




15.3 Applications of Genetic Engineering

Lesson Objectives

-  Describe the benefits of genetic engineering as they relate to agriculture and industry.
-  Explain how recombinant DNA technology can improve human health.
-  Summarize the process of DNA fingerprinting and explain its uses.

Lesson Summary

Agriculture and Industry Genetic engineers work to improve the products we get from plants and animals.

- ▶ Genetically modified crops may be more nutritious or higher yielding. They may be resistant to insects, diseases, or spoilage. Some can produce plastics.
- ▶ Genetically modified animals may produce more milk, have leaner meat, or contain higher levels of nutritious compounds. Transgenic salmon grow rapidly in captivity. Transgenic goats produce spider silk in their milk.

Health and Medicine Recombinant DNA studies are leading to advances in the prevention and treatment of disease.

- ▶ Examples include vitamin-rich rice, human proteins made in animals, animal models of human disease (for research), and bacteria that produce human insulin.
- ▶ **Gene therapy** is the process of changing a gene to treat a disorder. However, gene therapy is still an experimental and high-risk technique.
- ▶ Genetic testing can identify hundreds of inherited disorders.

Not all genes are active in every cell. **DNA microarray** technology lets scientists study thousands of genes at once to determine their activity level.

Personal Identification **DNA fingerprinting** analyzes sections of DNA that may have little or no function but that vary from one individual to another.

- ▶ DNA fingerprinting is used in **forensics**—the scientific study of crime-scene evidence—to identify criminals. It is also used to identify the biological father when paternity is in question.
- ▶ Common ancestry can sometimes be determined using mitochondrial DNA (mtDNA) and Y-chromosome analysis.

Agriculture and Industry

1. Give two examples of how genetically modified organisms lead to more environmentally friendly agricultural practices.

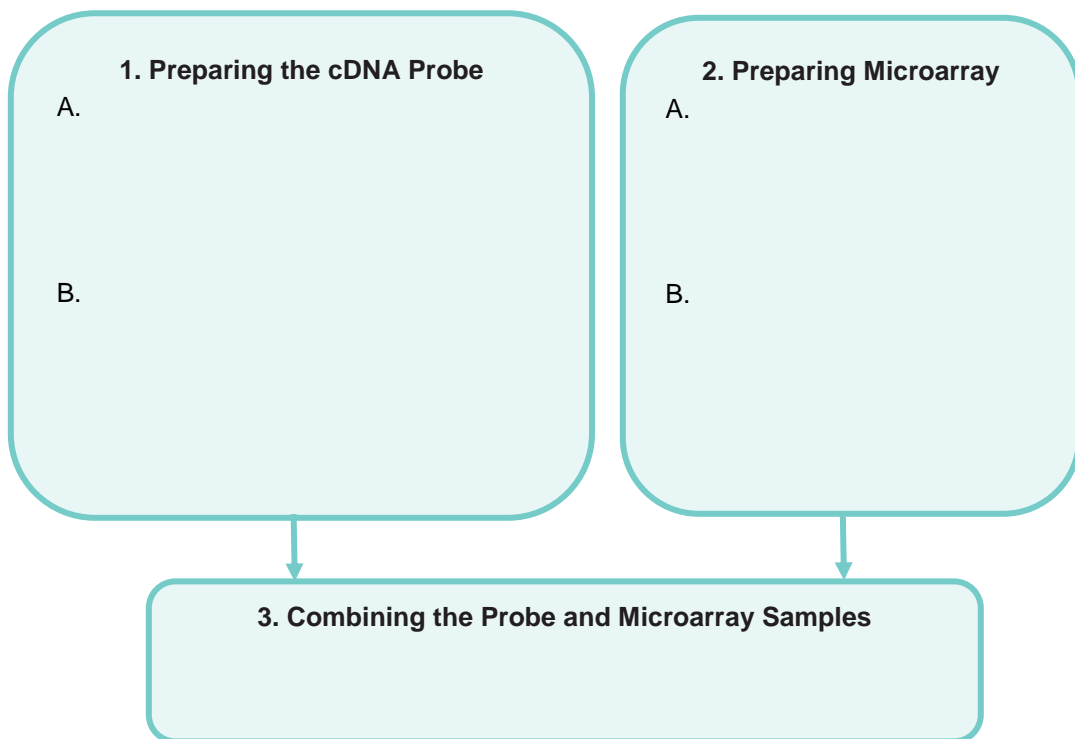
- a. _____
- b. _____

2. Name two other benefits that may be gained from genetically engineering food crops.
- a. _____
- b. _____
3. Give two examples of how DNA modification has increased the importance of transgenic animals to our food supply.
- a. _____
- b. _____

Health and Medicine

For Questions 4–6, write *True* if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

- _____ 4. Human growth hormone is now widely available because it is mass produced by recombinant viruses.
- _____ 5. In DNA fingerprinting, an absent or faulty gene is replaced by a normal, working gene.
- _____ 6. Prospective parents can find out if they carry the alleles for a genetic disease through genetic testing.
7. Complete the flowchart to show the steps required to analyze gene activity using a microarray.



Personal Identification

8. Complete the flowchart about how DNA fingerprints are made.

Restriction _____ are used to cut the DNA into fragments containing genes and repeats.

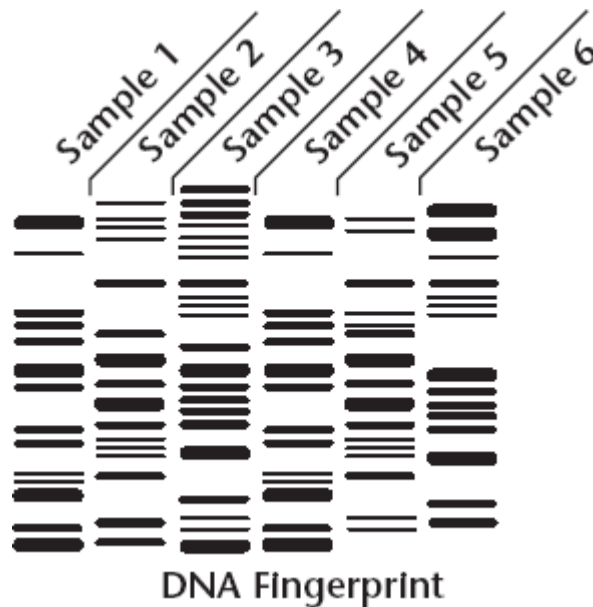


The restriction fragments are separated according to size using gel _____.



The DNA fragments containing repeats are then labeled using radioactive _____. This labeling produces a series of bands—the DNA fingerprint.

9. Study the DNA fingerprint below. Which two samples may be from a set of identical twins? How do you know?



Apply the Big idea

10. In 2001, scientists reported the successful use of gene therapy to treat three dogs that had been born blind. The animals' blindness was the result of a mutated gene. Explain the steps that the scientists probably would have used to restore sight to the dogs.
