

Viruses

As You Read

What You'll Learn

- **Explain** how a virus makes copies of itself.
- **Identify** the benefits of vaccines.
- **Investigate** some uses of viruses.

Vocabulary

virus
host cell

Why It's Important

Viruses infect nearly all organisms, usually affecting them negatively yet sometimes affecting them positively.

Figure 14

Viruses come in a variety of shapes.

What are viruses?

Cold sores, measles, chicken pox, colds, the flu, and AIDS are diseases caused by nonliving particles called viruses. A **virus** is a strand of hereditary material surrounded by a protein coating. Viruses don't have a nucleus or other organelles. They also lack a cell membrane. Viruses, as shown in **Figure 14**, have a variety of shapes. Because they are too small to be seen with a light microscope, they were discovered only after the electron microscope was invented. Before that time, scientists only hypothesized about viruses.

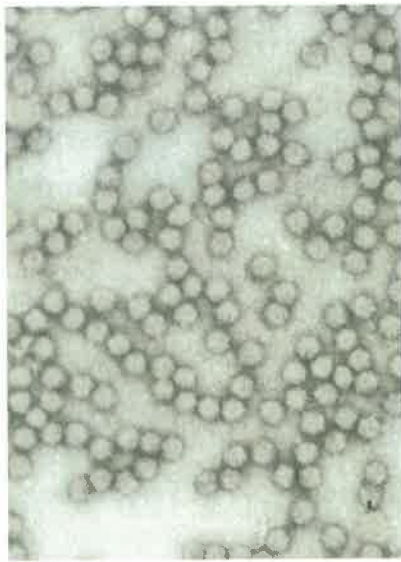
How do viruses multiply?

All viruses can do is make copies of themselves. However, they can't do that without the help of a living cell called a **host cell**. Crystallized forms of some viruses can be stored for years. Then, if they enter an organism, they can multiply quickly.

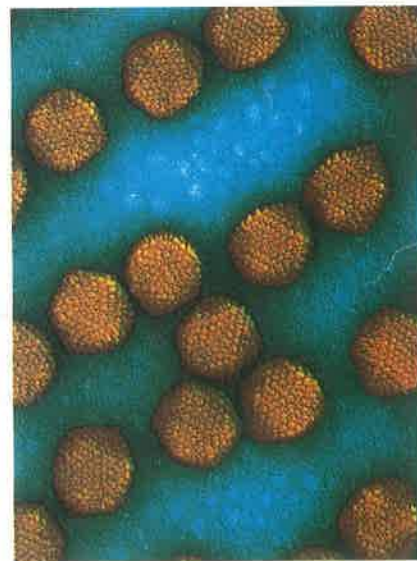
Once a virus is inside of a host cell, the virus can act in two ways. It can either be active or it can become latent, which is an inactive stage.



A Filoviruses do not have uniform shapes. Some of these *Ebola* viruses have a loop at one end.



B The potato leafroll virus, *Polerovirus*, damages potato crops worldwide.

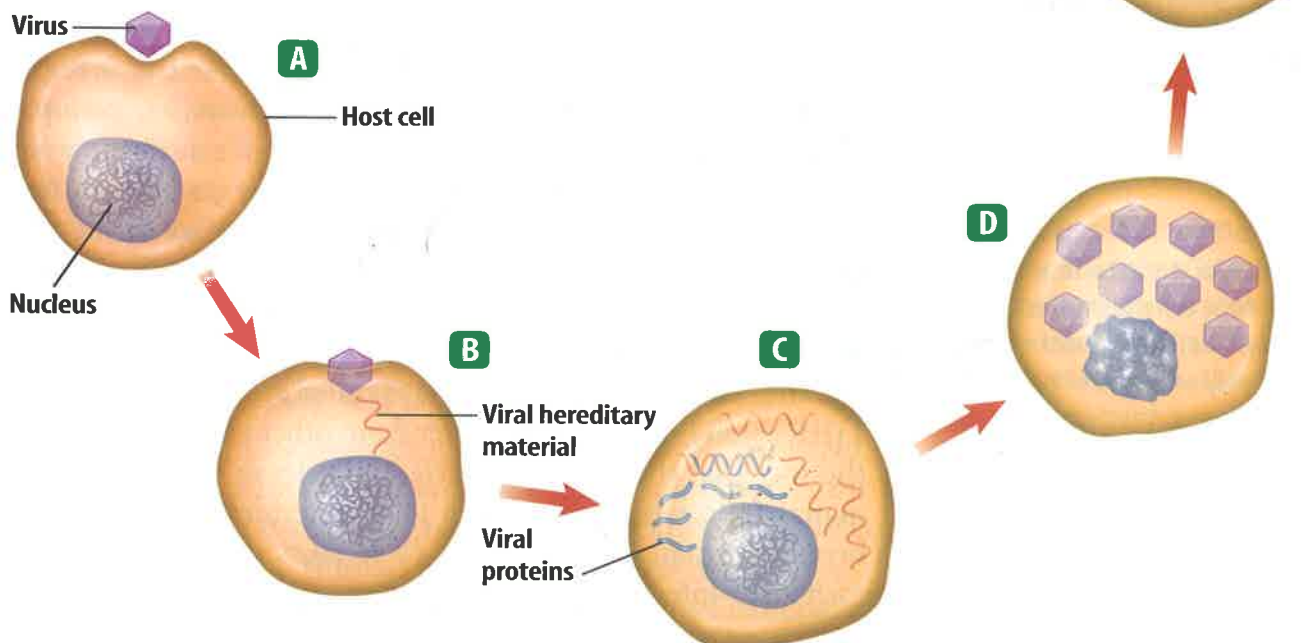


C This is just one of the many adenoviruses that can cause the common cold.

Figure 15

An active virus multiplies and destroys the host cell.

A The virus attaches to a specific host cell. **B** The virus's hereditary material enters the host cell. **C** The hereditary material of the virus causes the cell to make viral hereditary material and proteins. **D** New viruses form inside of the host cell. **E** New viruses are released as the host cell bursts open and is destroyed.



Active Viruses When a virus enters a cell and is active, it causes the host cell to make new viruses. This process destroys the host cell. Follow the steps in **Figure 15** to see one way that an active virus functions inside a cell.

Latent Viruses Some viruses can be latent. That means that after the virus enters a cell, its hereditary material can become part of the cell's hereditary material. It does not immediately make new viruses or destroy the cell. As the host cell reproduces, the viral DNA is copied. A virus can be latent for many years. Then, at any time, certain conditions, either inside or outside your body, can activate the virus.

If you have had a cold sore on your lip, a latent virus in your body has become active. The cold sore is a sign that the virus is active and destroying cells in your lip. When the cold sore disappears, the virus has become latent again. The virus is still in your body's cells, but it is hiding and doing no apparent harm.



Research Visit the Glencoe Science Web site at science.glencoe.com for information on viruses. What environmental stimuli might activate a latent virus? Record your answer in your Science Journal.

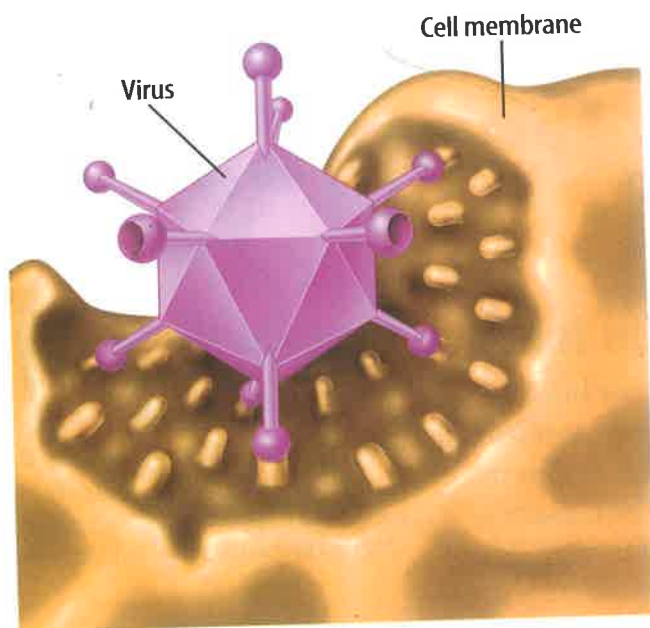


Figure 16
Viruses and the attachment sites of the host cell must match exactly. That's why most viruses infect only one kind of host cell.

How do viruses affect organisms?

Viruses attack animals, plants, fungi, protists, and all prokaryotes. Some viruses can infect only specific kinds of cells. For instance, many viruses, such as the potato leafroll virus, are limited to one host species or to one type of tissue within that species. A few viruses affect a broad range of hosts. An example of this is the rabies virus. Rabies can infect humans and many other animal hosts.

A virus cannot move by itself, but it can reach a host's body in several ways. For example, it can be carried onto a plant's surface by the wind or it can be inhaled by an animal. In a

viral infection, the virus first attaches to the surface of the host cell. The virus and the place where it attaches must fit together exactly, as shown in **Figure 16**. Because of this, most viruses attack only one kind of host cell.

Viruses that infect bacteria are called bacteriophages (bak TIHR ee uh fay juhzh). They differ from other kinds of viruses in the way that they enter bacteria and release their hereditary material. Bacteriophages attach to a bacterium and inject their hereditary material. The entire cycle takes about 20 min, and each virus-infected cell releases an average of 100 viruses.

Fighting Viruses

Vaccines are used to prevent disease. A vaccine is made from weakened virus particles that can't cause disease anymore. Vaccines have been made to prevent many diseases, including measles, mumps, smallpox, chicken pox, polio, and rabies.

Reading Check What is a vaccine?

The First Vaccine Edward Jenner is credited with developing the first vaccine in 1796. He developed a vaccine for smallpox, a disease that was still feared in the early twentieth century. Jenner noticed that people who got a disease called cowpox didn't get smallpox. He prepared a vaccine from the sores of people who had cowpox. When injected into healthy people, the cowpox vaccine protected them from smallpox. Jenner didn't know he was fighting a virus. At that time, no one understood what caused disease or how the body fought disease.

SCIENCE Online



Data Update Scientists have determined that *Marburg* virus, *Ebola zaire*, and *Ebola reston* belong to the virus family *Filoviridae*. Visit the Glencoe Science Web site at science.glencoe.com for the latest information about these viruses. Share your results with your class.

Treating and Preventing Viral Diseases Antibiotics are used to treat bacterial infections. They are ineffective against any viral disease. One way your body can stop viral infections is by making interferons. Interferons are proteins that protect cells from viruses. These proteins are produced rapidly by infected cells and move to noninfected cells in the host. They cause the noninfected cells to produce protective substances.

Antiviral drugs can be given to infected patients to help fight a virus. A few drugs show some effectiveness against viruses but some have limited use because of their adverse side effects.

Public health measures for preventing viral diseases include vaccinating people, improving sanitary conditions, quarantining patients, and controlling animals that spread the disease. Yellow fever was wiped out completely in the United States through mosquito-control programs. Annual rabies vaccinations protect humans by keeping pets and farm animals free from infection. To control the spread of rabies in wild animals such as coyotes and wolves, wildlife workers place bait containing an oral rabies vaccine, as shown in **Figure 17**, where wild animals will find it.

Research with Viruses

You might think viruses are always harmful. However, through research, scientists are discovering helpful uses for some viruses. One use, called gene therapy, is being tried on cells with defective genes. Normal hereditary material is substituted for a cell's defective hereditary material. The normal material is enclosed in viruses. The viruses then "infect" targeted cells, taking the new hereditary material into the cells to replace the defective hereditary material. Using gene therapy, scientists hope to help people with genetic disorders and find a cure for cancer.



Figure 17
This oral rabies bait is being prepared for an aerial drop by the Texas Department of Health as part of their Oral Rabies Vaccination Program. This five-year program has prevented the expansion of rabies into Texas.

Section

3

Assessment

1. Describe the structure of viruses and explain how viruses multiply.
2. How are vaccines beneficial?
3. How might some viruses be helpful?
4. How might viral diseases be prevented?
5. **Think Critically** Explain why a doctor might not give you any medication if you have a viral disease.

Skill Builder Activities

6. **Concept Mapping** Make an events chain concept map to show what happens when a latent virus becomes active. For more help, refer to the **Science Skill Handbook**.
7. **Using a Word Processor** Make an outline of the cycle of an active virus. For more help, refer to the **Technology Skill Handbook**.