

Name _____ Period _____

Chapter 19: Viruses

Besides the impact of viruses on human health, early experimental work with viruses provided important evidence that the genetic material was DNA. Viruses were also important in working out the molecular mechanisms of DNA replication, transcription, and translation and in the development of techniques for manipulating and transferring genes. As you learn about viruses in this chapter, you will build on the foundation necessary for an understanding of the molecular techniques of biotechnology. The role of viruses in horizontal gene transfer is significant in increasing genetic variation in many species. EK 3.C.2 and 3.C.3 are addressed in this important chapter.

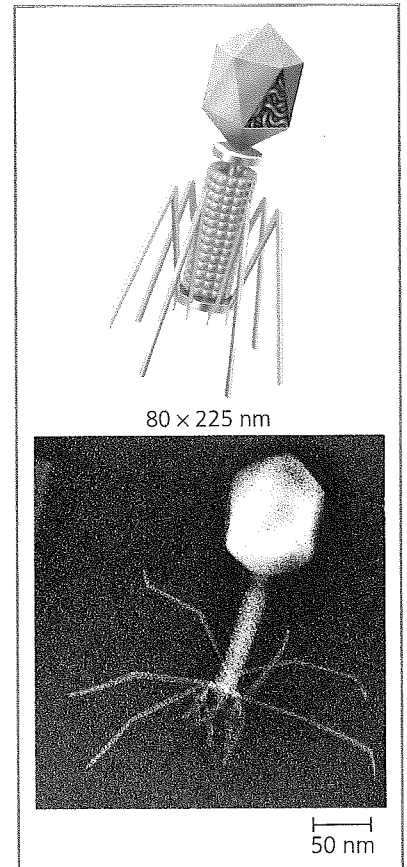
Concept 19.1 *A virus consists of a nucleic acid surrounded by a protein coat*

1. What was some early evidence of the existence of viruses? Why were they difficult to study?
2. What are the four forms of viral genomes?
3. What is a *capsid*? What different shapes may capsids have?
4. As you can see, all viruses consist of a nucleic acid enclosed in a protein coat. Some viruses also have a membranous envelope. What are the components of a *viral envelope*? Which component is derived from the host cell, and which is of viral origin?

Viral Envelope Component	Derived from Host or Virus?

5. What is the role of an *envelope* in animal viruses?

6. For the virus shown in the following figure, label the *protein capsid*, *tail fibers*, *head*, *tail sheath*, and *genome*.
- What type of virus is this? _____
 - What does its name mean? _____
 - What is its host? _____
 - Is the genome of this virus DNA or RNA? _____



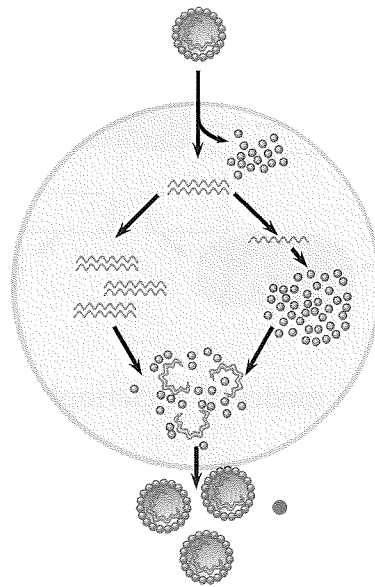
Concept 19.2 *Viruses replicate only in host cells*

- What property of a virus determines its attachment to a host cell membrane?
- Viruses are *obligate intracellular parasites*. What does this mean?
- What is meant by *host range*? Distinguish between a virus with a broad host range and one with an extremely limited host range, and give an example of each.
- Compare the *host range* for the rabies virus to that of the human cold virus.
- What components of the host cell does a virus use to reproduce itself?
- How does a DNA virus reproduce its genome?
- How do most RNA viruses replicate their genome?

Study Tip

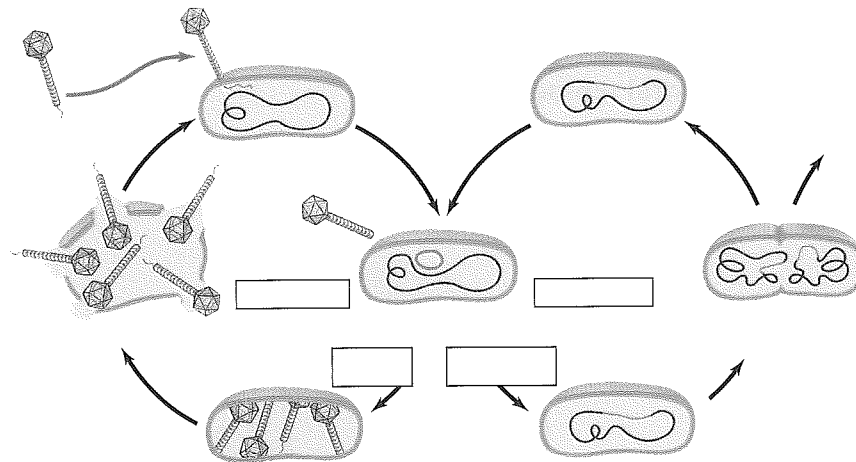
It is important to realize that many viruses have an RNA genome and therefore a high rate of mutation. Earlier you learned about the mechanisms of DNA repair that minimize mutation rates, but RNA replication lacks these repair enzymes. EK 3.C.3 deals with virus replication.

14. On this figure of a simplified viral reproductive cycle, label the arrows to show these processes: *transcription*, *translation*, *infection*, *replication*, and *self-assembly*. Annotate your labels to explain the process of viral reproduction.



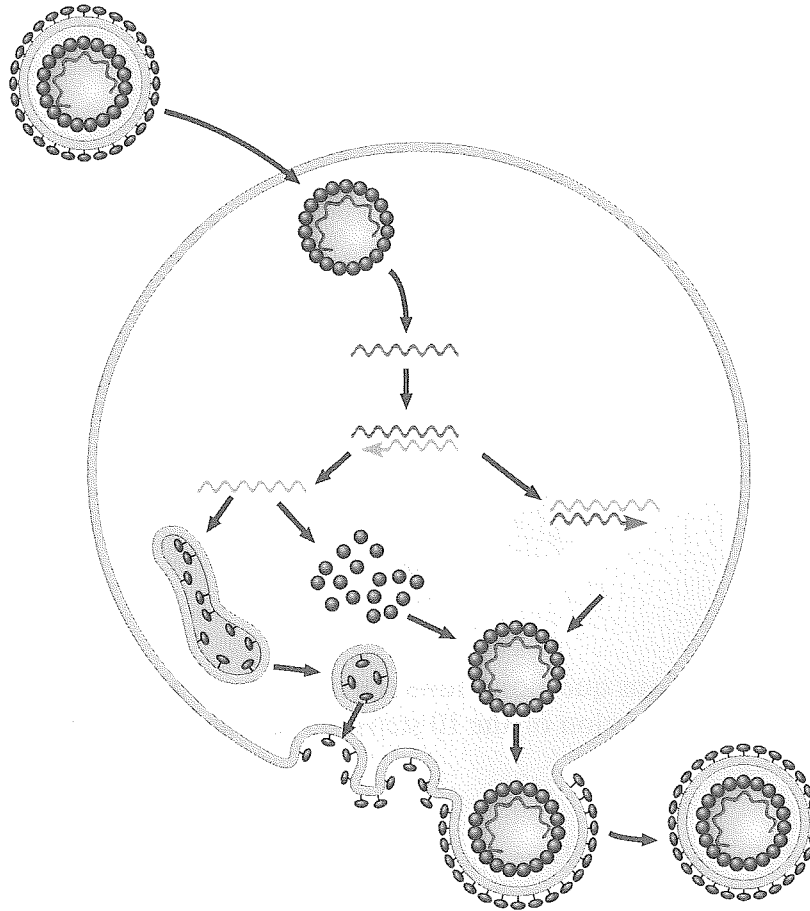
15. What are *bacteriophages*? Distinguish between *virulent* and *temperate* phages.
16. What portion of a phage enters the host cell? How does it do this?
17. What are *restriction enzymes*? How do they help prevent viral infections of bacteria?
18. Why don't restriction enzymes destroy the DNA of the bacterial cells that produce them?
19. What are three ways bacteria may win the battle against the phages?
20. What is a *prophage*?

21. Because cells that have incorporated phage DNA into their genome may continue to divide and propagate the viral genome, this might be considered somewhat like the Trojan horse. What might trigger the switchover from *lysogenic* to *lytic* mode?
22. Label these elements of the following figure: *lysogenic phage*, *lysogenic cycle*, *lytic cycle*, *prophage*, *phage DNA*, *bacterial chromosome*, and *self-assembly*.



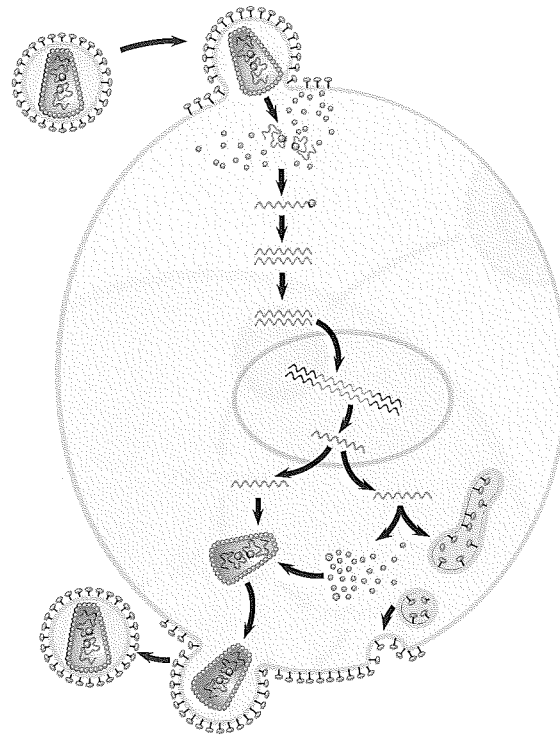
23. Describe the *lytic* and *lysogenic* modes of bacteriophage reproduction.
24. What are two elements that nearly all animal viruses have?

25. The infection of an animal cell by an RNA virus with an envelope is shown in the figure (Figure 19.7). In this viral infection the RNA genome serves as a template for mRNA synthesis. This is the pattern of infection for hepatitis C, SARS, rubella, and many others. On the figure, place label lines and summarize the eight steps of infection.



26. What is a *retrovirus*? How do retroviruses, such as HIV, replicate their genome?

27. Here is a sketch of HIV. Label these parts: *envelope*, *reverse transcriptase*, *RNA*, and *capsid*.



28. The sketch in the previous question shows the infection of a cell by HIV. Extend the label lines to give a complete explanation of the 10 steps to the infectious process. Refer to Figure 19.8 in your text for details.
29. Compare and contrast a *prophage* and a *provirus*. Which one are *you* likely to carry?
30. The final section in Concept 19.2 is titled “Evolution of Viruses.” From this part, describe the two possible sources of viral genomes. You will see each of these important *mobile genetic elements* again.

	Description of the Mobile Genetic Element
Plasmids	
Transposons	

Concept 19.3 Viruses, viroids, and prions are formidable pathogens in animals and plants

31. What are three ways that viruses make us ill? Why do we recover completely from a cold but not from polio?
32. What tools are in the medical arsenal against human viral diseases?
33. The 2009 flu *pandemic* was caused by *H1N1*. What is a pandemic? What does the name of the flu mean?
34. *Emerging viruses* such as HIV, Ebola, and SARS seem to burst upon the human scene. Explain the three processes that contribute to the sudden emergence of viruses.
 - a.
 - b.
 - c.
35. How do viruses spread throughout plant bodies?
36. What is a *viroid*? What important lesson do they teach? Name one *viroid* disease.
37. *Prions* strike fear into carnivores everywhere. What are they? How are they transmitted? What do they do?
38. Name four diseases caused by prions and two possible neurodegenerative diseases that may involve prions.
39. What are two alarming characteristics of prions?

Test Your Understanding Answers

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

1. _____ 2. _____ 3. _____ 4. _____ 5. _____