

Lesson Topic: Gene Mutations**Objective:**

Students will be able to:

1. Identify the three types of gene mutations.
2. Describe what occurs during each type of mutation.
3. Act like a DNA sequence through a game of telephone (words, actions, and drawings).
4. Determine a harmful, helpful, and indifferent mutation in living things.

Time Required: 95 minutes**Materials Needed:**

- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Gene Mutations handout (attached)
- Instruction Cards (attached)
- Mutation Images (attached)

Teacher Preparation:

- Assign a Legends of Learning Instructional [Quick Play](#) playlist for the day(s) you will be teaching the lesson.
 - Instructional - Middle School - Gene Mutations
- Assign a Legends of Learning Content Review [Quick Play](#) playlist for the day(s) you will be teaching the lesson.
 - Content Review - Middle School - Gene Mutations
- Make copies of Gene Mutations Worksheet (1 per student)
- Cut out instruction cards.

Engage (15 minutes):

1. Begin with a simple game of telephone.
2. Put students into small groups and have each student stand in a line.
3. As an example with one of the groups, whisper into the first student's ear a few words.
 - a. Then, that student will whisper to the person next to them what they heard, and so on and so forth.
 - b. The last student in the group will then announce what they heard.
 - c. The goal is to make sure the message at the beginning is the same message at the end. (This of course is very difficult to do!)
4. Tell students "We are going to play a game of telephone in your groups. I will tell the first person a message quietly. Then, that person will have to tell the next person, and the next person, all the way until the last person. The last person can then say what they heard."
 - a. Be sure to only say the message once.
 - i. If the student says they didn't hear it, they must merely make something up.

- b. Be quiet, it is a very quiet whisper voice.
 - c. Be sure to tell the message you hear as exactly as you can.
5. You can use whatever you would like as a message. Begin with an easy short message. However, you can progress to long, elaborate messages to make it more difficult.
6. Next, make the chain of students longer by combining groups. You could even have one long chain of the entire class and see how the message changes.
7. After you have completed all games of telephone, ask students “It wasn’t so easy was it? Why was the message different at the end of the telephone chain (most of the time)? (students wouldn’t hear correctly, and the message would get changed in the middle, ultimately changing the message the entire rest of the way, words would get missed, words would get replaced, words would get added).
8. Tell students “Keep this activity in mind as we continue on in the lesson. Today you will learn how your cells/DNA play a game of telephone of sorts when attempting to make copies of themselves”

Explore (20 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Instructional playlist.
2. As students complete the assigned game, students should fill out the Gene Mutations Handout.
3. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

Explain (30 minutes):

1. Show three images of “mutants” that the students are bound to know (Teenage Mutant Ninja Turtles, Spiderman, Captain Marvel).
2. Tell students “What do these all have in common? They are all mutants and so are we!”
3. Tell students “the way we are made is determined by our genes, the genes we get from our parents. The genes have our DNA and it is our DNA sequence of proteins that ultimately determine our traits. However, there are constantly changes and mistakes to our DNA make up. It’s ok! This is what makes us unique.
4. These changes in our DNA sequence are called mutations.
5. Mutations can be:
 - a. Changes that don’t make much difference, such as a birthmark, a beauty mark, or a funny quirk that you have like a super flexible thumb joint!
 - i. Show image of contortionists.
 - b. Changes that are actually beneficial to our lives or our survival. For example, having an exceptional immune system to common diseases. In the wild, some animal mutations can give them better hiding capabilities or an easier way to eat their food, or find a mate.
 - i. Show image of penguins.
 - ii. Ask “How is this mutation of white fur color in a penguin beneficial?” (They can better blend into the snow and camouflage from predators or sneak up on prey).
 - c. Changes that are harmful that can cause life to be more difficult, or need

medicine to survive. This could mean disease such as sickle cell disease, becoming predisposed to getting diseases, or even death.

- i. Show image of alligator.
 - ii. Say “Interestingly, it has a similar mutation being white in color as an albino alligator. However, white does not camouflage well in an alligator habitat and is more easily seen by prey.”
6. Just keep in mind we are all mutants. We are all different and just like in that game of telephone, no one’s DNA sequences are perfect. There are constantly changes in the middle that change the outcome.
 7. Our DNA is a sequence of base pairs (GCAT). We use letters to code for them.
 8. There are three types of genetic mutations that can occur in our DNA sequence (write on the board):
 - a. Substitution - the correct sequence is exchanged for a different base
 - i. GCAT ----> GAAT
 - b. Addition - Another base is added in
 - i. GCAT ----> GCAAT
 - c. Deletion - A base is taken out of the correct sequence
 - i. GCAT ----> G_AT
 9. Write the following sentence on the board: Jenny walked home.
 - a. Ask students “pretend this sentence is a DNA sequence. Write a sentence that would be a substitution mutation.”
 - i. Answers will vary but could include: Jenny ran home, Jenny skipped home, Jenny hopped home, Jenny walked away, Jenny walked happily, I walked home, I walked out.
 - b. Write an addition example:
 - i. Jenny walked home today, Jenny walked and ran home. Jenny and Suzy walked home, etc.
 - c. Write a deletion example:
 - i. Jenny walked, walk home.
 - d. Discuss how in each of these sentences, the “mutation” causes the sentence to change meaning, just as mutations in our DNA change the traits that are presented.

Elaborate (20 minutes):

1. Tell students ‘We are going to play telephone, but this time we are going to play it a little differently.’
2. Put students into small groups and have them stand in a line as before.
3. Give the first person in each line a piece of paper with some instructions on it (You can make up your own or use the cards attached)
 - a. There are three different options to give out to different groups at the same time, or to make copies and have three different rounds. Feel free to make up your own as well.
4. The first person needs to play telephone and give the instructions to the chain of students. The last person must complete the instructions on a piece of paper.
5. Then, have each group decide what kind of mutation (if any) occurred.
6. Come together as a class and discuss what happened.
7. Next, play the same game of telephone, but instead of words, have the students act

out certain physical or dance moves (You can make up your own or use the movement instructions attached).

- a. There are three different options to give out to different groups at the same time, or to make copies and have three different rounds. Feel free to make up your own as well.
8. Give the first person a piece of paper with the instructions. Have them act it out down the chain. (Each person should stand with their back turned until it is their turn, so as not to see the moves more than one time).
9. The last person in the chain must perform what they learned and see how closely they were able to do it according to the first sheet of instructions.
10. Then, as a group, decide what mutation (if any) occurred from the activity they were trying to perform.
11. Come together and discuss.

Evaluate (10 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Content Review playlist.
2. [Analyze student results](#) to determine what concepts need to be a focus for reteaching.

Additional Lesson Strategies:

- To use Legends for additional instruction, create a [custom playlist](#) with an [instructional game](#) and pre and post [assessment](#).
- To use Legends for a quick formative assessment, create a 5-question [assessment](#) in a [playlist](#).
- To use Legends for a student-directed experience, create a [targeted freeplay](#) playlist.
- Encourage students to play on their own at home in [Legends of Learning: Awakening](#) for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.



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Name: _____

Gene Mutations

There are many types of mutations that occur in nature. Some are beneficial, some are harmful, and some mutations have little effect on the organism at all.

1. Give an example of a helpful mutation.
2. Give an example of a harmful mutation.
3. Give an example of a mutation that has little effect on the organism.

Substitution -

Addition -

Deletion -

KEY

There are many types of mutations that occur in nature. Some are beneficial, some are harmful, and some mutations have little effect on the organism at all.

1. Give an example of a helpful mutation.

Answers can vary: White penguin in the snow, a human with certain disease immunities, any mutation that makes survival easier etc.

2. Give an example of a harmful mutation.

Answers can vary: Sickle cell disease, albino alligator, anything that makes survival more difficult, etc

3. Give an example of a mutation that has little effect on the organism.

Answers can vary: beauty mark, flexible body parts, any mutation that doesn't have an effect on the survival of the organism, etc.

Substitution - **the correct sequence is exchanged for a different base**

Addition - **Another base is added in**

Deletion - **A base is taken out of the correct sequence**

Helpful



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Harmful



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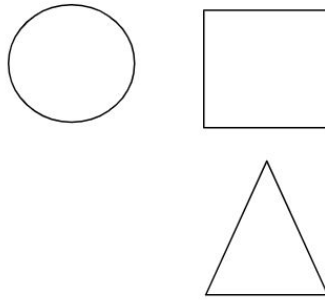
Little Effect



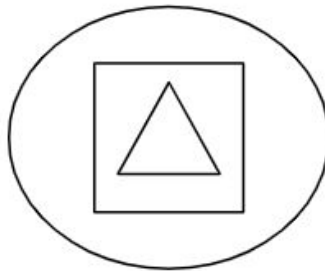
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#1: Instruction Cards (Keys are found below).

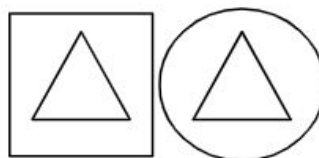
Draw a circle, draw a square to the right of the circle and a triangle under the square.



Draw a square, draw a circle around the square and a triangle inside the square.



Draw 2 triangles side by side. Circle the triangle on the right and put a square around the left one.





#2 - Instruction Cards

Clap twice, stomp twice, clap twice, shrug your shoulders three times

Clap three times, turn around, flap like a bird twice, hop once

Clap once, stomp once, clap twice, shrug your shoulders twice