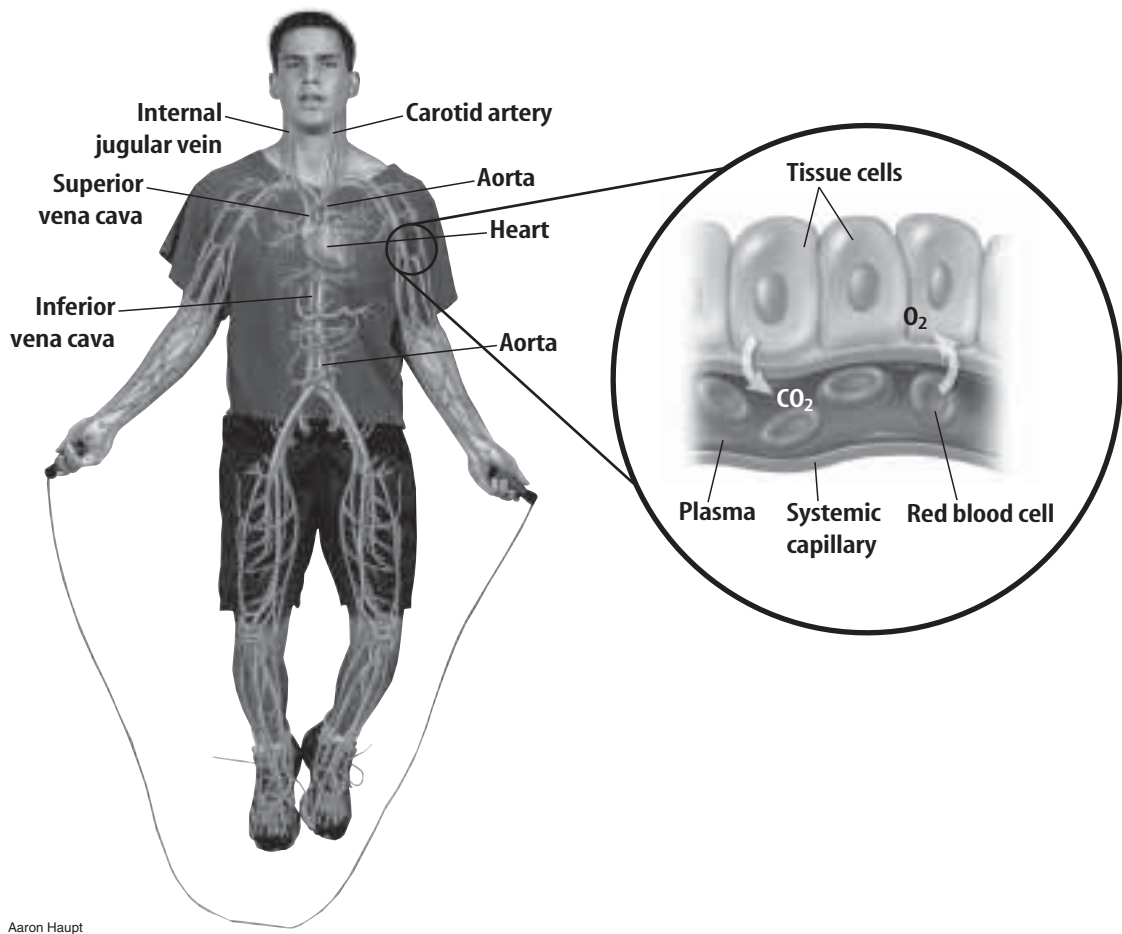
What is systemic circulation?

Oxygen-rich blood moves to all of your organs and body tissues, except the heart and lungs, by **systemic circulation**. Oxygen-poor blood returns to the heart by systemic circulation. The figure below shows the major arteries and veins (VAYNZ) of the systemic circulation system. Oxygen-rich blood flows from your heart in the arteries. Then nutrients and oxygen are delivered by blood to your body cells and exchanged for carbon dioxide and wastes, as shown below. The blood then returns to your heart in the veins.



Think it Over

3. **Infer** Why is systemic circulation important to your muscles?



Aaron Haupt

Blood Vessels

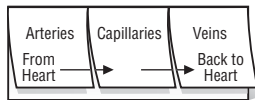
In the middle 1600s, scientists proved that blood moves in one direction in a blood vessel, like traffic on a one-way street. They discovered that blood moves by the pumping of the heart and flows from arteries to veins. They couldn't explain how blood got from arteries to veins. With the invention of the microscope, scientists discovered that capillaries (KAP uh ler eez) connect the arteries and veins.

Picture This

4. **Identify** Circle the name of the blood vessel in which oxygen and carbon dioxide are exchanged.

FOLDABLES™

B Explain Make a three-tab Foldable, as shown below. Label the outside of the Foldable *Circulation*. Inside take notes on arteries, capillaries, and veins.



What is the function of arteries?

The blood vessels that carry blood away from the heart are called **arteries**. Arteries have thick, elastic walls made of connective tissue and smooth muscle tissue.

Each ventricle of the heart is connected to an artery. The right ventricle of the heart is connected to the pulmonary artery. The left ventricle of the heart is connected to the aorta. Every time your heart contracts, blood moves from your heart into your arteries.

How does blood flow in the veins?

A blood vessel that carries blood back to the heart is called a **vein**. Veins have one-way valves that keep blood moving toward the heart. If blood flows backward, the pressure of the blood against the valve causes it to close. Two major veins return blood from your body to your heart. The superior vena cava returns blood from your head and neck. The inferior vena cava returns blood from your abdomen and lower body.

What is the function of capillaries?

Very small blood vessels called **capillaries** connect arteries and veins. Nutrients and oxygen diffuse into body cells through the thin capillary walls. Waste and carbon dioxide diffuse from body cells into the capillaries.

Blood Pressure

When your heart pumps, the pressure of the push moves through the blood. The force of the blood on the walls of the blood vessels is called blood pressure. Blood pressure is highest in arteries and lowest in veins. When you take your pulse, you can feel the waves of pressure. This rise and fall in pressure occurs with each heartbeat. Normal resting pulse rates are 60 to 100 heartbeats per minute for adults, and 80 to 100 beats per minute for children.

How is blood pressure measured?

Blood pressure is measured in large arteries. Two numbers describe blood pressure, such as 120 over 80. The first number is a measure of the pressure caused when the ventricles contract and blood is pushed out of the heart. The second number is a measure of the pressure that occurs as the ventricles fill with blood just before they contract again. 

Reading Check

5. **Describe** What does the first number in your blood pressure measure?

Blood Pressure and Heart Rate When blood pressure is higher or lower than normal, messages are sent to the brain by nerve cells in the arteries. One way the brain lowers or raises blood pressure is by speeding up or slowing down the heart rate. When blood pressure stays constant, enough blood reaches all organs and tissues in the body.

Cardiovascular Disease

There are many diseases that affect the cardiovascular system—the heart, blood vessels, and blood. Heart diseases are the leading causes of deaths in the United States.

What is atherosclerosis?

Atherosclerosis (ah thuh roh skluh ROH sus) is a leading cause of heart disease. In this condition, deposits of fat build up on the walls of the arteries. These fat deposits can block an artery. If a coronary artery is blocked, a heart attack can occur.

What happens with hypertension?

Hypertension (HI pur TEN chun) is high blood pressure. When blood pressure is higher than normal most of the time, the heart must work harder to keep blood flowing. Atherosclerosis is one cause of hypertension. 

How does heart failure occur?

Heart failure occurs when the heart cannot pump blood efficiently. When the heart does not pump properly, fluid collects in the arms, legs, and lungs. A person with heart failure is usually short of breath and tired.

Can cardiovascular disease be prevented?

Cardiovascular disease can be prevented by following a diet that is low in salt, sugar, cholesterol, and saturated fats. Large amounts of body fat force the heart to pump faster. Relaxing and exercising help prevent tension and relieve stress. Exercising strengthens the heart and lungs and helps maintain proper weight. Not smoking also helps prevent heart disease. 

Reading Check

- 6. Apply** What is another name for high blood pressure?

Reading Check

- 7. Explain** What is one thing you can do to prevent cardiovascular disease?

● After You Read

Mini Glossary

artery: a blood vessel that carries blood away from the heart

atria (AY tree umz): the two upper chambers of the heart

capillaries (KAP uh ler eez): very small blood vessels that connect arteries and veins

coronary (KOR uh ner ee) circulation: the flow of blood to and from the tissues of the heart

pulmonary circulation: the flow of blood through the heart to the lungs and back to the heart

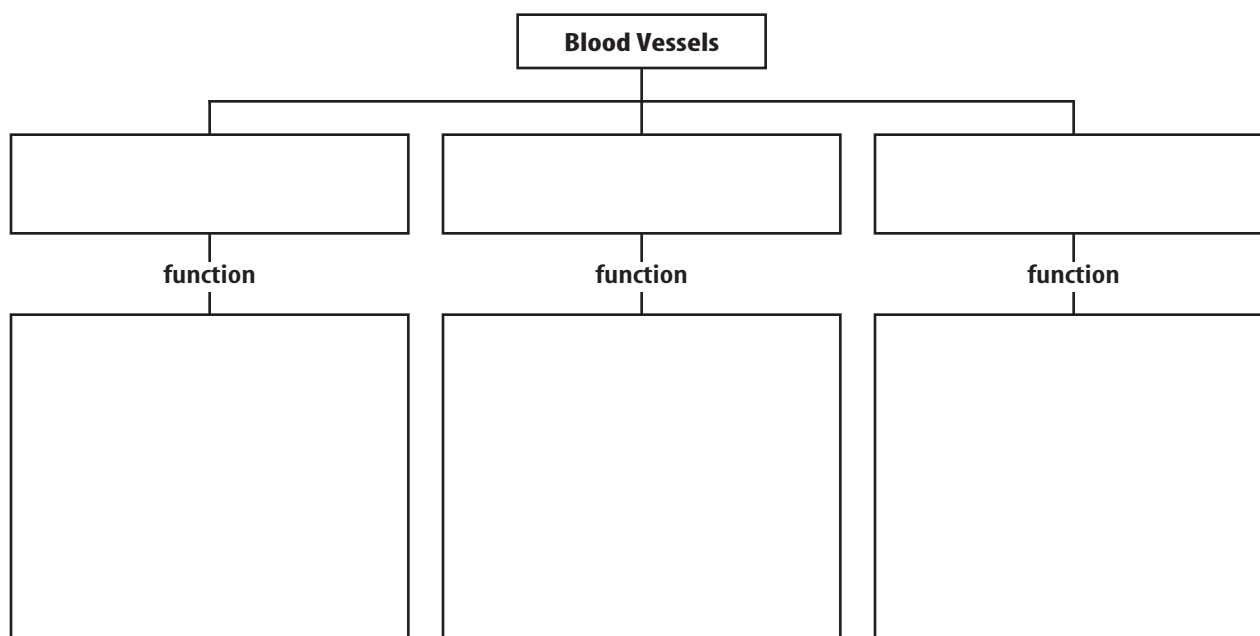
systemic circulation: the system in which oxygen-rich blood moves to all of the organs and body tissues, except the heart and lungs, and oxygen-poor blood returns to the heart

vein: a blood vessel that carries blood back to the heart

ventricles (VEN trih kulz): the two lower chambers of the heart

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that explains the difference between pulmonary circulation and systemic circulation.

2. Complete the concept map below to show the kinds of blood vessels and their functions.



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Visit life.msscience.com to access your textbook, interactive games, and projects to help you learn more about the circulatory system.