

9.4 Genetic Engineering

KEY CONCEPT DNA sequences of organisms can be changed.

Student text pages
275–279

Entire organisms can be cloned.

A clone is a genetically identical copy of a gene or organism. Cloning is quite common in some organisms. For example, many plants can clone themselves from their roots. Bacteria make clones of themselves when they reproduce by dividing in two.

Mammals cannot clone themselves. But scientists have developed a technique to clone mammals in the laboratory. The nucleus of a cell from the animal to be cloned is put into an egg cell that has had its nucleus removed. If the procedure is successful, the egg will develop into a living copy of the original animal.

Although a clone is genetically identical to the original animal, it will likely look different and act different from the original. As you have learned, many factors, including environment, affect the expression of genes. A clone may also not be as healthy as the original animal, possibly because it has “old” DNA.

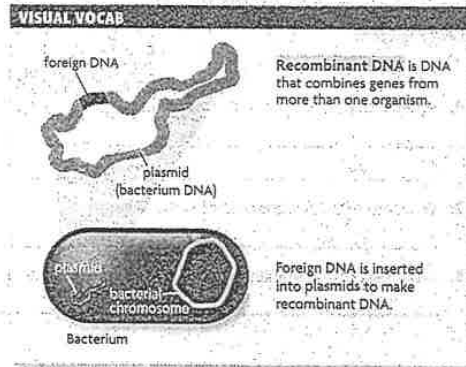
Cloning may be used for different purposes. For example, scientists are studying how to use organs from cloned mammals for transplant into humans.



What is one organism in which cloning is common?

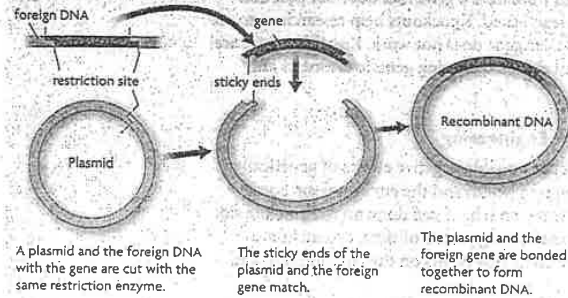
New genes can be added to an organism's DNA.

A copied gene is also called a clone. Scientists can insert a cloned gene from one organism into another organism. This process of changing an organism's DNA to give the organism new traits is called genetic engineering. Genetic engineering uses recombinant DNA (ree-KAHM-buh-nuhnt), or DNA that contains genes from more than one organism. In many cases, foreign DNA is inserted into a plasmid to make recombinant DNA. Plasmids are closed loops of DNA in a bacterial cell.



MAKING RECOMBINANT DNA

Foreign DNA can be inserted into a plasmid to make recombinant DNA.



Because the genetic code is shared by all organisms, a gene from one organism can be transcribed and translated in another organism.



What is the term for a plasmid that contains a foreign gene?

Genetic engineering produces organisms with new traits.

After a gene is added to a plasmid, the recombinant plasmid can be put into bacteria. The bacteria will express the new gene and make that gene's product. The bacteria with the recombinant plasmid are called transgenic. A transgenic organism has one or more genes from another organism inserted into its genome. Transgenic bacteria with the gene for human insulin make human insulin that is used to treat people with diabetes.

Genetic Engineering in Plants and Animals

Scientists have made transgenic plants that have new traits, such as resistance to frost or disease. Some genetically engineered crops, also called genetically modified (GM) crops, are now common in the United States.

Scientists have made some transgenic animals, too. Transgenic mice are often used as models of human development and disease. One type of transgenic mouse is used to study cancer.

VOCABULARY

The prefix *trans-* means “across,” and the root *genic* means “referring to genes.” When genes are transferred across different organisms, transgenic organisms are produced.

Another type of genetic manipulation involves “turning off” a particular gene in an organism. These organisms are called knockouts. For example, **gene knockout** mice have a gene that does not function because the gene has been deactivated. Knockouts help researchers to see what happens when a particular gene does not work. Knockout mice are used to study many different things, including genetic disorders and gene function.

Concerns About Genetic Engineering

There are some concerns about possible negative effects of genetically engineered organisms on human health and the environment. Some scientists think that too little research has been done on the possible side effects of eating GM foods over a long period of time. Scientists also have concerns about the effects of GM plants on the environment and on biodiversity.



What is one example of a transgenic organism?

9.4 Vocabulary Check

clone	plasmid
genetic engineering	transgenic
recombinant DNA	gene knockout

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold**.



Choose the correct term from the list to complete each sentence.

1. An organism with recombinant DNA is called _____.
2. The purposeful disruption of the function of a particular gene in an organism is called a _____.
3. Genetic engineering makes use of a circular piece of bacterial DNA called a _____.

9.4 The Big Picture

4. Bacteria and humans are very different. But recombinant bacteria that have a human gene for insulin can produce human insulin. What characteristic of the genetic code makes it possible for bacteria to make a human protein? _____
5. Imagine that your friend's cat was cloned. Would the clone be exactly like the original cat? Explain your answer. _____

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.

Entire organisms can be cloned.

1. Definition of clone

2. Cloning in nature

3. Cloning mammals

4. Potential benefits

5. Concerns

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?

Name

Period

Date

Section 9.4 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 help you with your sketch.

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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		

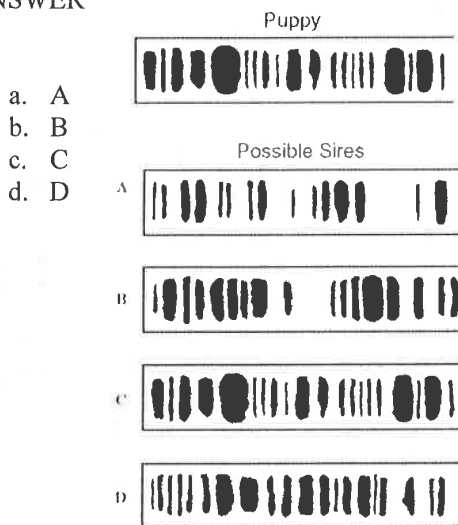
Vocabulary Check

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*?

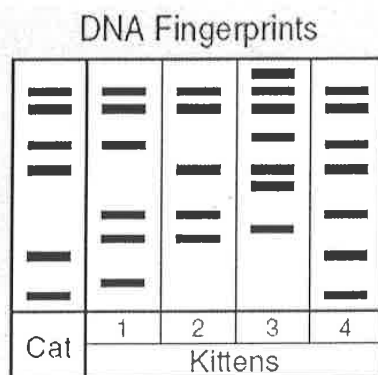
DNA Fingerprinting / worksheet

1. The DNA fingerprints were made from blood samples taken from a puppy and four possible sires of this puppy in an effort to determine the puppy's pedigree. According to this information, which sire was probably the father of this puppy? CIRCLE YOUR ANSWER

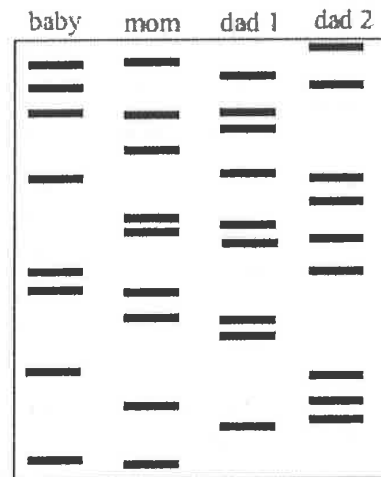


2. The picture shows a segment of DNA from a cat. Which of these is most likely the kitten of this cat? CIRCLE YOUR ANSWER.

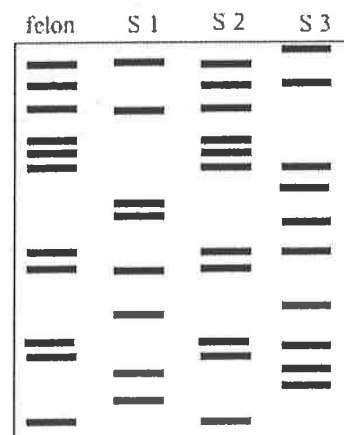
- a. 1
b. 2
c. 3
d. 4



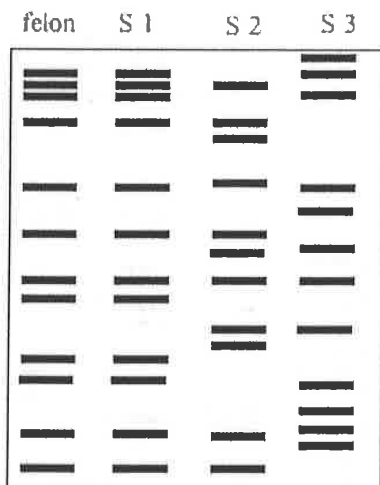
3. Mrs. Smith has a baby named Tyra. She believes one of two men can be the father of her child. A paternity test is done and the results are shown above. Which of the 2 men are baby Tyra's father? _____



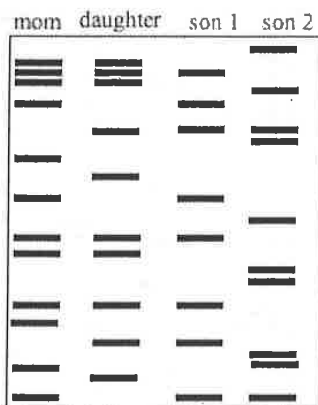
4. Lt. Russ is investigating a murder scene. The felon was scratched by his victim & some of his skin cells were found under the victim's fingernails. A DNA test was performed. Which of the suspects is the murderer? _____



5. Suzy was assaulted in an alley and is a victim of rape. The police collected a sample of sperm that was left at the crime scene and now have 3 suspects in custody. Which of the suspects raped Suzy? _____



6. The millionaire, Mr. Big, has just died. He has left behind a wife, daughter and a large inheritance. The news of his death has brought forth 2 men who claim to be the long lost son of Mr. & Mrs. Big. Before Mr. & Mrs. Big were married they had an illegitimate child and had placed him up for adoption. They had tried to find him after they became wealthy but had no luck in locating him. A DNA sample was taken from Mrs. Big, the Big daughter and the two men who claim to be the long lost son. Which, if any, of the men are telling the truth? _____



7. Mr. & Mrs. Jones just gave birth to fraternal twins- Bob and Jane. Unfortunately, the nurse has confused the Jones twins with 4 other babies. The doctors took samples of DNA from each of the babies and Mr. & Mrs. Jones. Which of the 6 children are Mr. & Mrs. Jones twins? _____

