Functions of the Circulatory System

Have you ever looked at a road map of the United States? A complex network of roads and highways crisscrosses the country. This network of roads is important for transporting people and materials from one place to another. The circulatory (SUR kyuh luh tor ee) system is similar to this road network. Your circulatory system is important for transporting materials from one part of your body to another.

Transportation

Trucks move food, fuel, and other products from factories and farms to markets and businesses around the country. Your circulatory system is like the network of roads that the trucks travel on. Your blood cells are like the vehicles that travel on these roads. In your circulatory system, blood carries food, water, oxygen, and other materials to your body's cells and tissues.

Elimination

Blood carries away waste materials, just as garbage trucks haul away trash. As blood travels through your circulatory system, it picks up carbon dioxide. Remember that carbon dioxide is produced during cellular respiration. Blood also picks up wastes produced by all the other chemical reactions that take place inside your cells.

Before Statement After
3. There are four chambers in a human heart.
4. Blood travels in both directions in veins.
Highways connect and provide routes for traffic. Your circulatory system is similar. It provides routes for blood to flow through your body. Your heart is like an engine that powers the flow of blood through your circulatory system. The figure shows the circulatory system with its pump, the heart. You can see that the veins and arteries look like a network of roads.

**The Heart**

Can you feel your heart beating? Even when you do not notice it, your heart is at work. The heart is a muscle that pushes blood through the circulatory system. A human heart beats an average of 70 to 75 times per minute, every minute of life. It slows when you sleep. It speeds up when you exercise or are scared.

Your heart has four main chambers—two upper chambers and two lower chambers. Look at the figure above to see the chambers. Blood enters the upper two chambers of the heart, called the atria (AY tree uh) (singular, atrium). Blood leaves the heart through the lower two chambers of the heart, called the ventricles (VEN trih kulz).
Blood Vessels

Blood travels through your blood vessels and reaches every cell in your body. There are three main types of blood vessels. All three are shown in the figure below.

**Arteries** A vessel that takes blood away from the heart is an artery. Look at the artery in the figure below. Blood pressure in the arteries is high because arteries are near the pumping action of the heart. Artery walls are thick and can stand up to the high pressure of the flowing blood. The aorta is the largest artery. It carries a large volume of blood. Arteries branch into smaller vessels called arterioles.

**Capillaries** Arterioles branch into tiny capillaries, as shown below. Capillaries are tiny blood vessels that deliver supplies to individual cells and take away waste materials. Capillaries are the smallest blood vessels in the circulatory system. Many capillary walls are only one cell thick. Thin walls make it possible for molecules of oxygen, food, water, and waste products to move between blood and body cells.

**Veins** A vessel that brings blood toward the heart is a vein. The pressure in veins is lower than in arteries. This is because capillaries separate veins from the pumping action of the heart. Because there is less pressure in the veins, there is a greater chance that blood could flow backward. Veins have one-way valves that prevent blood from moving backward and keep it moving toward the heart.

Capillaries join and form larger vessels called venules. Venules join and form veins. The inferior vena cava is the largest vein. It carries blood from the lower half of your body to your heart.

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**Key Concept Check**

4. **Explain** How do the heart and the blood vessels work together?

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**Visual Check**

5. **Compare** Which is thicker—the artery walls or the vein walls?
Types of Circulation

Your circulatory system moves blood throughout your entire body. There are three different types of circulation. The first type takes blood to the body. The second type takes blood to the heart. The third type takes blood to and from the lungs.

Systemic Circulation

Blood leaves your heart and travels to your body. Systemic circulation is the network of vessels that carry blood from the heart to the body and from the body back to the heart.

Coronary Circulation

The heart is a thick organ made of many layers of cells. Most heart cells do not come into contact with the blood inside the heart. A network of arteries and veins called coronary circulation supplies blood to all the cells of the heart. Coronary circulation provides oxygen and nutrients to the cells of the heart. It also removes carbon dioxide from the blood. Some of these vessels are inside the heart, while others are on the outside of the heart.

Pulmonary Circulation

Blood moves back and forth between the heart and the lungs. The network of vessels that carries blood to and from the lungs is called pulmonary circulation. Pulmonary circulation carries oxygen-poor blood, or blood low in oxygen, from the heart to the lungs. It also carries oxygen-rich blood, or blood high in oxygen, from the lungs back to the heart. Blood that enters the heart from the lungs is then pushed to the rest of the body.

Circulatory System Health

Good health depends on a healthy circulatory system. All parts of the circulatory system must be working properly to have a healthy system. Your heart muscle must be strong enough to push blood through all the blood vessels in your body. These blood vessels must be flexible, so the volume of blood flowing through them can change. The valves in your heart and veins must work well to keep blood from flowing in the wrong direction.

Circulatory diseases occur when some part of the circulatory system stops working properly. About one-third of all adults in the United States have a circulatory disease. Almost 2,400 people die from circulatory disease every day. The most common circulatory diseases are hypertension, atherosclerosis, heart attacks, strokes, and heart failure.
**Hypertension**

When the ventricles of the heart contract, they push blood into the arteries. The arteries bulge a little because blood presses against their sides. This bulging of an artery is what you feel when you check your pulse. This pressure is called blood pressure.

Normal blood pressure is considered to be 120 mm Hg (millimeters of mercury) or less during the contraction of the ventricles. It is 80 mm Hg or less after the contraction. Normal blood pressure is written as 120/80 mm Hg. Blood pressure higher than 140/90 mm Hg is called hypertension, or high blood pressure. Hypertension can weaken the artery walls and make them less flexible.

**Atherosclerosis**

*Atherosclerosis* (a thuh roh skluh ROH sus) is *the buildup of fatty material within the walls of arteries*. Fat deposits can keep blood from flowing well in the arteries. The deposits can also break loose, flow to a narrower artery, and block it. The figure below shows the results. A blockage in the heart can cause a heart attack. A blockage in a blood vessel in the brain can cause a stroke.

![Diagram of diseased artery](image)

**Think it Over**

8. Apply A neighbor says that she has high blood pressure. What is another name for that condition?

Reading Check

9. Identify What happens when an artery in the brain is blocked?

Visual Check

10. State What circulatory diseases are shown in the figures?
Heart Attacks, Strokes, and Heart Failure

A heart attack happens when part of the heart muscle dies or is damaged. Heart attacks occur when not enough oxygen reaches cells in the heart. Most heart attacks occur when a blood vessel in the heart is blocked.

A stroke happens when part of the brain dies or is damaged. Most strokes are caused when not enough oxygen reaches cells in the brain. A stroke might occur if a blood clot blocks a blood vessel in the brain.

Heart failure occurs when the heart is not working as well as it should. It can happen because of a heart attack, a problem with heart valves, or diseases that damage the heart.

Preventing Circulatory System Disorders

Some risk factors for circulatory system diseases cannot be avoided. For example, if one of your parents has a circulatory disease, you might have a slightly higher risk of getting a similar disease. However, most risk factors can be controlled by making good life choices. You can eat a healthful diet, control your weight, exercise, and not smoke.

The Circulatory System and Homeostasis

The circulatory system works closely with other body systems. Once oxygen enters your body, your respiratory system interacts with your circulatory system. Your circulatory system transports oxygen to all cells in your body. It also transports nutrients from your digestive system and hormones from your endocrine system. Your nervous system regulates your heartbeat. Later in this chapter you will learn how your circulatory system works with your skeletal system.
Mini Glossary

artery: a vessel that takes blood away from the heart

atherosclerosis (a thuh roh skluh ROH sus): the buildup of fatty material within the walls of arteries

atria (AY tree uh): the upper two chambers of the heart through which blood enters the heart (singular, atrium)

capillary: a tiny blood vessel that delivers supplies to individual cells and takes away their waste materials

coronary circulation: the network of arteries and veins that supplies blood to all the cells of the heart

pulmonary circulation: the network of vessels that carries blood to and from the lungs

systemic circulation: the network of vessels that carry blood from the heart to the body and from the body back to the heart

vein: a vessel that brings blood toward the heart

ven tricles (VEN trih kulz): the lower two chambers of the heart through which blood leaves the heart

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that compares arteries and veins.

2. Fill in the diagram below to show the functions of the circulatory system.

Circulatory System

transportation of food, water, oxygen, and other materials

3. Describe how the three types of circulation carry blood throughout the body.

What do you think? Now?

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?

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