




15.2 Recombinant DNA

Lesson Objectives

-  Explain how scientists manipulate DNA.
-  Describe the importance of recombinant DNA.
-  Define transgenic and describe the usefulness of some transgenic organisms to humans.

Lesson Summary

Copying DNA Genetic engineers can transfer a gene from one organism to another to achieve a goal, but first, individual genes must be identified and separated from DNA. The original method (used by Douglas Prasher) involved several steps:

- ▶ Determine the amino acid sequence in a protein.
- ▶ Predict the mRNA code for that sequence.
- ▶ Use a complementary base sequence to attract the predicted mRNA.
- ▶ Find the DNA fragment that binds to the mRNA.

Once scientists find a gene, they can use a technique called the **polymerase chain reaction** to make many copies.

- ▶ Heat separates the DNA into two strands.
- ▶ As the DNA cools, primers are added to opposite ends of the strands.
- ▶ DNA polymerase adds nucleotides between the primers, producing two complementary strands. The process can be repeated as many times as needed.

Changing DNA **Recombinant DNA** molecules contain DNA from two different sources. Recombinant-DNA technology can change the genetic composition of living organisms.

- ▶ **Plasmids** are circular DNA molecules found in bacteria and yeasts; they are widely used by scientists studying recombinant DNA, because DNA joined to a plasmid can be replicated.
- ▶ A **genetic marker** is a gene that is used to differentiate a cell that carries a recombinant plasmid from those that do not.

Transgenic Organisms **Transgenic** organisms contain genes from other species. They result from the insertion of recombinant DNA into the genome of the host organism. A **clone** is a member of a population of genetically identical cells.

Copying DNA

For Questions 1–5, complete each statement by writing in the correct word or words.

1. Genetic engineers can transfer _____ from one organism to another.
2. As a first step toward finding a gene, Douglas Prasher studied the _____ sequence of part of a protein.
3. Prasher next found the _____ base sequence that coded for the protein.

Changing DNA

- _____ 7. Why is DNA ligase so important in recombinant DNA technology?
- A. It causes DNA to make multiple copies of itself.
 - B. It joins two DNA fragments together.
 - C. It shapes bacterial DNA into a circular plasmid.
 - D. It cuts DNA into restriction fragments.
- _____ 8. A recombinant plasmid can be used to
- A. prevent nondisjunction at meiosis.
 - B. double the number of chromosomes in a plant cell.
 - C. cut DNA into restriction fragments.
 - D. transform a bacterium.
- _____ 9. What do genetic engineers use to create the “sticky ends” needed to splice two fragments of DNA together?
- A. an amino acid sequence
 - B. DNA ligase
 - C. restriction enzymes
 - D. mRNA

13. What is a transgenic organism?

16. What is a clone?

For Questions 18–22, write True if the statement is true. If the statement is false, change the underlined word to make the statement true.

- _____ 18. An organism that contains one or more genes from another species is inbred.
- _____ 19. Transgenic organisms can be made by inserting recombinant DNA into the genome of the host organism.
- _____ 20. Examining the properties of a transgenic organism allows scientists to discover the function of the transferred chromosome.
- _____ 21. Plant cells will sometimes take up DNA on their own if their cell walls are absent.
- _____ 22. Carefully designed DNA molecules can achieve gene replacement.

On the lines below, write T next to an example of a transgenic organism, and C next to an example of a clone.

- _____ 23. A goat that produces spider’s silk in its milk
- _____ 24. A plant that is grown from a cell into which *Agrobacterium* has incorporated recombinant DNA
- _____ 25. A lamb that is born with the same DNA as a donor cell
- _____ 26. A colony of bacteria that grows from one bacterium
- _____ 27. A bacterium that can produce human insulin

28. **THINK VISUALLY** Complete the sentences in the diagram below to show the steps in cloning a sheep.

