



TEACHER GUIDE

BIOTECHNOLOGY GRADES 6-8

COMMON MISCONCEPTIONS

- **Artificial selection makes new genes.**
In artificial selection, organisms are bred for specific traits; the traits sought must already be in the population. For example, dogs with short legs bred with other dogs with short legs eventually produce breeds that always have short legs, like dachshunds. The gene for short legs already existed; artificial selection only made short-legged dogs more common more quickly.
- **Biotechnology is a new science field.**
From using tree leaves for cooling fans to developing robotic limbs, biotechnology has been around as long as humans. Humans have utilized the world around them for centuries, and just like other fields of science, biotechnology has evolved over time to include many different fields of science, including computer science.
- **Biotechnology only includes biological sciences.**
Biotechnology actually includes the use of all sciences, as all the sciences work together. For example, when working on medicines that help humans, scientists and researchers must study how the chemistry (medicine) affects the biological process (human body).

ARTIFICIAL SELECTION

Artificial selection is the process where humans choose the traits they want organisms to have. This process is used with both plants and animals, and allows humans to design organisms for a specific look or to perform a certain function. Artificial selection has led to new breeds of dogs and many varieties of fruits and vegetables, including grapes (apples that taste like grapes) and cotton-candy grapes.

THE USE OF DNA IN BIOTECHNOLOGY

The use of DNA has been a game-changer in biotechnology. DNA is utilized in many areas of science, from creating batteries to solving crimes. Scientists have known about DNA since the 1800s, but mapping DNA sequences didn't occur until the 1960s. Today, DNA is commonly used for a variety of things like paternity testing, food production, and crime scene evidence.

GENE THERAPY

Gene therapy is a fairly new type of treatment that can be used to treat certain diseases and disorders. The goal of gene therapy is to treat a disease at its source—the cell—by replacing damaged cells with healthy cells. Gene therapy can currently be done in a few different ways, including gene addition and gene editing in gene therapy treatments.

TEACHER TIPS

Many students are familiar with biotechnology, but do not know much about it or all that it encompasses. Students may bring up topics they have seen in movies such as, *Jurassic Park* or *Iron Man*. While teaching, allow students to bring up and share these ideas and others, as it provides background information on which you can build. Facilitating a discussion about biotechnology is also a good way to identify misconceptions about scientific capabilities and limitations.

ABOUT THIS LESSON

This lesson was created by the National Science Teaching Association (NSTA) to pair with the Generation Genius video and support NGSS.

They have requested we provide the following background with this lesson:

The Next Generation Science Standards (NGSS) are the national standards on how students learn science, and they are based on contemporary research presented in *A Framework for K–12 Science Education (the Framework)*. The shift in science teaching and learning required by the Framework is summarized in this infographic: [A New Vision for Science Education](#).

At the start of each Generation Genius lesson, students are presented with a phenomenon, then they try to explain it. Students will notice they have gaps in their knowledge and ask questions, which motivates them to build ownership of science ideas they need in order to explain how or why the phenomenon occurred. The way students build ownership of science and engineering ideas is through active engagement in the science and engineering practices (SEPs). This process of sensemaking, or doing science to figure out how the world works, is one of the major shifts the *Framework* encourages.

To engage in the SEPs, students should be part of a learning community that allows them to share their ideas, evaluate competing ideas, give and receive critiques, and reach consensus. Students can start by sharing ideas with a partner, then with a small group, and finally, with the whole class. This strategy creates opportunities for all students to be heard, build confidence, and have something to contribute to whole-class discussions. Each Generation Genius lesson provides conversational supports to facilitate such productive student discussions to contribute to sensemaking.

Excited to continue your shift toward the new vision for science education? Check out the [Generation Genius Teacher Guide](#) page on the NSTA website for resources and strategies to engage every student in your classroom in **doing** science.

