



Name

Period

Date

SECTION
9.1

MANIPULATING DNA
Study Guide

KEY CONCEPT

Biotechnology relies on cutting DNA at specific places.

VOCABULARY

restriction enzyme
gel electrophoresis

restriction map

MAIN IDEA: Scientists use several techniques to manipulate DNA.

- 1. List five ways in which scientists study and manipulate DNA.

MAIN IDEA: Restriction enzymes cut DNA.

- 2. What is a restriction enzyme?

- 3. What is the nucleotide sequence at which a restriction enzyme cuts DNA called?

- 4. Why would different restriction enzymes cut the same DNA molecule into different numbers of fragments?

In the space provided below, draw two sketches. Show what happens when a restriction enzyme leaves “blunt ends,” and show what happens when a restriction enzyme leaves “sticky ends.” Label the restriction sites in each sketch.

| | |
|-------------------|--------------------|
| Blunt Ends | Sticky Ends |
|-------------------|--------------------|

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STUDY GUIDE, CONTINUED

MAIN IDEA: Restriction maps show the lengths of DNA fragments.

5. After DNA is cut with a restriction enzyme, how is the mixture of DNA fragments sorted?

6. How does gel electrophoresis work?

7. How do different fragments of DNA show up on a gel?

8. What information does a restriction map give about DNA? What information is not given by a restriction map?

9. How are restriction maps used?

Vocabulary Check

10. How does a restriction enzyme limit, or restrict, the effect of a virus on a bacterial cell?

11. The prefix *electro-* means “electricity.” The suffix *-phoresis* comes from a Greek word that means “carrying.” How do these two meanings relate to what happens in gel electrophoresis?

SECTION
9.2

COPYING DNA
Study Guide

KEY CONCEPT

The polymerase chain reaction rapidly copies segments of DNA.

VOCABULARY

polymerase chain reaction (PCR)
primer

MAIN IDEA: PCR uses polymerases to copy DNA segments.

1. What is PCR?

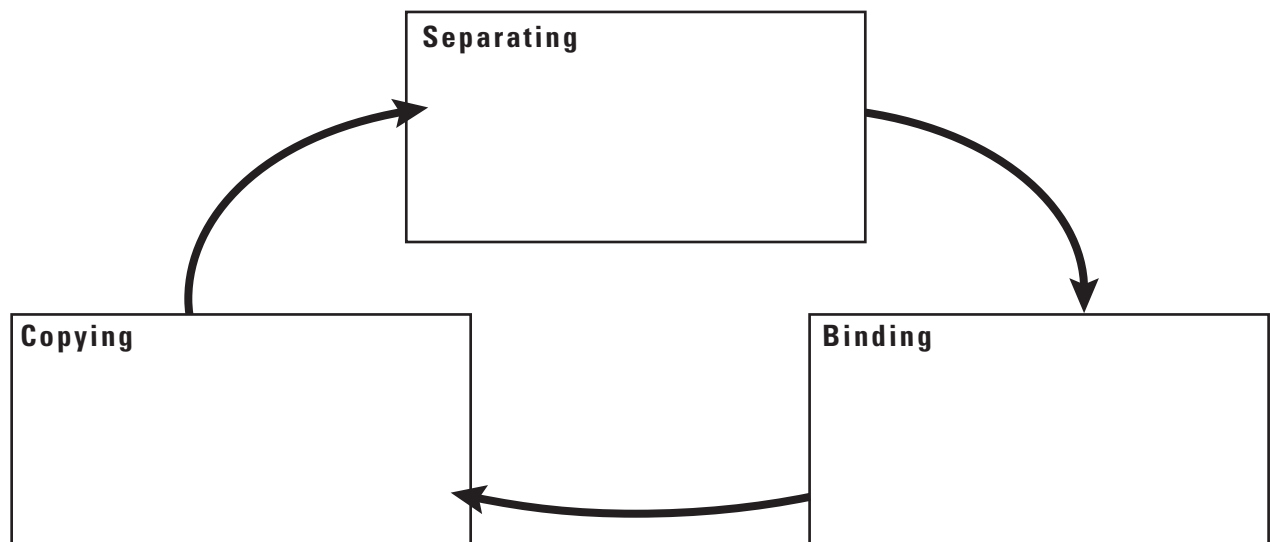
2. Why is PCR useful?

MAIN IDEA: PCR is a three-step process.

3. What four materials are needed for PCR?

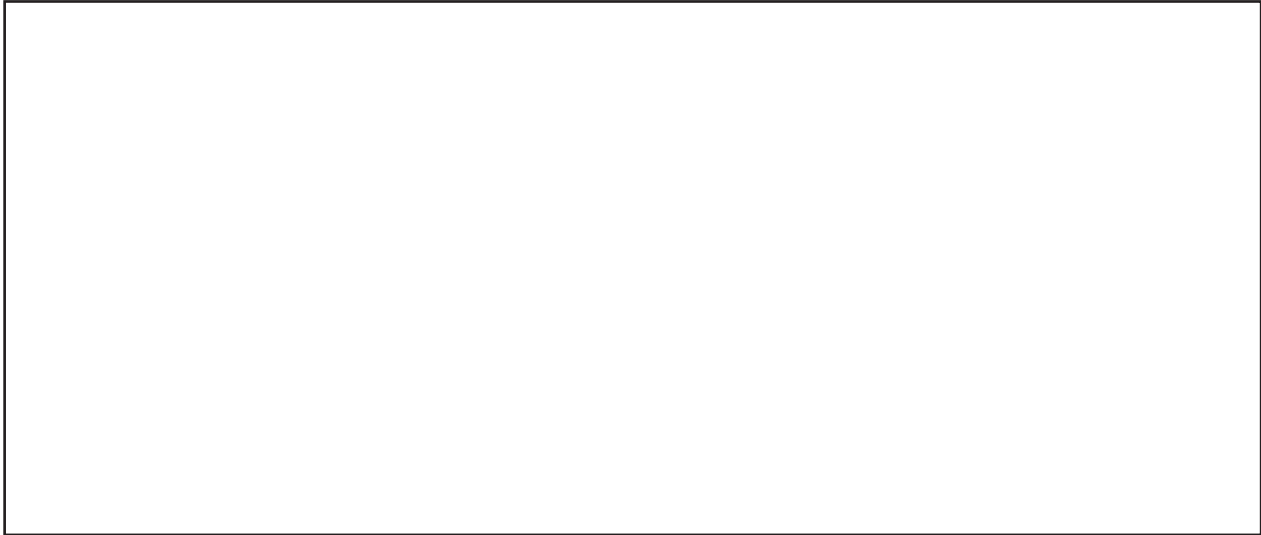
4. Why are primers needed in the PCR process?

Sketch and label the PCR process in the cycle below.



STUDY GUIDE, CONTINUED

Sketch how the amount of DNA changes during five PCR cycles.

**Vocabulary Check**

5. DNA polymerase is an enzyme that helps put DNA molecules together. A chain reaction is a process in which one event leads to the next event and the effect is stronger over time. How does the combination of these two terms describe what happens during PCR?

6. The verb *to prime* means “to prepare.” How does this meaning tell you what a primer does in PCR?



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SECTION
9.3

DNA FINGERPRINTING
Study Guide

KEY CONCEPT

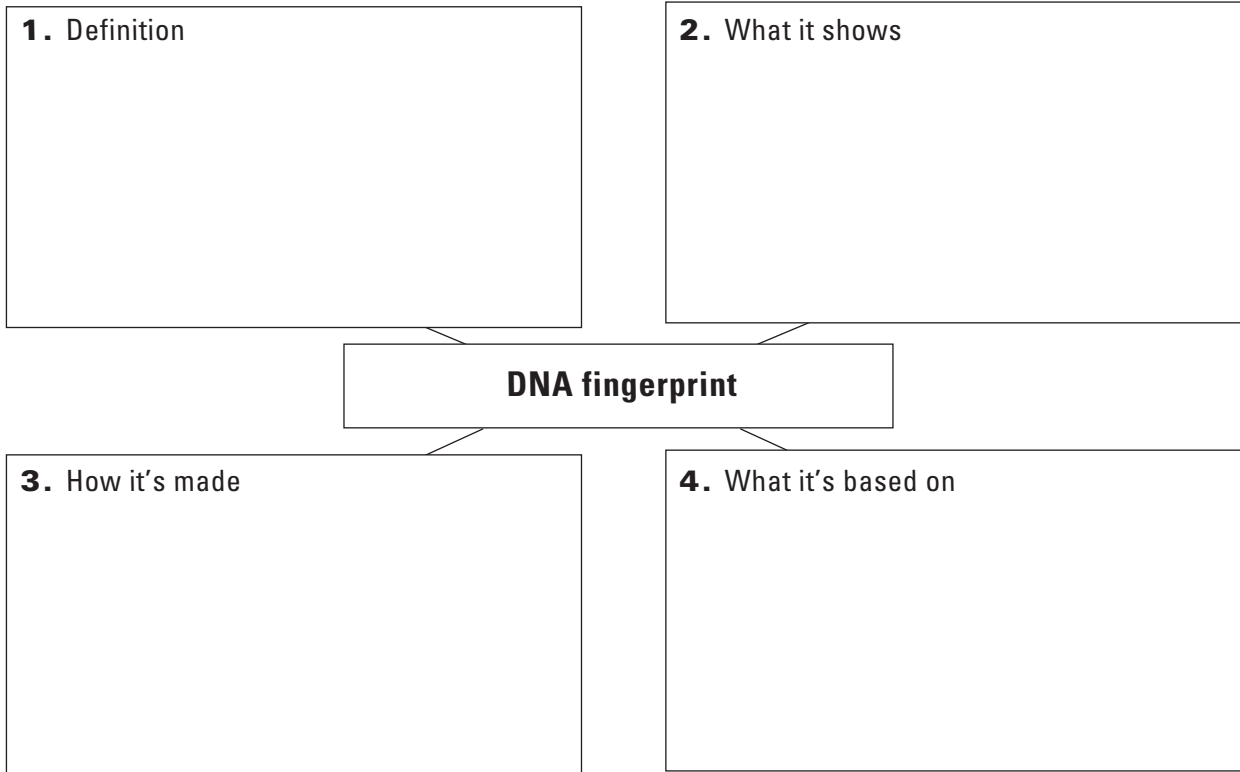
DNA fingerprints identify people at the molecular level.

VOCABULARY

DNA fingerprint

MAIN IDEA: A DNA fingerprint is a type of restriction map.

Take notes on DNA fingerprinting by filling in the main idea web below.



5. How is a DNA fingerprint a specific type of restriction map?

STUDY GUIDE, CONTINUED

MAIN IDEA: DNA fingerprinting is used for identification.

6. How does identification through DNA fingerprinting depend on probability?

7. The chance that two people have four repeats in location A is 1 in 100. The chance that two people have eight repeats in location B is 1 in 50. The probability that two people have three repeats in location C is 1 in 200. What is the probability that two people would have matching DNA fingerprints for these three locations by chance?

8. Why does using more regions of the genome decrease the probability that two people would have the same DNA fingerprint?

9. List two ways in which DNA fingerprinting is used for identification.

Vocabulary Check

10. One definition of the term *fingerprint* is “a distinctive mark or characteristic.” How does this meaning relate to a DNA fingerprint?



SECTION
9.4

GENETIC ENGINEERING
Study Guide

KEY CONCEPT

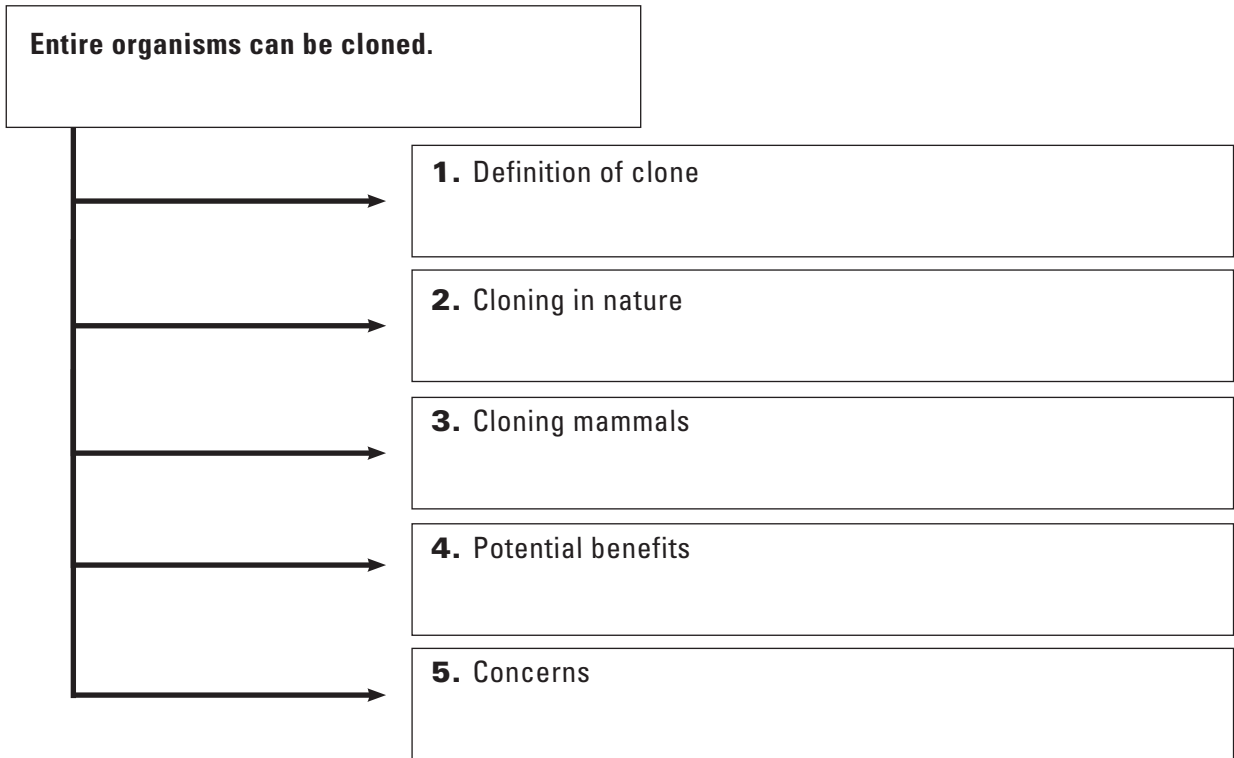
DNA sequences of organisms can be changed.

VOCABULARY

| | | |
|---------------------|-----------------|---------------|
| clone | recombinant DNA | transgenic |
| genetic engineering | plasmid | gene knockout |

MAIN IDEA: Entire organisms can be cloned.

Fill in the chart below to take notes about cloning.



MAIN IDEA: New genes can be added to an organism's DNA.

6. What is genetic engineering?

7. What is recombinant DNA?

8. Why are plasmids used to produce bacteria with recombinant DNA?

STUDY GUIDE, CONTINUED

Use the space below to sketch and label the process that scientists use to produce bacteria with recombinant DNA. Use Figure 9.11 to help you with your sketch.

| | | |
|--|--|--|
| | | |
|--|--|--|

MAIN IDEA: Genetic engineering produces organisms with new traits.

9. What is a transgenic organism?

10. Complete the table below to take notes on transgenic bacteria, plants, and animals.

| Type of Organism | Process Used | Example |
|------------------|--------------|---------|
| Bacteria | | |
| Plants | | |
| Animals | | |

Vocabulary Check

11. The term *recombine* means “to combine, or join, again.” How is the meaning of recombine related to the production of recombinant DNA?

12. The prefix *trans-* means “across,” and *genic* means “relating to genes.” How do these two meanings help to explain the meaning of *transgenic*?

SECTION
9.5

GENOMICS AND BIOINFORMATICS

Study Guide

KEY CONCEPT

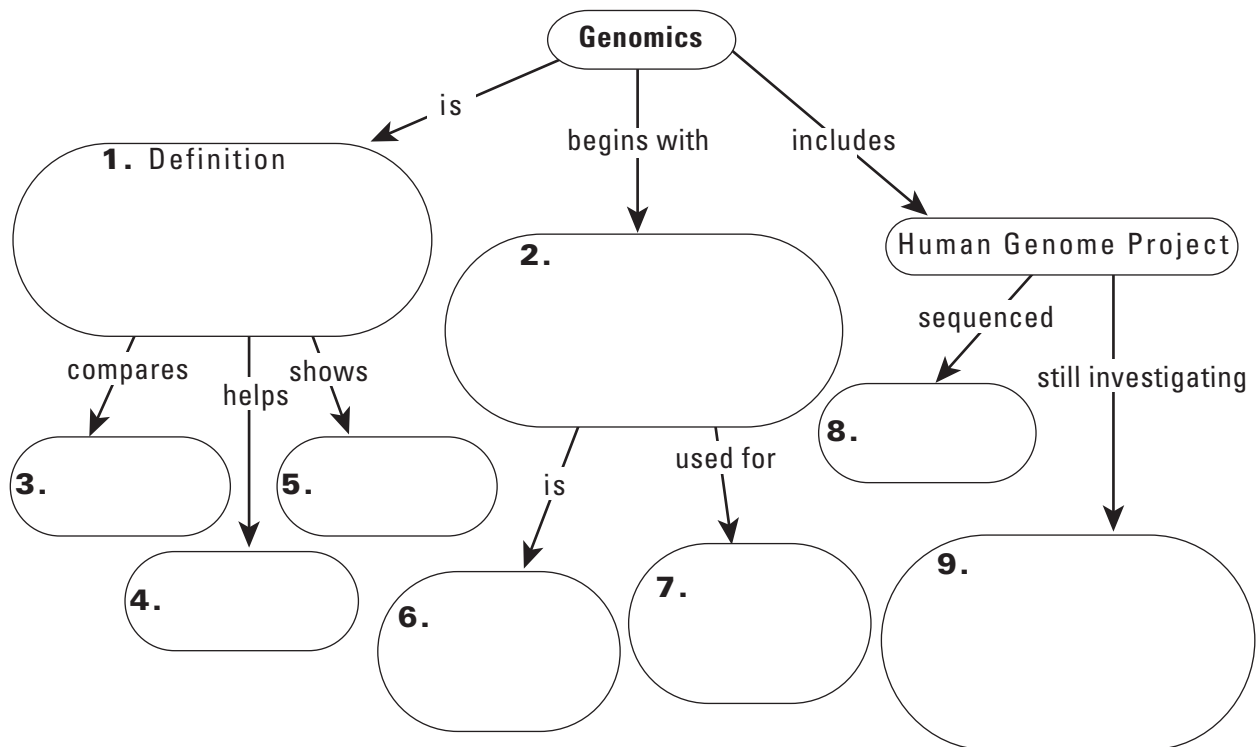
Entire genomes are sequenced, studied, and compared.

VOCABULARY

| | | |
|-----------------|----------------------|----------------|
| genomics | Human Genome Project | DNA microarray |
| gene sequencing | bioinformatics | proteomics |

MAIN IDEA: Genomics involves the study of genes, gene functions, and entire genomes.

Take notes on concepts in genomics by completing the concept map below.



MAIN IDEA: Technology allows the study and comparison of both genes and proteins.

10. What is bioinformatics?

11. Why is bioinformatics important for genomics research?

12. What are DNA microarrays?

STUDY GUIDE, CONTINUED

13. How can DNA microarrays compare gene expression in different cells?

14. What is proteomics?

15. What are some potential benefits and uses of proteomics?

Vocabulary Check

16. The suffix *-ic* means “related to.” A genome is all of an organism’s DNA. A proteome is all of an organism’s proteins. What does this information tell you about genomics, proteomics, and bioinformatics?

17. An *array* is an organized arrangement or a large number of objects. The prefix *micro-* means “small.” How are these meanings related to the definition of a DNA microarray?



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SECTION
9.6

GENETIC SCREENING AND GENE THERAPY

Study Guide

KEY CONCEPT

Genetics provides a basis for new medical treatments.

VOCABULARY

- genetic screening
- gene therapy

MAIN IDEA: Genetic screening can detect genetic disorders.

1. What is the purpose of genetic screening?

2. How is genetic screening used?

MAIN IDEA: Gene therapy is the replacement of faulty genes.

3. What is the goal of gene therapy?

4. What are two technical challenges in gene therapy?

5. What is one experimental method for the treatment of cancer?

Vocabulary Check

6. The verb *to screen* means “to examine.” Explain how this meaning is related to genetic screening.

7. What is gene therapy?

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STUDY GUIDE, CONTINUED

Advertise or Fight Against Genetic Screening

Choose one of the two following situations.

1. Suppose you work for a company that does genetic screening. Draw and write a one-page advertisement that explains genetic screening and what it both can and cannot do.
2. Suppose you are a spokesperson for a group that is against genetic screening. Draw and write a one-page advertisement that focuses on the ethical questions surrounding genetic screening.

