

Name _____ Period _____

Chapter 27: Bacteria and Archaea

Overview

1. The chapter opens with amazing tales of life at the extreme edge. What are the “masters of adaptation”? Describe the one case you thought most dramatic.

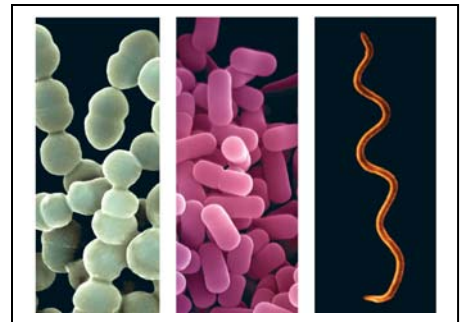
Concept 27.1 Structural and functional adaptations contribute to prokaryotic success

2. Which two domains include *prokaryotes*?
3. Let's focus on some general details about *prokaryotes*.

a. Are they multicellular or unicellular?

b. Compare their size relative to eukaryotic cells.

c. What three shapes are most common? Label them on the figure.



d. What is the composition of the typical bacterial cell wall?

4. A key feature of prokaryotic cells is the *cell wall*. What three functions does it provide for the cell?
5. Quick review! What material comprises the cell wall of plants? of fungi?
6. The cell walls of Archaeans are different. They lack _____ but contain _____ and _____.

7. Explain the difference between *Gram-positive* and *Gram-negative bacteria*.

8. What is a bacterial *capsule*? What functions may it serve?

9. Many prokaryotes are capable of directional movement. What is this called?

10. What bacterial feature makes this possible?

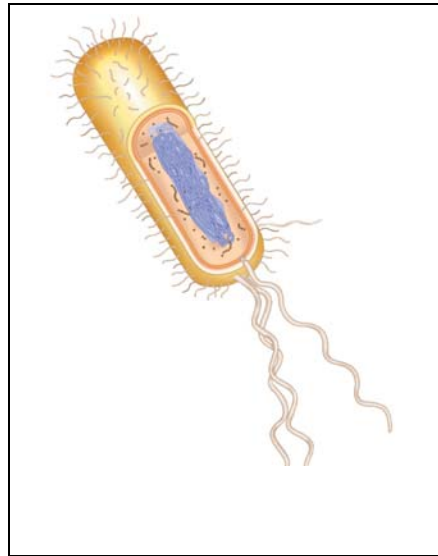
11. Under ideal conditions, how quickly can *E. coli* divide? What conditions check prokaryotic reproduction?

12. What three key features allow prokaryotic populations to consist of trillions of individuals?

13. Compare prokaryotes to eukaryotes in terms of the following characteristics:

	Prokaryotes	Eukaryotes
<i>Size</i>		
<i>Genome</i>		
<i>Membranes</i>		
<i>Location of genome</i>		
<i>Plasmids</i>		
<i>Ribosomes</i>		

14. What are the small, circular, self-replicating pieces of DNA found in bacteria called?
15. Label the following structures of a typical prokaryote seen here: *cell wall*, *sex pilus*, *circular chromosome*, *nucleoid region*, *ribosomes*, *flagella*, *capsule*, and *fimbriae*. Sketch in a plasmid or two, and label them. For each structure, know the function. (Go to the end of the chapter, p. 573, for help with this figure.)



16. When conditions for survival are difficult, some species produce *endospores*. What are these? Can you name any species that form *endospores*? As a hint, consider what causes botulism or tetanus.

Concept 27.2 Rapid reproduction, mutation, and genetic recombination promote genetic diversity in prokaryotes

17. You should now have some idea why there is so much potential for genetic diversity with bacterial populations. Although mutation is the major source of genetic variation in prokaryotes, listed below are the other three ways variation is introduced. Explain each one.

Source of Variation	Summary Explanation
<i>Transformation</i>	
<i>Transduction</i>	
<i>Recombination</i>	

18. Define *transformation*. This idea was first described by *Frederick Griffith*. (You read about his work in Concept 16.1.)

19. What is *transduction*? What is the vector for this process?

20. Compare and contrast *transduction* and *transformation*.

21. What is a *sex pilus*? What is the *F factor*? And how are the two related?

22. The F factor is an *episome*. This is a piece of DNA that can be integrated within the main chromosome of the bacterium, or able to exist as an independent plasmid. What is the bacterial cell called:

when the F factor is in plasmid form?

when it lacks an F plasmid?

when it is integrated within the chromosome?

23. What occurs in bacterial *conjugation*?

24. When a mating bridge forms between an F^+ cell and an F^- cell and the *F plasmid* is replicated and transferred, what is the status of the F^- cell afterward?

25. What is an *Hfr* cell?
26. How are *Hfr* cells created?
27. Summarize the transfer of genetic information from an *Hfr* cell to an *F*⁻ cell.
28. An understanding of *R plasmids* and antibiotic resistance will be important when you do a bacterial transformation lab. What are *R plasmids*?

Concept 27.3 *A great diversity of nutritional and metabolic adaptations have evolved in prokaryotes*

29. Prokaryotes can be placed in four groups according to their mode of nutrition, which is how they take in carbon and how they obtain energy. List each group below, and summarize how each of them obtains energy. Place an ** by the heterotrophs.

Mode of Nutrition	Energy Source	Examples

30. Compare the metabolic requirements of each group with respect to oxygen:
 - obligate aerobes**
 - obligate anaerobes**
 - facultative anaerobes**
31. To which of the above groups do you think the bacterium *Clostridium tetani*, the causative agent of tetanus, belongs?

32. *Biofilms* form dental plaque and result in tooth decay. They can damage industrial and medical equipment and contaminate products. What are *biofilms*? How do individual cells cooperate to form dental plaque?

Concept 27.4 Molecular systematics is illuminating prokaryotic phylogeny

33. The work of *Carl Woese* changed our approach to the taxonomy of prokaryotes. How did it do this?
34. As you read in the Overview to this chapter, many archaea live on the edge and so are termed *extremophiles*. Where would you find these types of archaea?

extreme halophiles

extreme thermophiles

The *thermophiles* are interesting because their DNA and enzymes are stable at high temperatures. DNA polymerases from *thermophiles* are important in *polymerase chain reaction* (Chapter 20).

35. Pee-yoo! *Methanogens* are found in many habitats. What are some of these habitats? What do they all have in common?
36. Compare the three domains of life in this chart by filling in either *present* or *absent*. One row is done for you.

A COMPARISON OF THE THREE DOMAINS OF LIFE

Characteristic	Bacteria	Archaea	Eukarya
<i>Nuclear envelope</i>			
<i>Membrane-enclosed organelles</i>			
<i>Introns</i>			
<i>Histone proteins associated w/ DNA</i>	absent	absent	present
<i>Circular chromosome</i>			

Concept 27.5 Prokaryotes play crucial roles in the biosphere

37. Define each of these terms, and give a specific example of the role that prokaryotes play in the terms marked with an asterisk (*):

decomposers*

symbiosis

host

symbiont

mutualism*

commensalism*

parasitism*

parasite

pathogens*

Concept 27.6 Prokaryotes have both harmful and beneficial effects on humans

38. What are *antibiotics*? Why are they becoming less effective?
39. There are many bacterial diseases. Make a list of six bad ones here, and give as much information about each disease as you can find in your text.
40. Explain how a normally harmless symbiont of our gut, *E. coli*, can be the agent of serious food poisoning. (Tell the story of 0157:H7.)

41. Not all bacterial activity is negative. Humans employ bacteria for many diverse activities. Cite three human applications of prokaryotes here.

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____