

Chapter 13**Genetic Engineering****Section 13–1 Changing the Living World (pages 319–321)**

This section explains how people use selective breeding and mutations to develop organisms with desirable characteristics.

Selective Breeding (pages 319–320)

- What is meant by selective breeding? _____

- Circle the letter of each organism that has been produced by selective breeding.
a. horses b. dogs c. cats d. potatoes
- Who was Luther Burbank? _____

- Complete the compare-and-contrast table of types of selective breeding.

SELECTIVE BREEDING

Type	Description	Examples
	Crossing dissimilar individuals to bring together the best of both organisms	
	The continued breeding of individuals with similar characteristics	

- Is the following sentence true or false? Hybrids are often hardier than either of the parents. _____.
- What two plant traits did Luther Burbank try to combine in his crosses?
a. _____
b. _____
- Is the following sentence true or false? To maintain the desired characteristics of a line of organisms, breeders often use hybridization. _____
- Most members of a breed are genetically _____.
- What are the risks of inbreeding? _____

Chapter 13, Genetic Engineering *(continued)*

Increasing Variation (pages 320–321)

10. Why are biologists interested in preserving the diversity of plants and animals in the wild? _____

11. Is the following sentence true or false? The genetic variation that exists in nature is enough to satisfy the needs of breeders.

12. Breeders can increase the genetic variation by inducing _____, which are the ultimate source of genetic variability.
13. Circle the letter of an inheritable change in DNA.
 a. variation b. trait c. mutation d. genotype
14. Is the following sentence true or false? Mutations cannot occur spontaneously. _____
15. Name two methods used by breeders to increase the rate of mutation.
 a. _____ b. _____
16. Is it easy for breeders to produce mutants with desirable mutations? Explain. _____

17. Why are radiation and chemicals useful techniques for producing mutant bacteria? _____

18. Is the following sentence true or false? Scientists have produced bacteria that can digest oil. _____
19. What technique do scientists use to produce mutant plants? _____

20. Circle the letter of each sentence that is true about polyploidy.
 a. Polyploid plants have many sets of chromosomes.
 b. Polyploidy is usually fatal in animals.
 c. Polyploidy produces new species of plants that are weaker and smaller than their diploid relatives.
 d. Bananas and some citrus fruits are polyploid.

Section 13–2 Manipulating DNA (pages 322–326)

This section describes the various techniques used by molecular biologists to study and change DNA molecules.

The Tools of Molecular Biology (pages 322–323)

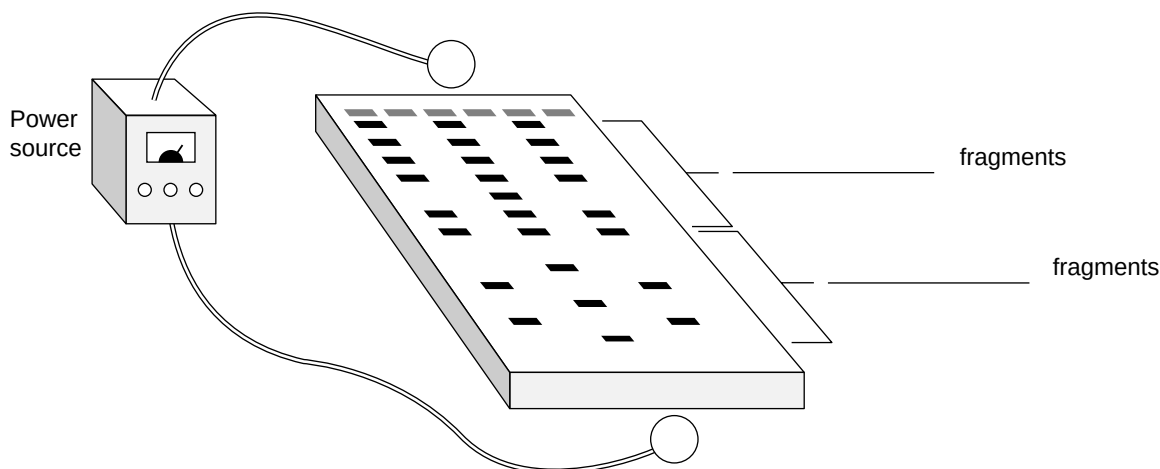
1. What is genetic engineering? _____

2. Is the following sentence true or false? Making changes to the DNA code is similar to changing the code of a computer program.

3. Scientists use their knowledge of the _____ of DNA and its _____ properties to study and change DNA molecules.
4. List four different techniques that molecular biologists use to study and change DNA molecules.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
5. Explain how biologists get DNA out of a cell. _____

6. Biologists use _____ to cut DNA molecules at a specific sequence of nucleotides to make smaller fragments.
7. Circle the letter of the process by which DNA fragments are separated and analyzed.

a. gel electrophoresis	c. transformation
b. extraction	d. restriction
8. In the diagram below, label the positive and negative ends of the gel and identify the location of longer and shorter fragments.

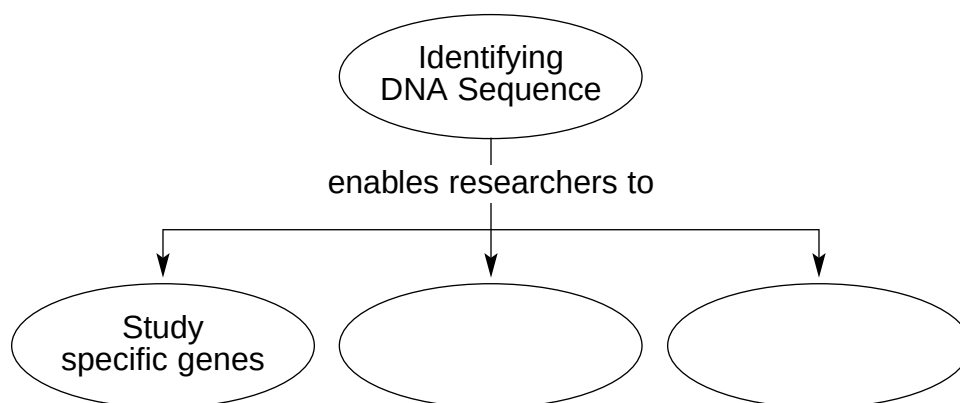


Chapter 13, Genetic Engineering *(continued)*

9. Circle the letter of each sentence that is true about gel electrophoresis.
 - a. An electric voltage applied to the gel separates the DNA fragments.
 - b. DNA molecules are positively charged.
 - c. Gel electrophoresis is used to compare the genomes of different organisms.
 - d. Gel electrophoresis can be used to locate and identify one particular gene in an individual's genome.

Using the DNA Sequence *(pages 323–326)*

10. Complete the concept map to show how researchers use the DNA sequence of an organism.



11. List four “ingredients” added to a test tube to produce tagged DNA fragments that can be used to read a sequence of DNA.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
12. What does the reaction in the test tube generate when complimentary DNA is made for reading DNA? _____

13. Is the following sentence true or false? The pattern of colored bands on a gel tells the exact sequence of bases in DNA.

14. Enzymes that splice DNA together can also be used to join _____ DNA sequences to natural DNA sequences.
15. How is recombinant DNA produced? _____

16. What is polymerase chain reaction? _____

17. What is the role of the primers in PCR? _____

18. Circle the letter of the first step in the polymerase chain reaction.
 - a. The copies become templates to make more copies.
 - b. The DNA is cooled to allow the primers to bind to the single-stranded DNA.
 - c. The DNA is heated to separate its two strands.
 - d. DNA polymerase makes copies of the region between the primers.

Section 13–3 Cell Transformation (pages 327–329)

This section tells what happens during cell transformation. It also describes techniques used to determine if transformation has been successful.

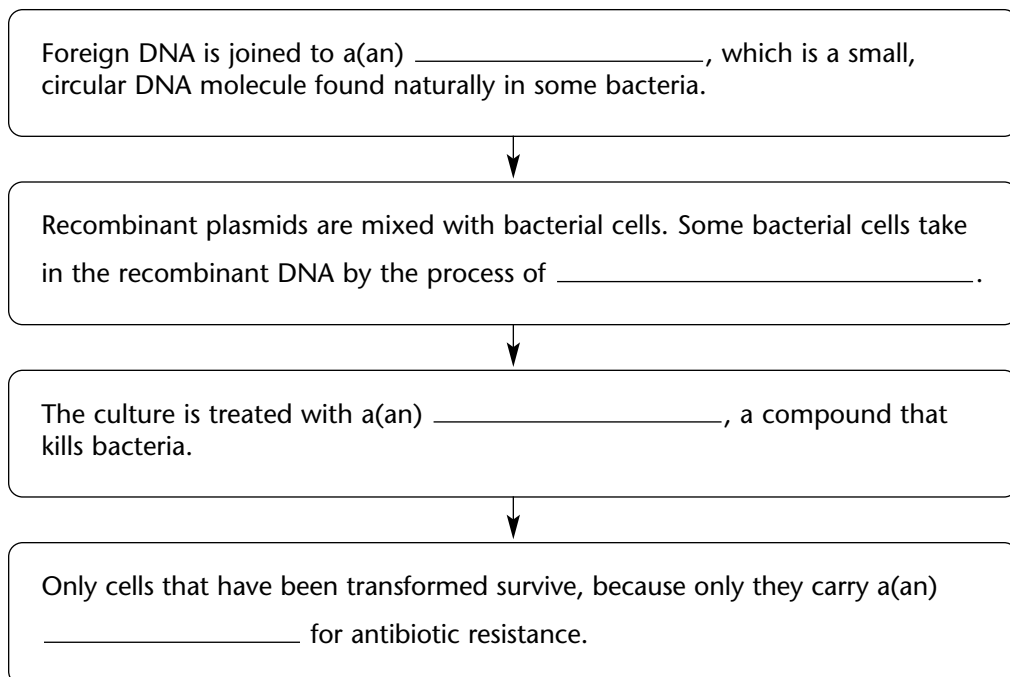
Introduction (page 327)

1. What occurs during transformation? _____

2. Is the following sentence true or false? Griffith's extract of heat-killed bacteria contained DNA fragments. _____

Transforming Bacteria (pages 327–328)

3. Complete the flowchart to show the steps in transforming bacteria.



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4. Give two reasons why a plasmid is useful for DNA transfer.

- a. _____

- b. _____

Transforming Plant Cells (pages 328–329)

5. Circle the letter of each sentence that is true about transforming plant cells.

- a. Many plant cells can be transformed by using a bacterium that will, in nature, insert a tumor-producing plasmid into plant cells.
- b. Sometimes plant cells in culture will take up DNA on their own when their cell walls are removed.
- c. It is impossible to inject DNA directly into plant cells.
- d. Plant cells that are transformed cannot develop into adult plants.
6. When researchers transform plant cells using a bacterium that causes plant tumors, how do researchers prevent plant tumors from forming in the transformed cells? _____

7. Describe what occurs in a successful transformation of cells. _____

Transforming Animal Cells (page 329)

8. Describe how animal cells can be transformed by directly injecting DNA. _____

9. Is the following sentence true or false? The DNA molecules used for transformation of animal cells do not require marker genes.

10. How is a DNA molecule constructed so that it will “knock out” a particular gene? _____

11. Is the following sentence true or false? Gene replacement has made it possible to identify the specific functions of genes in many organisms. _____

Reading Skill Practice

When you read about related concepts, a compare-and-contrast table can help you focus on their similarities and differences. Construct a table to compare and contrast transformation in bacteria, plants, and animals. Look in Appendix A for more information about compare-and-contrast tables. Do your work on a separate sheet of paper.

Section 13–4 Applications of Genetic Engineering (pages 331–333)

This section explains how transgenic organisms are made. It also describes what a clone is and how animal clones are produced.

Introduction (page 331)

1. How do scientists know that plants and animals share the same basic mechanisms of gene expression? _____

Transgenic Organisms (pages 331–333)

2. What is a transgenic organism? _____

3. Describe how to make a transgenic organism. _____

4. Genetic engineering has spurred the growth of _____, a new industry that is changing the way we interact with the living world.
5. Circle the letter of each sentence that is true about transgenic microorganisms.
 - a. Transgenic bacteria will never produce useful substances for health and industry.
 - b. Transgenic bacteria produce human proteins cheaply and in great abundance.
 - c. People with insulin-dependent diabetes are now treated with pure human insulin.
 - d. In the future, transgenic organisms may produce the raw materials for plastics.
6. Is the following sentence true or false? Researchers are working on developing transgenic chickens that will be resistant to bacterial infections that sometimes cause food poisoning.

Chapter 13, Genetic Engineering *(continued)*

7. List four ways in which transgenic animals have been used.

- a. _____
- b. _____
- c. _____
- d. _____

8. Many transgenic plants contain genes that produce a natural _____, so the crops do not have to be sprayed with pesticides.

9. Circle the letter of each item that might soon be produced by transgenic plants.

- | | |
|---------------------|----------------------------|
| a. human antibodies | c. rot-resistant foods |
| b. plastics | d. vitamin A-enriched rice |

Cloning *(page 333)*

10. What is a clone? _____

11. Is the following sentence true or false? For years, many scientists thought that that it was impossible to clone bacteria.

12. Complete the sentences in the diagram below to show the steps in cloning a sheep.

