

disease is the leading cause of death in the United States. However, people can practice behaviors that decrease their risks of developing cardiovascular problems.

Cardiovascular Disease

Compare the two arteries shown in Figure 15. The one on the left is a healthy artery. It has a large space in the center through which blood can flow easily. The artery on the right, in contrast, has a thick wall and only a small space in the middle. This artery exhibits **atherosclerosis** (ath uh roh skluh ROH sis), a condition in which an artery wall thickens as a result of the buildup of fatty materials. One of these fatty materials is cholesterol, a waxy, fat-like substance. Atherosclerosis restricts the flow of blood in the arteries.

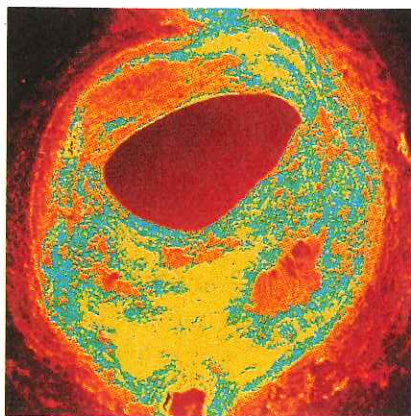
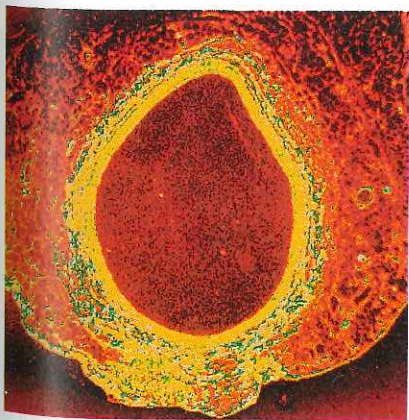
Atherosclerosis can develop in the coronary arteries that supply the heart. When that happens, the heart muscle receives less blood and therefore less oxygen. This condition may lead to a heart attack. A **heart attack** occurs when blood flow to part of the heart muscle is blocked. Cells die in the part of the heart that does not receive blood. This permanently damages the heart.

Treatment for mild atherosclerosis usually includes a low-fat diet and a moderate exercise program. In addition, medications that lower the levels of cholesterol and fats in the blood may be prescribed. People with severe atherosclerosis may need to undergo surgery or other procedures to unclog blocked arteries.

Checkpoint Why is atherosclerosis especially serious when it affects the coronary arteries?

Hypertension

High blood pressure, or **hypertension** (hy pur TEN shun), is a disorder in which a person's blood pressure is consistently higher than normal—greater than 140/90. Hypertension makes the heart work harder. It also may damage the walls of the vessels.



TRY THIS

Blocking the Flow

Use this activity to find out how

ACTIVITY

fatty deposits affect the flow of blood through an artery.

1. Put a funnel in the mouth of a plastic jar. The funnel will represent an artery.
2. To model blood flowing through the artery, slowly pour 100 mL of water into the funnel. Have your partner time how many seconds it takes for all the water to flow through the funnel. Then discard the water.
3. Use a plastic knife to spread a small amount of peanut butter along the bottom of the funnel's neck. Then, with a toothpick, carve out a hole in the peanut butter so that the funnel is partly, but not completely, clogged.
4. Repeat Steps 1 and 2.

Predicting If the funnels were arteries, which one—blocked or unblocked—would do a better job of supplying blood to tissues? Explain.

Figure 15 The healthy artery on the left is unblocked. In contrast, notice the narrow opening in the artery on the right. This person has atherosclerosis, which is caused by fatty deposits on the artery walls.

Relating Cause and Effect What kind of diet can lead to atherosclerosis?

SCIENCE & History

Over time, both the heart and arteries can be severely harmed by hypertension. Because people with hypertension often have no obvious symptoms to warn them, hypertension is sometimes called the “silent killer.”

Hypertension and atherosclerosis are closely related. As the arteries narrow, blood pressure increases. Being overweight and failing to get enough exercise can also increase a person’s risk of developing hypertension.

Cardiovascular Advances in the Twentieth Century

Scientists today have an in-depth understanding of how the cardiovascular system works and how to treat cardiovascular problems. This time line describes some advances of the twentieth century.



1944

Treatment for “Blue Babies”

Helen Taussig identified the heart defect that causes the skin of some newborn babies to be bluish in color. The blood of these “blue babies” does not receive an adequate amount of oxygen. Taussig and another surgeon, Alfred Blalock, developed an operation to correct the defect and save these babies’ lives.

1900

1901

Discovery of Blood Types

Karl Landsteiner demonstrated that people have different blood types, which are determined by marker molecules on their red blood cells. Landsteiner’s discovery enabled blood transfusions to be done safely.

1920



1930s–1940s

Blood Banks

Charles Drew demonstrated that emergency transfusions could successfully be done with plasma if whole blood was not available. During World War II, Drew established blood banks for storing donated blood. His work helped save millions of lives on and off the battlefield.

1940

For mild hypertension, regular exercise and careful food choices may be enough to lower blood pressure. People with hypertension need to limit their intake of sodium, which can increase their blood pressure. Sodium is found in salt and in processed foods such as soups and packaged snack foods. For some people who have hypertension, however, medications are needed to reduce their blood pressure.

✓ Checkpoint Why is hypertension called the “silent killer”?

In Your Journal

Choose one of the scientists whose work is described here. Imagine that you are on a committee that has chosen him or her to receive an award. Write the speech you would give at the award ceremony. The speech should explain the importance of the scientist's contributions.

1967

First Heart Transplant

Christiaan Barnard, a South African surgeon, performed the first transplant of a human heart. Louis Washkansky, the man who received the heart, lived for only 18 days after the transplant. But Barnard's work paved the way for future successes in transplanting hearts and other organs.



1992

Laser Beam Unclogs Arteries

The United States government approved a device that uses a laser beam to burn away the material causing blockage in some arteries. This device can help some people with atherosclerosis.

1960

1980

2000

1982

Artificial Heart

An artificial heart, developed by Robert Jarvik, was implanted into a patient by surgeon William DeVries at the University of Utah. Barney Clark, the man who received the artificial heart, lived for 112 days. Today artificial hearts are sometimes used temporarily in people waiting for heart transplants.



Keeping Your Cardiovascular System Healthy

Few young people have heart attacks, but atherosclerosis can begin to develop in people as young as 20 years old. You can establish habits now that will lessen your risk of developing atherosclerosis and hypertension. **To help maintain cardiovascular health, people should exercise regularly; eat a balanced diet that is low in fat, cholesterol, and sodium; and avoid smoking.**



Figure 16 Eating foods that are low in fat can help keep your cardiovascular system healthy.

Exercise Do you participate in sports, ride a bike, swim, dance, or climb stairs instead of taking the elevator? Every time you do one of those activities, you are helping to maintain your cardiovascular health. Exercise strengthens your heart muscle and also helps prevent atherosclerosis.

A Balanced Diet Foods that are high in cholesterol and fats can lead to a buildup of fatty deposits on artery walls. In addition, eating too many high-fat foods can lead to excessive weight gain. Foods such as red meats, eggs, and cheese are high in cholesterol. These foods also contain substances that your body needs. Therefore, a smart approach might be to eat them, but only in small quantities. Some foods that are especially high in fat include butter and margarine, potato chips, doughnuts, and fried foods such as French fries. Eat high-fat foods only occasionally, if at all.

Avoid Smoking Smokers are more than twice as likely to have a heart attack than are nonsmokers. Every year, almost 180,000 people in the United States die from cardiovascular disease caused by smoking. If smokers quit, however, their risk of death from cardiovascular disease decreases.



Section 4 Review

1. List three things you can do to help your cardiovascular system stay healthy.
2. What is atherosclerosis?
3. How does hypertension affect blood vessels?
4. **Thinking Critically Relating Cause and Effect** Coronary heart disease is much less common in some countries than it is in the United States. What factors might account for this difference?

Science at Home

Healthy Hearts With your family, discuss some things that you all can do to maintain healthy cardiovascular systems. Make a list of exercise activities, such as bicycling and swimming, that family members can enjoy together. You might also work with your family to cook and serve a "heart-healthy," low-fat meal.