

When Mutations Make You Mighty!

DNA Mutations

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Essential Question

How do mutations impact your traits?

Summary

Students will use the DNA sequence to find out about mutations. They will learn about insertion, deletion, substitution in the DNA process to find if mutations are harmful or beneficial.

Snapshot

Engage

Students reflect on mutations and work together to define what a mutation is.

Explore

Students make a claim in response to a provided prompt and provide evidence and reasoning to defend their claim.

Explain

Students watch a video to reflect on the main concepts of mutation and define necessary vocabulary terms.

Extend

Students create a DNA keychain model that represents a mutation.

Evaluate

Students choose a superhero and summarize their understanding of a mutation's impact on a protein between the mutated and unmutated version of their superhero.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD302: Understand basic scientific terminology
EMI301: Identify implications in a model

Oklahoma Academic Standards for Science (Grade 8)

8.LS3.1: Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

Attachments

- C.E.R.T.I.fy Your Thinking—When Mutations Make You Mighty.docx
- C.E.R.T.I.fy Your Thinking—When Mutations Make You Mighty.pdf
- DNA Keychain Instructions—When Mutations Make You Mighty.docx
- DNA Keychain Instructions—When Mutations Make You Mighty.pdf
- Lesson Slides—When Mutations Make You Mighty.pptx
- Making a Superhero—When Mutations Make You Mighty.docx
- Making a Superhero—When Mutations Make You Mighty.pdf
- Mutation Cards—When Mutations Make You Mighty.docx
- Mutation Cards—When Mutations Make You Mighty.pdf
- Vocabulary Note Catcher—When Mutations Make You Mighty.docx
- Vocabulary Note Catcher—When Mutations Make You Mighty.pdf

Materials

- Lesson Slides (attached)
- Chain Notes handout (attached; one per student)
- C.E.R.T.I.fy Your Thinking handout (attached; one per student)
- Vocabulary Note Catcher handout (attached; one per student)
- DNA Keychain Instructions handout (attached; one per student)
- Mutation Cards (attached; one per student)
- Pony beads (48 total: 16 with four different colors, 16 black, and 16 white per student)
- Glitter pony beads (1–4)
- Wire (36 gauge and 18 gauge, one of each per student)
- Key rings (one per student)
- Sharpies (one per student)
- Wire cutters
- Needle nose pliers

Engage

Use the attached lesson slides to guide the lesson. Begin with **slide 3** and briefly read aloud the essential question: “How do mutations impact your traits?”

Move to **slide 4** and review the learning objectives.

Optional: Cat Video

Consider having students watch the following video on **slide 5**: *Ernest Hemingway’s Polydactyl Cats*.

Embedded video
https://youtube.com/watch?v=mN2GHx-K6hY

After watching the video, invite students to share out what the video made them notice and wonder about.

Once students have figured out the problem, ask them to justify the cause of the extra appendage (mutation).

Move to **slide 6** and place students in groups of four. Have each student take out a piece of paper and write down three points associated with anything they know about the prompt on the slide:

- What is a mutation?

Display **slide 7** and review the Chain Notes instructional strategy. Explain to students that they will pass their papers clockwise in their group. Each paper’s recipient will have two minutes to choose one of the points their peer made and add an additional fact, idea, or correction to it through words or a drawing. Start a two-minute timer and repeat this process of passing clockwise and writing until the papers get back to their original writers.

After the original writers review the comments from their peers, have each group come up with a summary of their ideas to share with the class. Select one student from each group to share their summary.

Explore

Go to **slide 8** and review the C.E.R.T.I.fy Your Thinking instructional strategy with students. Pass out the attached **C.E.R.T.I.fy Your Thinking** handout to each student. First, have them create a claim in response to the following prompt: “Do you believe that mutations are harmful or beneficial?”

After they have made their claim, direct them to research and identify three points of evidence to support their claim. Students should record and cite these in the space provided on their handout.

Move to **slide 9**. Once students have made their claim and collected their evidence, split the room into two sections. Explain to students that they will be participating in a debate regarding their claims. Ask students to move to the "harmful" side or "beneficial" side of the room based on their claim.

Next, have them debate over the topic. Use the rules listed below to facilitate the discussion. After the debate, have students return to their seats to come up with their comprehensive reasoning.

Teacher's Note: Debate Guidelines

It is always a good idea to have set guidelines to follow during a class discussion. Use the guidelines below to help you facilitate a class discussion.

1. Choose a side to start the discussion (typically, start with the side with less students).
2. Ask one student from the group you chose to respond with *one* piece of evidence that supports their claim.
3. Next, give a student from the opposing side time to give a rebuttal, responding with one piece of evidence.
4. Have groups take turns, repeating this process for 5–10 rounds.
5. Once groups have thoroughly expressed their evidence, ask the groups if there is anyone that would like to switch sides based on the information they have heard.
6. Next, give each group 30 seconds to discuss a final summary. Ask them to provide reasoning as to why their claim is correct.
7. Finally, have one spokesperson from each group share their group's summary.

Teacher's Note: Optional Student Expectations

Consider reviewing the debate guidelines with students to help them better understand expectations and procedures for the debate.

Explain

Display **slide 10** and pass out the attached **Vocabulary Note Catcher** handout. Explain to students that they will review the main concept of mutations and related vocabulary. Play the video on the slide: *Amoeba Sisters: Mutations (Updated)*. Ask students to complete their handout as they watch it. Make sure to tell students that not every vocabulary word on the handout is mentioned in the video.

Embedded video
https://youtube.com/watch?v=vl6Vlf2thvI

Once students have completed their handout as best as they can, move through **slides 11, 12, and 13** and review the vocabulary words and definitions with them.

Move to **slide 14** and use the Muddiest Point instructional strategy to help students communicate what they felt were the clearest and the most confusing parts of the lesson.

- Crystal Clear: What do you think is the easiest part to understand about mutations?
- Muddiest Point: What do you think is the most confusing part about mutations?

Extend

Display **slide 15** and pass out the following materials to each student:

- **DNA Keychain Instructions** handout (1)
- Pony beads (48 total; 16 with four different colors, 16 black, and 16 white)
- Glitter pony beads (1–4)
- Pre-cut wire (an 18-inch piece of 36 gauge and a 24-inch piece of the 18 gauge)
- Key ring (1)
- Sharpie for deletion (1)
- Mutation Card (1)

Explain to students that they are going to create their DNA model and embed a mutation into the DNA structure. Review the **DNA Keychain Instructions** handout with students, working through the correct DNA base pairing for the original strand.

Explain to students that the Mutation Card they were given represents the type of mutation that will occur in their DNA model.

Ask students to follow the steps provided in their handout and allow them time to build their keychain. As students work, circulate the room to offer support and guidance as needed.

Once students have created their DNA model, facilitate and complete a verbal assessment. Students should review key features about the makeup of a DNA model (bases pairing, backbone, helix) and the impact of their mutation.

Evaluate

Pass out the attached **Making a Superhero** handout to each student. Have students first choose a superhero mutation that they want to create.

Teacher's Note: Superhero Mutations

Provide examples of different superhero mutations to help students generate ideas. Consider sharing the following:

- Night vision
- Aquatic breathing
- Super strength
- Telekinesis

Display **slide 16** and review the Gist instructional strategy with students. Ask students to use their handout and write the "gist" about their superhero mutation. They should include the following:

- Describe the mutation.
- Determine if the mutation can be beneficial or harmful.
- Identify the type of mutation at the DNA level.
- Describe the impacts of protein and superhero traits.

Additionally, at the bottom of their handout, have students draw the non-mutated superhero next to the mutated superhero. Display **slide 17** to show an example.

Once students complete their drawings, hang them up around the classroom to view.

Resources

- Amoeba Sisters. (2019, July 31). *Mutations* [Video]. YouTube. https://www.youtube.com/watch?v=vl6Vlf2thvI&t=300s
- K20 Center. (n.d.). Claim, evidence, reasoning, test, improve (C.E.R.T.I.fy your thinking). Strategies. https://learn.k20center.ou.edu/strategy/827
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- K20 Center. (2021, September 21). *2 minute timer* [Video]. YouTube. https://youtu.be/HcEEAnwOt2c?si=KGD2iBg1LSLOGQQq
- M. (2013, April 3). *Ernest Hemingway's polydactyl cats* [Video]. YouTube. https://www.youtube.com/watch?v=mN2GHx-K6hY