Chapter 3 • Lesson 14

The Immune System

Key Words: pathogen, white blood cell, antibody, active immunity, vaccine, passive immunity

Getting the Idea

Most diseases are caused by microorganisms and viruses. You come in contact with agents of disease each day. Luckily, your body has ways to protect you from germs before they can make you sick.

Protection against Pathogens

Many diseases are caused by microorganisms. Microorganisms are tiny living things, many of which are made up of only one cell. A microorganism that causes disease is called a pathogen.

Your immune system works to protect you from pathogens. The immune system is made up of the cells, tissues, and organs that protect you from disease.

Your body has two lines of defense against disease. The first line of defense works to keep pathogens out of your body. If this line of defense fails, the second line of defense goes to work. The second line of defense works to detect and destroy pathogens that enter your body.

First Line of Defense

The main structure in your body's first line of defense is the skin. The skin is a barrier between your body and the environment. This barrier helps keep pathogens out of your body.

Your skin also contains sweat glands. Sweat glands are part of the excretory system. The sweat they produce removes water, salts, and other wastes from your body. The salts in sweat also help kill any bacteria that may be on your skin.

Tears are also part of the first line of defense. Tears help wash pathogens out of the eyes. Like sweat, tears contain salts that slow the growth of bacteria.
Pathogens can enter your body through the nose and mouth. Recall that the mouth and nose are part of your respiratory system. Parts of your body’s first line of defense against disease are located in your respiratory system. These parts include tiny hairs that line the nostrils. These hairs help filter pathogens out of the air you inhale.

The nose and nasal passages are covered with mucus and cilia. Mucus is a sticky liquid that keeps the respiratory system moist. Cilia are tiny hairlike structures that line your respiratory system. Pathogens inhaled with air get trapped by the mucus and cilia. The pathogens are removed from the body when you sneeze, cough, or blow your nose.

Stomach acids are also part of your body’s first line of defense. Recall that acids in your stomach help digest food. These acids can also kill pathogens that enter the body in food.

**Second Line of Defense**

Sometimes, pathogens get past the body’s first line of defense. When this happens, the second line of defense takes over. White blood cells are the second line of defense against pathogens.

Recall that blood is a tissue that is part of the circulatory system. **White blood cells** are cells of the blood that help your body fight disease. Your body has several kinds of white blood cells. The white blood cells that are part of the second line of defense are called **phagocytes**. This word comes from Greek roots that mean “eater of cells.” Phagocytes protect the body by swallowing and destroying pathogens.

When you are hurt, the injured cells release chemicals that increase the blood flow to the injured region, such as a cut or scrape. The blood brings phagocytes that attack invading pathogens. These white blood cells engulf and kill the pathogens. This is part of the second line of defense.
Third Line of Defense
The second and third lines of defense are called the immune response. The third line of defense attacks specific pathogens. This part of the immune response involves phagocytes and white blood cells known as T cells. Together, these cells attack infected body cells, destroying both the pathogen and the infected cell.

Another kind of white blood cell, called a B cell, makes antibodies. An antibody is a protein that is made by the body to kill a specific pathogen. The diagram below shows how all three kinds of cells involved in the immune response work together to fight off a virus.

Active Immunity
Immunity is the body's ability to protect itself from disease. There are two types of immunity: active immunity and passive immunity. You get each type of immunity in a different way.

Active immunity develops after exposure to a pathogen. One way to develop active immunity to a disease is to get the disease. When this happens, your immune system begins to produce antibodies. Recall that your body makes antibodies to fight off specific pathogens. Once you have made antibodies to a pathogen, your immune system is prepared to respond quickly if you are exposed to the same pathogen again.
Another way to develop active immunity is to get a vaccine. A **vaccine** is a small dose or a piece of a pathogen that is introduced into the body. Vaccines are used to prevent diseases caused by many viruses and bacteria.

A vaccine contains a weakened or deactivated form of a pathogen. When the vaccine is introduced to the body, the pathogen causes the immune system to make antibodies. Because the pathogen in the vaccine is deactivated, it cannot cause disease. However, if you are later exposed to an active, harmful form of the pathogen, your body will immediately be able to make antibodies to destroy that pathogen.

**Passive Immunity**

**Passive immunity** occurs when antibodies made by one organism are transferred to another organism. This type of immunity can be acquired before birth. As a fetus develops, it gets antibodies from its mother. These antibodies protect the baby from disease for a short time after birth.

Antibodies can also be transferred in breast milk. Babies who are breast-fed may have passive immunity for as long as they are nursing.

Passive immunity is sometimes used to fight rabies. A person bitten by a dog may be given antibodies from other people who were vaccinated against rabies in the past. This is important because rabies may progress too quickly for a person to make his or her own antibodies. The injected antibodies slow the spread of the virus. This gives the person’s immune system time to make antibodies.

**Discussion Question**

During cold and flu season, people are encouraged to wash their hands frequently. Why might frequent hand-washing help protect you from disease? What are some other ways you could protect yourself and other people from disease?