Lesson Objectives

- Explain how bacteria cause disease.
- Explain how viruses cause disease.
- Define emerging disease, and explain why emerging diseases are a threat to human health.

BUILD Vocabulary

A. The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of each term. One has been done for you.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>How I’m Going to Remember the Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic</td>
<td>A drug that blocks the growth and reproduction of bacteria</td>
<td><em>Anti-</em> means “against.” <em>Antibiotics fight against infection by bacteria.</em></td>
</tr>
<tr>
<td>Emerging disease</td>
<td>An unknown disease that appears for the first time or a well-known disease that is suddenly harder to control</td>
<td><em>Emerge means “to come into view.”</em></td>
</tr>
<tr>
<td>Pathogen</td>
<td>A microorganism or particle that causes a disease</td>
<td>*It’s pathetic being sick. <em>Patho-</em> means “disease.”</td>
</tr>
<tr>
<td>Prion</td>
<td>An infectious particle made up of protein only rather than DNA or RNA</td>
<td><em>Prions are proteins that pry into a cell and mess up normal proteins.</em></td>
</tr>
<tr>
<td>Vaccine</td>
<td>A preparation of weakened or killed pathogens used to prevent disease</td>
<td><em>My doctor suggests getting a flu vaccine, or “flu shot.”</em></td>
</tr>
</tbody>
</table>

B. As you work through this lesson, you may find these terms in the activities. When you need to write a key term or a definition, **highlight** the term or the definition.
Bacterial Diseases

Bacteria cause disease in two ways. Some bacteria destroy living cells and the tissues of the infected organisms. Other bacteria release chemicals that upset homeostasis in an organism.

Decide if the methods listed in the chart below control, prevent, or treat bacterial diseases. Complete the chart.

<table>
<thead>
<tr>
<th>Method</th>
<th>Control, Prevent, or Treat?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccine</td>
<td>prevent</td>
</tr>
<tr>
<td>Physical Removal</td>
<td>control</td>
</tr>
<tr>
<td>Sterilization</td>
<td>control</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>treat</td>
</tr>
<tr>
<td>Disinfection</td>
<td>control</td>
</tr>
</tbody>
</table>

Read the following scenarios. Decide which method of controlling bacteria is being used. Circle the correct answer.

1. After cooking raw chicken, Miguel always makes sure to wash his hands.
   - physical removal
   - disinfection
   - food storage

2. Louise always uses a food thermometer to make sure her meat is well cooked.
   - food storage
   - food processing
   - sterilization

3. Andrew works in a lab. He always heats his equipment to a temperature of 100 degrees Celsius.
   - physical removal
   - sterilization
   - disinfection

4. Marco puts his lunch in the refrigerator at the office instead of leaving it at his desk.
   - physical removal
   - food processing
   - food storage

BUILD Understanding

Two-Column Chart As you read a lesson, it is helpful to take notes. One way to take notes is to make a two-column chart. In the left column, write the key questions from the lesson. In the right column, write answers to the questions. One question has been added for you. Continue your chart on a separate sheet of paper.

<table>
<thead>
<tr>
<th>Key Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do bacteria cause disease?</td>
<td>Bacteria destroy living cells or release chemicals that upset homeostasis in the infected organism.</td>
</tr>
</tbody>
</table>
Inquiry Into Scientific Thinking

MRSA on the Rise  In the past, MRSA infection was common only in hospitals. There it could spread quickly between patients. Scientists are now discovering many more MRSA cases. The infected people were not hospitalized. They were otherwise healthy. They were, however, in close contact with large groups of other people. These are called community associated or CA-MRSA infections.

Look at the graphs below. The graph on the left shows the percent of CA-MRSA infections in 2000. The graph on the right shows CA-MRSA infections in 2005.

**MRSA Infections by Category**

**Analyze and Conclude**

1. In 2000, what percentage of total MRSA infections were community-based?  
   **2%**

2. In 2005, what percentage of total MRSA infections were community-based?  
   **17%**

3. What statement is an accurate interpretation of the data shown on the graphs? Circle the correct answer.
   - **CA-MRSA infections are on the rise.**
   - CA-MRSA infections are on the decline.

4. Why do you think scientists are concerned about CA-MRSA?  
   *Sample answer: Scientists are concerned because infections are spreading in new areas.*

5. What types of communities might be affected the most by CA-MRSA?  
   *Sample answer: Communities of people that live or work in close proximity and in large groups. Examples include students, athletes, military personnel, and prisoners.*
Chapter Review

Use the clues and words to help you write the vocabulary terms from the chapter in the blanks. You may use a word once, more than once, or not at all.

<table>
<thead>
<tr>
<th>retrovirus</th>
<th>spirillum</th>
<th>vaccine antibiotic</th>
<th>bacteriophage</th>
</tr>
</thead>
</table>

1. An example of a spiral-shaped bacterium is ____ spirillum ___.
2. A ____ retrovirus ____ is a virus that copies its genetic material from RNA to DNA.
3. A drug that blocks the growth of a bacterial disease is an ____ antibiotic ____.

Answer the following questions.

4. Unicellular organisms that have no nucleus are called ____ prokaryotes ____.
5. Which of the following diseases could be treated with antibiotics?
   A. common cold       C. influenza
   B. meningitis        D. human papillomavirus (HPV)
6. Complete the compare/contrast table showing the differences between viruses and cells.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Virus</th>
<th>Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>DNA or RNA in capsid</td>
<td>Cell membrane, cytoplasm; eukaryotes have nuclei and organelles.</td>
</tr>
<tr>
<td>Reproduction</td>
<td>Only in a host cell</td>
<td>Independent cell division</td>
</tr>
<tr>
<td>Genetic code</td>
<td>DNA or RNA</td>
<td>DNA</td>
</tr>
<tr>
<td>Responds to environment?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Changes over time?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Use the diagram above to answer Questions 7 and 8.

7. The structure shown in this diagram is a ____ bacterial cell ____.
8. What are the structures labeled A in the diagram? Circle your answer.
   A. flagella       C. cilia
   B. pili           D. ribosomes
Taking a Standardized Test

Test-Taking Tip: Best Guess

Always guess instead of leaving hard questions unanswered. By guessing, you have a 25% chance of answering the question correctly. By not answering the question you have a 100% chance of getting the question wrong.

Read the following question and answer choices.

What is a lytic infection?
A. a bacterial infection in which the cell bursts
B. a viral infection in which the cell bursts
C. a bacterial infection in which the host cell copies the bacterium’s DNA when it reproduces
D. a viral infection in which the host cell copies the DNA of the virus when it reproduces

Step 1 Read the question carefully. Look for any clues that will help you answer the question. If there are none, mark the question so you can easily find it again after you finish the rest of the test.

Step 2 Return to the marked questions. Once you have answered the questions you knew the answers to, return to the questions you found difficult. Reread the questions.

Step 3 Try to eliminate any answer choices you know are wrong. In this case, you know that a lytic infection has to do with viruses, and not bacteria. So you can eliminate choices A and C.

Step 4 Use context clues to make your best guess at an answer. With only two answers left, you have a 50% chance of getting the question correct. You know the answer is either B or D. You think you remember that lytic comes from a Greek word that means “to burst.” The correct answer is B.

Self-Test

Practice what you have learned by answering the following questions. If you find a question difficult, mark it. Return to it when you have answered all the other questions. If you still cannot answer it, make your best guess.

1. The common cold is an example of a(n)
   A. DNA virus.
   B. RNA virus.
   C. retrovirus.
   D. bacteriophage.

2. An organism that lives in the extreme conditions of a deep sea vent would most likely be considered a(n)
   A. archaea.
   B. bacterium.
   C. retrovirus.
   D. bacteriophage.

3. A type of strep throat is caused by chains of round bacteria cells. This bacteria would be classified as
   A. bacilli.
   B. capsid.
   C. cocci.
   D. spirillum.
Use the chart to answer Questions 4–7.

<table>
<thead>
<tr>
<th>Mode of Nutrition</th>
<th>How Energy Is Captured</th>
<th>Habitat</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heterotroph</td>
<td>Take in organic molecules from environment or other organisms to use as both energy and carbon supply</td>
<td>Wide range of environments</td>
<td>Clostridium</td>
</tr>
<tr>
<td>Photoheterotroph</td>
<td>Like basic heterotrophs, but also use light energy</td>
<td>Where light is plentiful</td>
<td>Rhodobacter, Chloroflexus</td>
</tr>
<tr>
<td>Photoautotroph</td>
<td>Use light energy to convert CO(_2) into carbon compounds</td>
<td>Where light is plentiful</td>
<td>Anabaena</td>
</tr>
<tr>
<td>Chemoautotroph</td>
<td>Use energy released by chemical reactions involving ammonia, hydrogen sulfide, etc.</td>
<td>In chemically harsh and/or dark environments: deep in the ocean, in thick mud, in digestive tracts of animals, in boiling hot springs</td>
<td>Nitrosomonas</td>
</tr>
</tbody>
</table>

4. Which phrase would best describe a Clostridium?
   A. other feeder
   B. light and other feeder
   C. light self-feeder
   D. chemical self-feeder

5. Which phrase would best describe a chemoautotrophic prokaryote?
   A. other feeder
   B. light and other feeder
   C. light self-feeder
   D. chemical self-feeder

6. In which type of habitat would you find a prokaryote that feeds on light and other energy?
   A. deep in the ocean
   B. where light is plentiful
   C. in a chemically harsh environment
   D. in a dark environment

7. Which type of feeder uses light energy to change carbon dioxide into carbon compounds?
   A. other feeder
   B. light and other feeder
   C. light self-feeder
   D. chemical self-feeder

Short-Response Question

Answer the following question in two or three sentences.

8. What are the pros and cons of using antibiotic products like hand cleanser and other cleaning products?

   Sample answer: Antibiotic products can help prevent the spread of disease. However, overuse of these products has led to a process of natural selection that favors emergence of “superbugs” that are resistant to antibiotics.