

## Chapter 13 Study Guide

### Study Tip

Have students develop a crossword puzzle, word search, or other word puzzle that incorporates the Vocabulary terms and some of the Key Concepts. Students can exchange their puzzles and solve them.

### Thinking Visually

1. Selective Breeding
2. Genetic Engineering
3. Hybridization

## Chapter 13 Assessment

### Reviewing Content

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

### Understanding Concepts

11. Hybridization: cross dissimilar organisms; inbreeding: breed similar organisms; both involve selecting to breed organisms with the desired characteristics.
12. By inducing mutations with chemicals or radiation
13. The condition in which cells have many sets of chromosomes; it may instantly produce new plant species that are larger and stronger.
14. Both have codes that can be isolated and altered to change the characteristics of the game or the organism.
15. With restriction enzymes that recognize and cut specific nucleotide sequences of DNA
16. Gel electrophoresis enables scientists to separate and analyze DNA fragments, to compare genomes of different individuals and organisms, and to identify a specific gene.
17. A DNA molecule produced by combining DNA from other sources

## Chapter 13 Study Guide

### 13-1 Changing the Living World

#### Key Concepts

- Humans use selective breeding, which takes advantage of naturally occurring genetic variation in plants, animals, and other organisms, to pass desired traits on to the next generation of organisms.
- Breeders can increase the genetic variation in a population by inducing mutations, which are the ultimate source of genetic variability.

#### Vocabulary

selective breeding, p. 319  
hybridization, p. 319  
inbreeding, p. 320

### 13-2 Manipulating DNA

#### Key Concept

- Scientists use their knowledge of the structure of DNA and its chemical properties to study and change DNA molecules. Different techniques are used to extract DNA from cells, to cut DNA into smaller pieces, to identify the sequence of bases in a DNA molecule, and to make unlimited copies of DNA.

#### Vocabulary

genetic engineering, p. 322  
restriction enzyme, p. 323  
gel electrophoresis, p. 323  
recombinant DNA, p. 324  
polymerase chain reaction (PCR), p. 325

### 13-3 Cell Transformation

#### Key Concepts

- During transformation, a cell takes in DNA from outside the cell. This external DNA becomes a component of the cell's DNA.
- If transformation is successful, the recombinant DNA is integrated into one of the chromosomes of the cell.

#### Vocabulary

plasmid, p. 327  
genetic marker, p. 328



### 13-4 Applications of Genetic Engineering

#### Key Concept

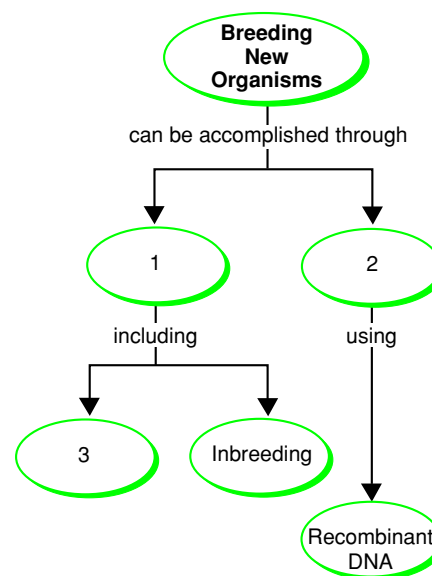
- Genetic engineering has spurred the growth of biotechnology, which is a new industry that is changing the way we interact with the living world.

#### Vocabulary

transgenic, p. 331  
clone, p. 333

### Thinking Visually

Using the information in this chapter, complete the following concept map.



## CHAPTER RESOURCES

#### Print:

- **Teaching Resources**, Chapter Vocabulary Review, Graphic Organizer
- **Chapter Tests**: Levels A and B, Chapter 13 Test

#### Technology:

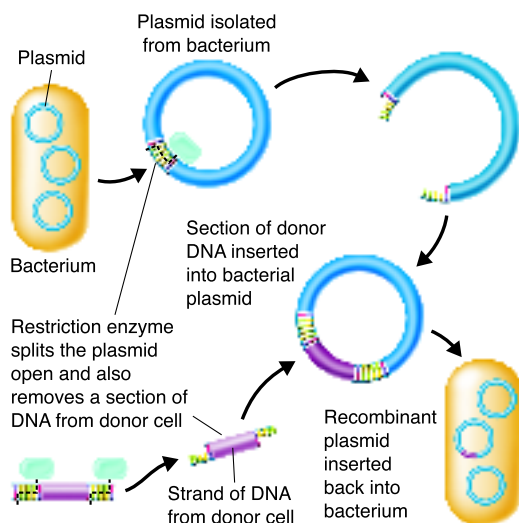
- **iText**, Chapter 13 Assessment
- **Computer Test Bank**, Chapter 13 Test

## Chapter 13 Assessment

### Reviewing Content

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

- A cross between dissimilar individuals to bring together their best characteristics is called  
a. genetic engineering. c. hybridization.  
b. inbreeding. d. sequencing.
- Crossing individuals with similar characteristics so that those characteristics will appear in the offspring is called  
a. inbreeding. c. hybridization.  
b. electrophoresis. d. genetic engineering.
- Varieties of purebred dogs are maintained by  
a. selective breeding. c. inbreeding.  
b. hybridization. d. genetic engineering.
- Changing the DNA of an organism is called  
a. genetic engineering.  
b. hybridization.  
c. selective breeding.  
d. inbreeding.
- DNA can be cut into shorter sequences by proteins known as  
a. restriction enzymes.  
b. plasmids.  
c. mutagens.  
d. clones.
- What has been produced in the drawing below?  
a. a clone c. a genome  
b. recombinant DNA d. a species



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- When cell transformation is successful, the recombinant DNA  
a. undergoes mutation.  
b. is treated with antibiotics.  
c. becomes part of the transformed cell's genome.  
d. becomes a nucleus.
- Bacteria often contain small circular molecules of DNA known as  
a. clones. c. plasmids.  
b. restriction enzymes. d. hybrids.
- Organisms that contain genes from other organisms are called  
a. transgenic. c. donor organisms.  
b. mutagenic. d. cloned organisms.
- A member of a population of genetically identical cells produced from a single cell is a  
a. clone. c. mutant.  
b. plasmid. d. sequence.

### Understanding Concepts

- Compare hybridization and inbreeding. Why are they considered forms of selective breeding?
- How do breeders produce new genetic variations not found in nature?
- What is polyploidy? When is this condition useful?
- Explain why genetic engineering can be compared to reprogramming a computer game.
- How are large DNA molecules cut up?
- What role does gel electrophoresis play in the study of DNA?
- What is recombinant DNA?
- Describe what occurs during a polymerase chain reaction (PCR).
- What happens during cell transformation? What are some types of cells that have been transformed?
- Explain what genetic markers are, and describe how scientists use them.
- What did the successful transfer of the luciferase gene from an animal to a plant indicate about the functioning of genes?
- What is a transgenic organism? Explain how transgenic bacteria have been useful.
- How did Ian Wilmut clone the sheep known as Dolly?
- Explain how a transgenic plant differs from a hybrid plant.



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### (Continued from page 336)

18. A short piece of complementary DNA—a primer—is added to both ends of the DNA fragment to be copied. The DNA is heated to separate the two strands, and then cooled. DNA polymerase makes copies of the region between the two primer sequences. The copies also serve as templates to make more copies.

19. A cell takes in DNA from outside the cell, and the external DNA becomes a part of the cell's DNA. Bacteria and plant and animal cells are types of cells that have been transformed.

20. Genetic markers make it possible to distinguish bacteria that carry plasmids and foreign DNA from those that do not; genetic markers are inserted into plasmids so that scientists can identify transformed bacteria.

21. That the basic mechanisms for gene expression are shared by plants and animals

22. An organism that contains genes from other organisms; produce important substances for health and industry

23. Ian Wilmut removed the nucleus of an egg cell and replaced it with a nucleus taken from a cell from another adult. This egg was then placed in the reproductive system of a foster mother, where it developed normally.

24. A transgenic plant contains DNA from another organism via genetic engineering. A hybrid plant contains DNA only from both parents via fertilization.



### HOMEWORK GUIDE

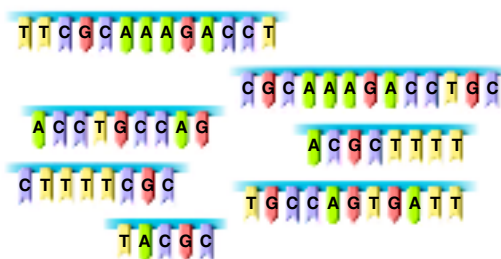
Section:	Questions:
Section 13-1	1-3, 11-13, 27
Section 13-2	4, 5, 14-18, 28
Section 13-3	6-8, 19, 20, 30
Section 13-4	9, 10, 21-26, 29, 31-35

## Critical Thinking

25. They can be produced relatively inexpensively in large quantities; they are the actual human protein; and they are pure.
26. No, the change involves body (somatic) cells, not germ cells.
27. Answers should involve crossing the different varieties of roses and selecting the offspring with the desired traits for further crosses. For example: cross the pink and yellow roses until a thornless plant with sweet-smelling flowers is obtained. Cross this plant with purple roses until thornless plants with sweet-smelling purple flowers are obtained. Inbreed these plants until the traits breed true.
28. T-A-C-G-C-T-T-T-C-G-C-A-A-A-G-A-C-C-T-G-C-C-A-G-T-G-A-T-T
29. Breeding techniques require little technology and take much time. It is also difficult to achieve the desired combination of traits. Genetic engineering requires extensive training and expensive equipment. Specific combinations of traits can be made, and traits from organisms that cannot be crossed naturally can be combined.
30. DNA from one organism can be inserted into another, and the gene is successfully expressed to produce the same protein.
31. The blood proteins that people need could be produced by bacteria that have been transformed with the human gene that encodes the needed protein.
32. Sample answers: Transgenic microorganisms might produce substances designed to fight cancer, as well as the raw materials for plastics and synthetic fibers. Transgenic animals might provide humans with sources of human proteins. Transgenic plants might produce human antibodies that can be used to fight disease, foods that are resistant to spoilage, and foods that contain extra vitamins.
33. All DNA contains the same four nucleotides and is translated by the same mechanism and genetic code, so the DNA from a bacterium could be used to make a human protein.
34. Students should disagree. Possible explanations include: too

## Critical Thinking

25. **Applying Concepts** Describe one or more advantages of producing needed proteins such as insulin through genetic engineering.
26. **Inferring** If a human patient's bone marrow cells were removed, altered genetically, and reimplanted, would the change be passed on to the patient's children? Explain your answer.
27. **Problem Solving** Suppose a plant breeder has a thornless rose bush with scentless pink flowers, a thorny rose bush with sweet-smelling yellow flowers, and a thorny rose bush with scentless purple flowers. How might the plant breeder develop a purebred variety of thornless sweet-smelling purple roses?
28. **Problem Solving** The following fragments were obtained when a gene that consists of ten codons was cut by restriction enzymes. What is the sequence of bases in the gene? (*Hint*: Look for overlapping sections on the fragments.)



29. **Comparing and Contrasting** Compare the advantages and disadvantages of breeding techniques and genetic engineering.
30. **Formulating Hypotheses** Almost every organism has DNA that is made of the same four nucleotides and translated by the same genetic code. Explain why this fact is significant in cell transformation.
31. **Inferring** Some people need blood transfusions because their blood lacks important proteins, such as those needed for blood clotting. People who receive blood transfusions have some risk of being exposed to disease-causing viruses. How might genetic engineering eliminate this risk?
32. **Predicting** Predict three ways in which you think genetically engineered organisms will be used in the future.

33. **Applying Concepts** Bacteria and human beings are very different organisms. Why is it sometimes possible to combine their DNA and use a bacterium to make a human protein?
34. **Applying Concepts** Your friend proposes that with the techniques of genetic engineering, biologists should be able to produce an organism with any combination of characteristics. For example, they could create an animal with the body of a frog and the wings of a bat. Do you think this is a reasonable proposal? Explain your answer.
35. **Connecting Concepts** In Chapter 12, you learned how DNA and RNA molecules specify the traits of an organism. Use this knowledge to illustrate how, at the molecular level, the DNA and RNA of a transgenic tobacco plant produce the trait of glowing in the dark.

## Writing in Science

Your local newspaper has published an editorial against the use of genetic engineering. The editorial states that genetic engineering is still too new to use, while traditional selective breeding can accomplish anything that genetic engineering can do. Write a letter to the newspaper either in support of the newspaper's position or against it. (*Hint*: Use actual examples of genetic engineering to make your points.)

## Performance-Based Assessment

**Design a Procedure** Insulin is a protein that enables body cells to take in glucose from the blood. People with one type of diabetes do not produce enough insulin, so their cells cannot take in glucose. Devise a procedure for transforming bacterial cells so that they produce human insulin, which can then be used to treat people with diabetes. Describe and illustrate the procedure for transforming the bacteria.

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many genetic differences exist between frogs and bats; it is too difficult to control the expression of so many genes in such a specific location.

35. The luciferase gene became a part of the plant's DNA molecule. When the DNA in the region of the inserted gene was transcribed into RNA, the inserted gene was also transcribed. This mRNA sequence was translated by the ribosomes to produce the protein responsible for producing the trait of glowing in the dark.