

Study Tip

Divide the class into small groups, and have students quiz one another about the Vocabulary terms and the Key Concepts.

Thinking Visually

1. Archaeobacteria
2. Bacilli
3. Cocci
4. Spirilla

Chapter 19 Assessment**Reviewing Content**

- | | | |
|------|------|-------|
| 1. a | 5. a | 9. b |
| 2. a | 6. d | 10. c |
| 3. b | 7. d | |
| 4. b | 8. c | |

Understanding Concepts

11. Prokaryotes are the smallest and most common microorganisms. They are single-celled and lack a nucleus.
12. The three most common shapes of prokaryotes are the rod-shaped bacilli, spherical-shaped cocci, and corkscrew-shaped spirilli.
13. Gram-positive bacteria with a single cell wall layer absorb only the violet primary stain. Gram-negative bacteria have a thin layer of peptidoglycan. This layer absorbs the red stain so that the bacteria appear red.
14. Some prokaryotes move by flagella, some spiral forward, and some glide along on a slimelike material they secrete.
15. Both photoautotrophs and chemoautotrophs make their own food. Photoautotrophs obtain energy from photosynthesis and thus depend upon light. Chemoautotrophs obtain energy from chemical reactions involving ammonia, hydrogen sulfide, nitrates, sulfur, or iron.

19-1 Bacteria**Key Concepts**

- Eubacteria, the larger of the two kingdoms of prokaryotes, have cell walls made up of peptidoglycan.
- Archaeobacteria do not contain peptidoglycan. The DNA sequences of key archaeobacterial genes are more like those of eukaryotes than those of eubacteria.
- Prokaryotes are identified by their shapes, the chemical natures of their cell walls, the ways they move, and the way they obtain energy.
- Some bacteria are producers that capture energy by photosynthesis. Others break down the nutrients in dead matter and the atmosphere. Still other bacteria have human uses.

Vocabulary

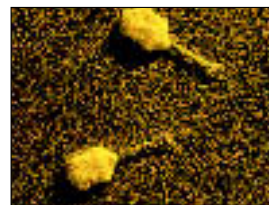
prokaryote, p. 471 • bacillus, p. 473
 coccus, p. 473 • spirillum, p. 473
 chemoheterotroph, p. 473
 photoheterotroph, p. 474
 photoautotroph, p. 474
 chemoautotroph, p. 474
 obligate aerobe, p. 474
 obligate anaerobe, p. 474
 facultative anaerobe, p. 474
 binary fission, p. 475
 conjugation, p. 475
 endospore, p. 475
 nitrogen fixation, p. 477

19-2 Viruses**Key Concepts**

- A typical virus is composed of a core of DNA or RNA surrounded by a protein coat.
- In a lytic infection, a virus enters a cell, makes copies of itself, and causes the cell to burst.
- In a lysogenic infection, a virus integrates its DNA into the DNA of the host cell and the viral genetic information replicates along with the host cell's DNA.

Vocabulary

virus, p. 478 • capsid, p. 479
 bacteriophage, p. 479
 lytic infection, p. 480
 lysogenic infection, p. 480
 prophage, p. 480
 retrovirus, p. 482

**19-3 Diseases Caused by Bacteria and Viruses****Key Concepts**

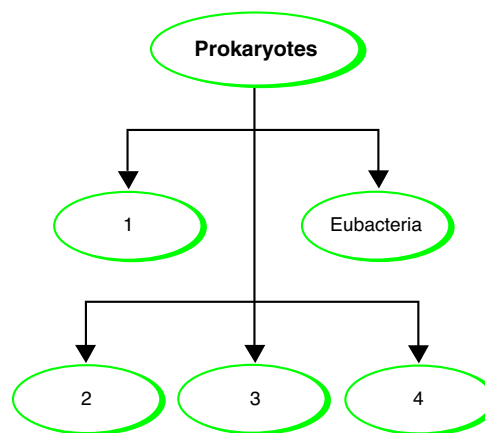
- Bacteria produce disease in one of two general ways. Some bacteria damage the cells and tissues of the infected organism directly by breaking down the cells for food. Other bacteria release toxins (poisons) that travel throughout the body interfering with the normal activity of the host.
- There are various methods used to control bacterial growth, including sterilization, disinfectants, and food processing.
- Viruses produce disease by disrupting the body's normal equilibrium.

Vocabulary

pathogen, p. 485
 vaccine, p. 486
 antibiotic, p. 486
 viroid, p. 490
 prion, p. 490

Thinking Visually

Complete this concept map about prokaryotes.

**CHAPTER RESOURCES****Print:**

- **Teaching Resources**, Chapter Vocabulary Review, Graphic Organizer
- **Chapter Tests: Levels A and B**, Chapter 19 Test

Technology:

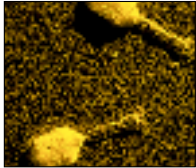
- **Computer Test Bank**, Chapter 19 Test
- **iText**, Chapter 19 Assessment

Chapter 19 Assessment

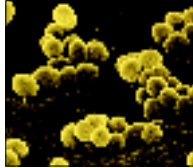
Reviewing Content

Choose the letter that best answers the question or completes the statement.

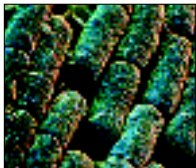
- Prokaryotes are unlike all other organisms in that their cells
 - lack nuclei.
 - have organelles.
 - have cell walls.
 - lack nucleic acids.
- Archaeobacteria that live in oxygen-free environments include
 - methanogens.
 - retroviruses.
 - bacteriophages.
 - protists.
- Which micrograph shows bacillus bacteria?



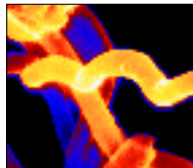
a.



c.



b.



d.

- Bacteria that contain chlorophyll *a* belong in the group
 - archaeobacteria.
 - cyanobacteria.
 - chemoautotrophs.
 - pathogens.
- Bacteria reproduce asexually by
 - binary fission.
 - spores.
 - conjugation.
 - fixation.
- The process of converting nitrogen into a form plants can use is known as nitrogen
 - conjugation.
 - sterilization.
 - decomposition.
 - fixation.
- Particles made up of nucleic acids, proteins, and in some cases, lipids that can reproduce only by infecting living cells are known as
 - bacteria.
 - capsids.
 - prophages.
 - viruses.

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- The outer protein coat of a virus is a
 - core of DNA.
 - core of RNA.
 - capsid.
 - membrane envelope.
- One group of viruses that contain RNA as their genetic information is
 - oncogenic viruses.
 - retroviruses.
 - capsids.
 - prophages.
- Disease-causing organisms are known as
 - cocci.
 - bacilli.
 - pathogens.
 - archaeobacteria.

Understanding Concepts

- What are two distinguishing characteristics of prokaryotes?
- Describe the three main cell shapes of prokaryotes.
- How do scientists distinguish between Gram-positive and Gram-negative bacteria?
- Describe two methods by which prokaryotes move.
- How are photoautotrophs similar to chemoautotrophs? How are they different?
- State one way in which photoheterotrophs are similar to chemoheterotrophs.
- Distinguish between an obligate aerobe and an obligate anaerobe.
- Facultative anaerobes can survive with or without oxygen. How is this advantageous to them?
- What is the role of certain bacteria in changing atmospheric nitrogen into a form usable by plants?
- What one characteristic do all viruses have in common?
- How is the capsid protein important to the functioning of a virus?
- Describe the sequence of events that occur during a lytic infection.
- Describe what happens to the host cell of a lysogenic virus.
- What is the best way to protect humans against most viral diseases?
- How are viruses highly specific to the cells they infect?



If your class subscribes to the iText, your students can go online to access an interactive version of the Student Edition and a self-test.

(Continued from page 492)

- They are similar in that both require organic compounds in order to stay alive.
- Obligate aerobes require oxygen to survive. Obligate anaerobes are killed by oxygen.
- Because facultative anaerobes are able to switch between cellular respiration and fermentation for their energy demands, they are able to live anywhere.
- Plants can't use nitrogen gas directly. Certain bacteria that have symbiotic relationships with plants carry out nitrogen fixation, which is the process of converting nitrogen gas into a form plants can use.
- One thing all viruses have in common is that they enter living cells and, once inside, use the machinery of the infected cell to multiply.
- The capsid protein of a virus is important because it binds to the surface of a cell and tricks the cell into allowing it inside. Once inside, the viral genes take over.
- In a lytic infection, a virus enters a cell, makes copies of itself, and causes the cell to burst.
- In a lysogenic infection, a virus integrates its DNA into the DNA of the host cell, and the viral genetic information replicates along with the host cell's DNA.
- The best way to protect against most viral diseases is prevention. Once a viral disease has been contracted, it might be too late to control the disease.
- Viruses are highly specific to the cells they infect because they must bind precisely to proteins on the cell surface in order to penetrate the cytoplasm.



HOMEWORK GUIDE

Section:	Questions:
Section 19-1	1-6, 11-19, 26-30, 34-37
Section 19-2	7-9, 20-23, 25, 33
Section 19-3	10, 24, 31, 32

Critical Thinking

26. Because other organisms depend on bacteria for converting nitrogen gas into nitrogen compounds, these organisms might die if bacteria lost their ability to fix nitrogen.
27. Viruses can replicate only within living things. As a result, bacteriophages can grow on cultures of bacteria but not on synthetic media.
28. These foods are dehydrated, and bacteria need water to live.
29. Not brushing your teeth leaves particles on teeth that bacteria can use for food. This encourages bacterial growth.
30. The organism probably belongs to Eubacteria because it is unicellular, has a cell wall containing peptidoglycan, and lacks a nucleus.
31. Antibiotics B and C were the least effective. The growth of the bacteria was not retarded at all.
32. Antibiotics A and D would be good treatments because both retarded the growth of the bacteria.
33. Viruses, prokaryotes, and eukaryotes all have nucleic acids and proteins. Prokaryotes and eukaryotes have cell membranes, and eukaryotes have organelles.
34. Binary fission produces two cells from one, whereas endospore formation and conjugation do not increase the number of cells. In addition, conjugation results in genetic recombination.
35. Two labeled agar plates are needed. Touch one plate with a finger. Leave both plates uncovered for 20 minutes. Then, cover the plates, and store them in a protected area of the classroom. Use a hand lens to count the bacteria colonies after 24 and 48 hours.
36. Students should infer that if the agar plates are not sterile at the beginning of the lab, the results of the lab may be suspect. The reason is that the bacterial colonies that grow on the plates may not be the result of wiping the swab across the plate. For instance, the bacterial colonies that develop might not be of the same species as the bacteria in the bacterial culture and might grow at different rates under the same conditions.
37. Bacteria break down carbon compounds, so they can be used to make all four types of organic compounds.

Critical Thinking

26. **Predicting** Suppose that bacteria lost the ability to fix nitrogen. How would this affect other organisms?
27. **Applying Concepts** Bacteria can be grown in the laboratory on synthetic media. Can bacteriophages be grown on cultures of bacteria? Can bacteriophages be grown on synthetic media? Explain your answers.
28. **Applying Concepts** Why don't foods such as uncooked rice and raisins spoil?
29. **Problem Solving** Bacteria that live on teeth produce an acid that causes decay. Why do people who do not brush their teeth regularly tend to have more cavities than those who do?
30. **Classifying** A scientist finds a new organism but is unsure to which kingdom it belongs. The organism is unicellular, has a cell wall containing peptidoglycan, has a circular DNA molecule and ribosomes, but it lacks a nucleus. Based on those characteristics, to which kingdom does it belong?

Questions 31–32

An experiment was conducted to determine the effectiveness of different antibiotics against a certain strain of bacteria. Four disks, each soaked in a different antibiotic, were placed in a petri dish where the bacteria were growing. The results are summarized below.

Effects of Antibiotics	
Antibiotic	Observation After One Week
A	Growth retarded for 6 mm diameter
B	Growth not retarded
C	Growth not retarded
D	Growth retarded for 2 mm diameter

31. **Analyzing Data** Which antibiotics were the least effective at retarding the growth of the bacteria? Explain your answer using data from the experiment.
32. **Inferring** Which antibiotics might be most effective treatments for an infection caused by this strain of bacteria? Explain your answer using data from the experiment.

33. **Comparing and Contrasting** Make a chart that compares the structure and function of viruses with prokaryotes and eukaryotes.
34. **Comparing and Contrasting** Explain how the outcome of binary fission differs from that of both endospore formation and conjugation.
35. **Designing Experiments** Design an experiment to test the hypothesis that contact of an agar plate with a finger results in more bacterial growth than the exposure of the plate to classroom air.
36. **Evaluating** In science, sources of error are factors or conditions that cause recorded data to be inaccurate. Review the lab procedures on page 491. Is the following a possible source of error for that investigation: "At the beginning of the lab, the agar plates may not be sterile (may be contaminated)." Explain your answer.
37. **Connecting Concepts** Many prokaryotes are decomposers, helping to recycle materials, including organic molecules. How are chemical reactions involved in the formation of organic molecules? You may wish to review Chapter 2.

Writing in Science

You are writing a science article entitled "Viruses in the Biosphere" for the local newspaper. Explain the role viruses play in the environment. Describe the harm they cause.

Performance-Based Assessment

Demonstrating a Lytic Infection A flip-book consists of pages of sequential drawings that, when flipped, appear to move. Create a flip-book movie of the steps in a lytic infection. Be sure to show what happens to the bacteriophage at each step. Exchange your flip-book with another student. Look at the other student's movie, and write a review of it.

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Writing in Science

Helpful aspects that student essays might mention: Viruses can be used in the production of vaccines that could eradicate specific diseases such as measles and polio; genetic engineers can correct genetic defects by using viruses to carry desirable genes from one cell to another. Harmful aspects: Viruses are pathogens and

resistant to antibiotics. Viral diseases that affect humans include the common cold, measles, chickenpox, mumps, AIDS, and polio. Viral diseases that affect animals include distemper, rabies, and pneumonia. Viral diseases that affect plants may discolor leaves, stunt growth, or even kill the plant.