

# Lesson Self-Check

## CAN YOU EXPLAIN IT?

**FIGURE 18:** Genetically modified zebrafish.



Fluorescent zebrafish are genetically modified. Originally, fluorescent color genes from jellyfish and sea anemones were inserted into zebrafish eggs. The color genes became part of the zebrafish DNA. It is now a heritable trait that is passed to offspring. Current generations of fluorescent zebrafish are born, not modified, but their roots lie in genetic modification.



**Explain** Refer to the notes in your Evidence Notebook to answer the following questions:

1. How can a gene from one organism be inserted into the genome of an unrelated organism?
2. Does genetically altering an organism make a new species?
3. What are the implications of genetic engineering?

The green fluorescent protein (GFP) is used for more than creating glow-in-the-dark pets. When a GFP sequence is added to a gene, the translated protein will include the green fluorescent protein, which glows. This glowing tag allows scientists to track the protein in the organism. Knowing where, when, and how often a protein is made is important for understanding what abnormal expression of a protein looks like. GFP has been modified to produce a range of colors. The different colors are used by scientists to track multiple proteins at the same time.

Research performed using GFP tags includes exploring cell behavior during embryonic development, monitoring cell death during apoptosis, and studying insulin cells in the pancreas. Processes that are difficult to monitor directly, such as the growth of a neuron or tumor, can be tracked using GFP-tagged proteins.

## CHECKPOINTS

### Check Your Understanding

1. What is the difference between genetic engineering and cloning?
  - a. Genetic engineering is governed by an international ethics committee. Cloning does not have any formal ethics oversight.
  - b. Genetic engineering uses PCR and CRISPR. Cloning does not use PCR or CRISPR.
  - c. Genetic engineering focuses on changing an organism's genome, while cloning focuses on exactly copying genetic material.
  - d. Genetic engineering refers to gene manipulation in humans. Cloning refers to gene manipulation in all other species.
2. Place the elements in order to model how mosquito populations can be controlled using genetic engineering.
  - a. affected males and affected offspring die
  - b. insertion of gene into mosquito embryo
  - c. release of affected male mosquitos to the wild
  - d. development of drug-dependency gene
  - e. breeding of genetically modified mosquitoes
  - f. affected males mate with wild females
3. What would happen if a thermocycler malfunctioned during a PCR run and never heated the solution?
  - a. The DNA polymerase used to separate the DNA strands would not be activated.
  - b. The PCR would proceed at a slower rate.
  - c. The primers would not bind to the target DNA sites, and DNA synthesis would not occur.
  - d. The DNA strands would never separate, and the PCR would never begin.
4. Which of the following is not a criterion for a disease being a good candidate for gene therapy?
  - a. genetic information can be distributed to new cells
  - b. biology is understood
  - c. genetic basis of disease is identified
  - d. controlled by one gene up to a handful of genes
  - e. none of the above
5. How does the mutated CFTR protein contribute to cystic fibrosis?
  - a. The mutation prevents the channel protein from moving chloride across the membrane, resulting in a thick, sticky mucus.
  - b. The mutation prevents the channel protein from moving sodium across the membrane, resulting in a thick, sticky mucus.
  - c. The mutation causes the channel protein to produce the sticky, thick mucus.
  - d. The mutation attracts more mucus to the channel protein.
6. How is CRISPR used in genetic engineering?
  - a. to clone cells
  - b. to cut DNA
  - c. to insert foreign DNA in a chromosome
  - d. to test for genetic conditions

### MAKE YOUR OWN STUDY GUIDE



In your Evidence Notebook, design a study guide that supports the main ideas from this lesson:

**Genetic engineering is used to solve many societal and environmental problems, but there are benefits and risks associated with genetic engineering.**

**The ethical considerations of cloning and genetic engineering are complex. Scientists must balance scientific progress with the concerns of the public.**

Remember to include the following information in your study guide:

- Use examples that model main ideas.
- Record explanations for the phenomena you investigated.
- Use evidence to support your explanations. Your support can include drawings, data, graphs, laboratory conclusions, and other evidence recorded throughout the lesson.

Consider how genetics, engineering, technology, and society influence and affect each other.