



TEACHER GUIDE

GENES AND MUTATIONS GRADES 6-8

COMMON MISCONCEPTIONS

- **Mutations are always harmful.**
Mutations are a change in an organism's genetic material and can sometimes result in a change in the structure and function of an organism. Genetic and environmental factors can both cause mutations to an organism's DNA. Some mutations can also be passed on from parent to offspring.
- **Having sickle cell disease makes you immune to malaria.**
Persons with sickle cell disease are not immune from malaria and actually have a higher risk of developing more severe symptoms of malaria. Carriers of the sickle cell gene can also get malaria; however, once infected they have a lower risk of developing severe symptoms of malaria.
- **Environmental factors cannot change traits.**
Environmental factors can affect traits in both plants and animals. For example, the Sun can affect the color of your skin, but it can also affect your health. Too much Sun exposure can lead to skin damage and could even cause your skin cells to mutate causing a melanoma (skin cancer) to develop.

TRAITS

All organisms have traits. Traits are passed down from parents to offspring through both asexual and sexual reproduction. In asexual reproduction parents and offspring have identical traits as the cell is split in two. In sexual reproduction genetic material from two parents are combined, producing a genetically unique organism.

GENES

Genes are sections of genetic material located in specific areas on chromosomes. Genes are passed from parent to offspring and code for specific amino acids, which form proteins. Although genes code for specific characteristics, there can be variations in genes. These variations explain why two siblings from the same parent do not look exactly the same.

DEOXYRIBONUCLEIC ACID

Deoxyribonucleic acid is commonly referred to as DNA. DNA contains the genetic code of all organisms. An organism's

DNA is unique to that organism, which is why DNA can be used to identify specific organisms. Sometimes an organism's DNA can change and this change is called a *mutation*. Mutations in DNA can happen for a number of reasons and may or may not affect how the organism functions.

TEACHER TIPS

Genetics is a fascinating field and many students come in knowing a variety of different things about genetics and DNA, mostly from TV. It is important to let students share to identify misconceptions they have about DNA, mutations, and the process of inheritance. As you work through the lesson, allow students to change their own minds about what they know about this conception instead of just telling them they are wrong and then telling them the correct information. Allowing students to change their thinking and add to their conceptual understanding about this concept helps makes more concrete connections they will take with them to the higher grades.

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.

