

**▶ MAIN IDEA**

## There are different types of pathogens.

Traditionally, bacteria and larger pathogens were isolated by straining them through a ceramic filter with tiny pores. The disease-causing bacteria would remain on the filter, and the solution that passed through the pores was harmless.

Sometimes, however, there were no visible pathogens on the filter, and the solution caused disease. By 1898, scientists had hypothesized that some disease-causing agents must be smaller than bacteria. They called these agents filterable viruses. As better technology was developed, scientists discovered a huge variety of tiny new pathogens, which are outlined below and in **FIGURE 1.2**.

**CONNECT TO**

### PATHOGENS

You can read more about microorganisms and viruses that cause disease in **Viruses and Prokaryotes** and **Protists and Fungi**.

- **Bacteria** are single-celled organisms. They can cause illness by releasing chemicals that are toxic to the host or by destroying healthy body cells. Food poisoning, which causes a person to become nauseous, is a sickness caused by bacteria-released toxins.
- **Viruses** are disease-causing strands of DNA or RNA that are surrounded by protein coats. Viruses are so small that they could not be seen until the invention of the electron microscope in the 1930s. These particles enter and take over a healthy cell, forcing it to stop its normal activities and produce more viruses. Viruses cause illnesses such as flus, colds, and AIDS. You will learn more about AIDS in Section 6.
- **Fungi** can be multicellular or single-celled organisms, such as those you read about previously. The fungi that cause disease do so by piercing healthy cells and taking the cell's nutrients. Fungal infections usually occur in places that are warm and damp. Athlete's foot, for example, is a fungus that invades the skin cells between the toes.

**FIGURE 1.2 Common Infectious Diseases Worldwide**

DISEASE	PATHOGEN TYPE	HOW IT SPREADS	AFFECTED BODY SYSTEMS	DEATHS ANNUALLY
HIV	virus	body fluids	immune	3,100,000
Pneumonia	virus, bacteria	airborne	respiratory	2,000,000
Tuberculosis	bacteria	airborne	respiratory, digestive	1,800,000
Malaria	protozoa	mosquito bite	digestive, circulatory, muscular	1,000,000
Hepatitis B	virus	contaminated food/water	digestive, immune	1,000,000
Measles	virus	airborne	respiratory, nervous	500,000
Influenza	virus	airborne, direct contact	respiratory	400,000

Source: World Health Organization

- **Protozoa** are single-celled organisms that prey on other cells. Like viruses, protozoa need healthy cells to complete their life cycles. Malaria is a blood disease that is caused by a protozoan. The chapter on protists and fungi includes a description of how the protozoan that causes malaria uses red blood cells to complete its life cycle.
- **Parasites** are organisms that grow and feed on a host. Some parasites kill the host, while others drain the body's resources without killing the host. **FIGURE 1.3** shows a filaria, a parasitic worm found in tropical climates. Filaria will rarely kill its host, although some forms, such as heartworm, can be fatal in mammals. You can read more about parasitic worms in the chapter on invertebrate diversity.

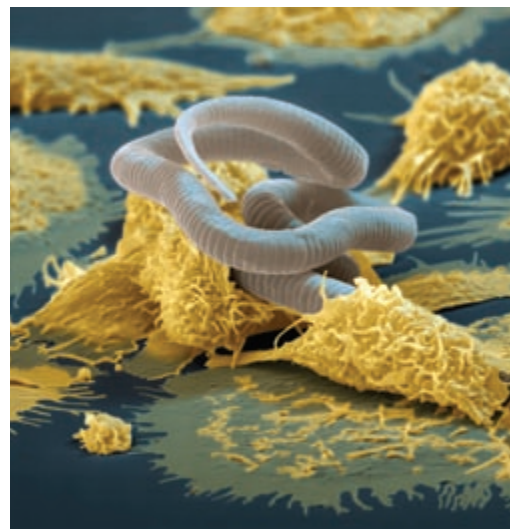
Although each of these pathogens is different, they all cause disease by attacking healthy cells. However, the way by which they attack varies.

**Summarize** What do all of these pathogens do that makes a person sick?

### ▶ MAIN IDEA

## Pathogens can enter the body in different ways.

Before a pathogen can make a person sick, it must get inside the body. Some pathogens can be transferred by direct or indirect contact. Pathogens that spread by direct contact are those that require an infected person or animal to physically touch a healthy person. Rabies, for example, is transferred when an infected animal bites a healthy animal. HIV is transmitted through an exchange of bodily fluids, such as during sexual intercourse or sharing of infected needles. It can also be transmitted from a mother to her child through the placenta or breast milk.



**FIGURE 1.3** Filaria, such as this one, enter the body through contaminated food and can grow to be a meter long. (colored SEM; magnification 2500×)

## QUICK LAB MODELING

### How Pathogens Spread

Pathogens are disease-causing particles. In this lab, you will model how a pathogen spreads through a population.

**PROBLEM** From whom did the pathogen originate?

#### PROCEDURE

1. Obtain a cup filled with an unknown solution. Pour half your solution into a classmate's cup. Then pour the same amount from your classmate's cup back into your cup. Now your cup contains a mixture of the two solutions.
2. Repeat step 1 two more times with different classmates. Keep a record of with whom you exchanged solutions and in which order.
3. After you have exchanged solutions with three classmates, add three drops of "pathogen"-detecting solution to your cup. If your solution becomes pink, your cup contains the pathogen.

#### ANALYZE AND CONCLUDE

1. **Analyze** If your cup contained the pathogen, can you identify its origin? If your cup did not contain the pathogen, is it possible that any of the other solutions poured into your cup contained the pathogen?
2. **Analyze** Only one person in your class began with the pathogen in his or her cup. How can you determine whose cup had it?

#### MATERIALS

- 8-oz cup
- 100 mL unknown solution
- eyedropper
- 3 drops "pathogen"-detecting solution

