Before You Read
Have you ever heard of mad cow disease? On the lines below, write what you know about mad cow disease. In this section, you will read about what causes mad cow disease.

Read to Learn
Viruses
A virus is a non-living strand of genetic material within a protein coat. Some are harmless, while others cause disease in living things. The table below lists some diseases in humans caused by viruses. Viral diseases such as HIV and genital herpes transmitted through sexual contact have no cure or vaccine.

The origin of viruses is not known. One theory, however, is that viruses came from parts of cells. Scientists found that viruses are similar to genes in cells. These genes somehow became able to exist outside the cell.

<table>
<thead>
<tr>
<th>Category</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexually transmitted diseases</td>
<td>AIDS (HIV), genital herpes</td>
</tr>
<tr>
<td>Childhood diseases</td>
<td>measles, mumps, chicken pox</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>common cold, influenza</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>warts, shingles</td>
</tr>
<tr>
<td>Digestive tract diseases</td>
<td>gastroenteritis</td>
</tr>
<tr>
<td>Nervous system diseases</td>
<td>polio, viral meningitis, rabies</td>
</tr>
<tr>
<td>Other diseases</td>
<td>smallpox, hepatitis</td>
</tr>
</tbody>
</table>

Picture This
1. Contrast How is a cold different from strep throat?

Main Idea
Viruses and prions invade cells and can alter cellular functions.

What You’ll Learn
- the general structure of viruses
- how viruses and retroviruses replicate
- how prions cause disease

Mark the Text
Restate the Main Point As you read the section, highlight the main point in each paragraph. Then restate each main point in your own words.
How are viruses structured?

The figure below shows the structure of three viruses. Adenovirus causes a cold. Influenza virus causes the flu. A bacteriophage (bak TIEH ee uh fayj) is a virus that infects bacteria. Notice that all three viruses have the same basic structure. Viruses have an outer layer called a capsid that is made of protein. Inside the capsid is genetic material, which could be DNA or RNA but not both. Viruses are classified as either DNA or RNA based on the type of genetic material they contain.

Smallpox, caused by a DNA virus, infected humans for thousands of years. A successful worldwide vaccination program eliminated the disease.

Viral Infection

A virus attaches to the host cell using receptors on the plasma membrane of the host. Different species have receptors for different types of viruses. As a result, many viruses cannot pass from one species to another.

Once attached, the genetic material enters the cytoplasm of the host cell. The virus then replicates by either the lytic cycle or the lysogenic cycle.

How do viruses replicate in the lytic cycle?

In the lytic cycle, the host cell makes many copies of the viral RNA or DNA. The viral genes instruct the host cell to make a protein coat around the copies of genetic material, forming capsids. These new viruses leave the cell by exocytosis or by cell lysis—bursting of the cells. The new viruses are then free to infect other cells.

Viruses that replicate by the lytic cycle cause active infections. This means that symptoms start in one to four days. Colds and flu are examples of active infections.
How does the lysogenic cycle differ?

In the **lysogenic cycle**, shown in the figure below, the viral DNA enters the nucleus of the host cell. The viral genes become a permanent part of the host chromosome. The genes might stay inactive for months or years until something activates them. When activated, the viral genes replicate by the lytic cycle and cause active infection.

**Retroviruses**

Some viruses are made of RNA instead of DNA. A **retrovirus** is a type of RNA virus with a replication cycle that has many parts. Human immunodeficiency virus (HIV) is a retrovirus.

**What is the structure of HIV?**

The structure of HIV is similar to other viruses. It has a protein capsid. Around the capsid is a lipid envelope that it got from the plasma membrane of the host cell. In the core of a retrovirus is RNA and an enzyme called reverse transcriptase. This enzyme makes DNA from the viral RNA.

**Picture This**

3. **Label** the active period and the dormant period in the virus's cycle.

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4. **Identify** What does reverse transcriptase make?

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How does HIV replicate?

Study the figure below to learn about HIV replication. HIV attaches to a host cell and releases its RNA. Reverse transcriptase makes DNA from the virus’s RNA. Then the DNA moves into the nucleus of the host cell and becomes part of a chromosome. The viral DNA might stay inactive for years. Once it is activated, the virus makes RNA from the viral DNA. The host cell then makes new HIV particles.

Prions

A prion (PREE ahn) is a protein that can cause infection or disease. Prions normally exist in cells. Normal prions are shaped like a coil. Mutations in the genes that code for these proteins occur, causing the proteins to be misfolded. Mutated prions are shaped like a piece of paper folded many times. Mutated prions can cause normal proteins to mutate. Abnormal prions infect and burst nerve cells in the brain, leaving spaces that make the brain look like a sponge.

What is a disease caused by prions?

Prions cause diseases such as “mad cow.” Abnormal prions are found in the brains and spinal cords of cattle. Scientists think that spinal cords might be cut during butchering, infecting the meat, and then infecting humans that eat the meat. Other examples caused by prions include Creutzfeldt-Jakob disease (CJD) in humans, scrapie (SKRAY pee) in sheep, and chronic wasting disease in deer and elk.