Viruses, bacteria, viroids, and prions can all cause infection.

Any living organism or particle* that can cause an infectious disease is called a **pathogen**. An infectious disease is an illness that can be passed from one organism to another. Bacteria, viruses, viroids, and prions can all be pathogens. Although many types of bacteria are helpful—and even necessary—for your health, some types of bacteria can make you sick.

**Relative Sizes of Cells and Infectious Particles**

Bacteria, viruses, viroids, and prions can all cause infection. Eukaryotic cells can be microscopic, but they are larger than prokaryotic cells, like bacteria. Prokaryotes are larger than viruses, viroids, and prions.

- **Eukaryotic cells**: 10,000–100,000 nm
- **Prokaryotic cells**: 200–10,000 nm
- **Viruses**: 50–200 nm
- **Viroids**: 5–150 nm
- **Prions**: 2–10 nm

### Bacteria

These single-celled organisms are prokaryotes. Bacteria are living things—they contain DNA, use nutrients and energy, grow and reproduce, and respond to their environment.

### Viruses

A **virus** is an infectious particle made only of a piece of DNA or RNA surrounded by a protein coat. Viruses have some characteristics of living things, but not all. For example, they cannot reproduce on their own. They need living cells to help them reproduce and to make proteins.

### Viroids

A **viroid** is a piece of single-stranded RNA without a protein coat. Viroids cause diseases in plants, and are passed through seeds or pollen. Like a virus, a viroid cannot reproduce without the help of living cells.
Prions A **prion** (PREE-ahn) is an infectious particle made only of proteins. Recall from Chapter 2 that proteins have a three-dimensional shape. Prions cause proteins to fold incorrectly, so they end up with the wrong shape and do not work properly. Prions are different from other pathogens because they have no genetic material, but can still cause disease. Prion diseases are always deadly, because the body has no immune response against a protein. The illness commonly called mad cow disease is caused by prions.

Circle the names of four pathogens presented above.

**18.1 Vocabulary Check**

<table>
<thead>
<tr>
<th>virus</th>
<th>viroid</th>
</tr>
</thead>
<tbody>
<tr>
<td>pathogen</td>
<td>prion</td>
</tr>
</tbody>
</table>

Match each clue below to the correct term from the list above.

1. made of protein only _________________
2. made of DNA or RNA and a protein coat _________________
3. causes infectious disease _________________
4. made of RNA only _________________

**18.1 The Big Picture**

5. Fill in the table below with the following terms: *bacteria, viruses, viroids, and prions*.

<table>
<thead>
<tr>
<th>PATHOGENS</th>
<th>LIVING CELLS</th>
<th>NOT LIVING CELLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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