

Mutations Lesson 1: *The Solve* Educator's Resource Guide: Animated Mystery

The Solve contains two mini lessons: The [live video lesson](#) and the [animation lesson](#). For the most comprehensive learning experience, conduct both. If you're short on time, choose one. Which lesson?

- For a more structured lesson, choose the animation (the lesson below).
- For a more inquiry-based lesson, choose the live video lesson and assign the animation for homework.

Objective

In *The Solve*, students will:

1. Solve a mystery that demonstrates how mutations occur and impact organisms.
2. Create a Mind Map to explore relationships among complex Mutation vocabulary words.
3. Communicate understanding that genes are responsible for traits and that mutations can occur due to copying errors in a chromosome.
4. Communicate understanding that mutations can be harmful, neutral, or beneficial to a species and can also cause a species to change over time.

Time Required: 40-75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
<ul style="list-style-type: none"> • Student Guide (<i>includes student agenda and Mind Map</i>) • Mutations Episode • Scissors • Glue or Tape 	None	<ul style="list-style-type: none"> • Developing and using models • Constructing explanations or arguments from evidence

Episode Description

Kitty Perry is competing in the Pretty Kitty Show but judges are disqualifying her because something is wrong: She has six toes and this is “just not normal” for cats!

Mosa is called to the scene to help discover why Kitty Perry has six toes. After speaking with a chromosome and a crazy cat lady, Mosa and her crew are able to determine that Kitty's sixth toe was caused by a mutation, passed down through generations.

Mosa and her team inform contest officials of their findings and the show is renamed to “Magnificent Mutations”, where Kitty Perry, along with other contestants, can celebrate and display their unique mutations.



Inquiry Scale: Leveling Information

The Solve can be completed in various settings, including presentation-style, small groups, or individually. In the case of a flipped or blended classroom, it can be completed entirely at home.

Level 1: Most teacher-driven *(recommended for grades 4–5)*

View the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video as needed to answer the episode questions as a group. Project and complete the Mind Map as a class-wide activity. This can be done digitally or on paper. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 2 *(recommended for grades 5–6)*

View the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play the mystery a second time, pausing the video to discuss each question. Direct students to complete the Mind Map in small groups, either digitally or on paper. Come back as a class to review correct answers, as needed. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 3 *(recommended for grades 6–7)*

Provide students with their student URL and have students view the animated mystery in small groups. Have students play the animated mystery once in full and then answer episode questions in their table groups to the best of their ability. Then, as a class, project the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. Have students complete the Mind Map in table groups, either digitally or on paper. Have students quiz each other on the vocabulary until you feel they're familiar with the terms. In table groups, have students go through the discussion questions on their own, and review answers as a class. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 *(recommended for grades 7–8)*

Provide students with their student URL and have students view the animated mystery and complete episode questions in pairs. Have students review their answers with a neighboring table group. Have students complete the Mind Map in pairs, either digitally or on paper. Have students quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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Agenda

I. Solve the Mutations Video Mystery (20 minutes)

Differentiation Tip: The Video Mystery can be viewed as a class, in small groups, individually, or completed for homework. For additional support, students can view the episode twice: once before completing the questions and once with teacher guidance, pausing the video to discuss each answer.



1. Play the animated Mosa Mack Mystery on Mutations.
2. Students answer questions either digitally on the Mosa Mack platform or on paper in the Student Guide as they watch. Encourage students to cite the specific time codes in the episode to promote writing with supporting evidence. Answers can be found in the key below.
3. View the answer video to confirm student understanding.

II. Vocabulary Mind Map Activity (15–45 minutes)

Differentiation Tip: The Mind Map can be done as a class, in small groups, individually, or completed for homework. It can be done digitally or on paper.

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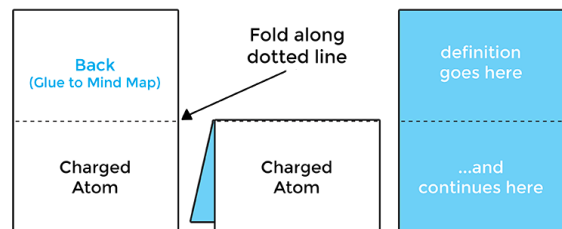
III. Exit Ticket: Check for Understanding
Complete the exit ticket below or you can take the quiz online!

Name: _____ Date: _____

1. Which of the following is an example of a non-renewable resource?
a. Wind
b. Solar (Sun)
c. Trees
d. Petroleum
2. Resources are equally distributed throughout the world. True or false?
a. True
b. False
3. How long does it take to make?
a. Hundreds of millions of years
b. 40 years
c. A few years
d. 1 million years
4. Burning fossil fuels releases which gas into the air, making the Earth warmer?
a. Oxygen
b. Water
c. Nitrogen
d. Carbon Dioxide
5. Which of the following does not show a quick "cycle"?
a. Wood
b. Oil
c. Water
d. Carbon

1. Students may complete the Mind Map **digitally**. Follow directions below. (15 minutes)
 - a. Go to <https://mosamack.com/home/mutations>
 - b. Select **Lesson 1: The Solve**.
 - c. Select **Vocabulary** and complete **Part 1**: matching terms with definitions.
 - d. Complete **Part 2**: matching terms and definitions with images on a diagram.
2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
 - a. Print and pass out the Student Guide: Mutations Lesson 1: *The Solve*.
 - b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Mutations unit.
 - c. Model the directions carefully, emphasizing the following. Students should:

- **cut** out the vocabulary cards on the solid lines only
- **fold** the cards at the dotted lines
- write the definition of the term on the inside of the card using definitions provided



- d. Students use the clues from the Mind Map images, definitions, and terms to place the cards in the correct location in the Mind Map.
- e. Check that the students have matched their cards correctly before moving on.

- f. Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
- g. Students discuss the questions with their group or as a class when they have completed the Mind Map.

Teacher Tips:

- Since this is the first time many of the students will have seen these vocabulary terms, have students work together to use the images, definitions, and collaborative thinking to figure out where the terms go.
- Check in on student groups throughout this process. When you see students or groups who have placed their card in the correct place, ask a facilitating question such as, “Why do you think that term goes there?” or, “What evidence leads you to believe that term goes there?” When students explain their thinking, this is a great opportunity to provide positive reinforcement. Then, encourage them to share their reasoning to the class or to other groups who may have trouble identifying the location of that specific term.
- If you do not have access to a color printer, provide students with black and white copies and project the colored Mind Map at the front of the room so that students can reference both images.

III. Exit Ticket: Check for Understanding (10–15 minutes)

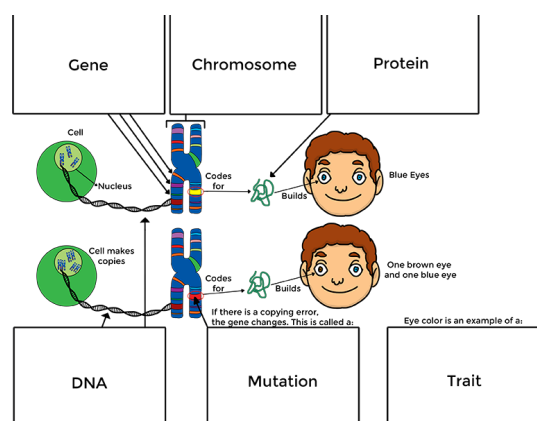
Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

- Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the Answer Key section below.

Answer Key

Mind Map Discussion

- a. Where are chromosomes found? *Chromosomes are found in the nucleus of our cells.*
- b. What is a gene? *A gene is a section of DNA on a chromosome that codes for a particular trait.*
- c. Besides eye color, what are other human traits? *Student answers will vary. Some example of other human traits include hair color, skin color, height and ear shape.*
- d. How can a mutation occur? *A mutation can occur if a gene on a chromosome changes. A gene can change due to a copying error in DNA.*



Episode Questions

1. Why was Kitty Perry disqualified from the Pretty Kitty show? Be as specific as possible. (15 seconds-30 seconds)

Kitty Perry was disqualified from the show because she had 6 toes on her paw, considered to be an “abnormal” trait.

2. Where do we get our traits? (59 seconds-1:28)

Genes determine our traits and we get our genes from our parents - an exact copy from our mother and father.

3. Explain how a mutation can occur. (2:15-2:40)

Sometimes there is a miscopy that makes the child’s genes a bit different from the parents. This miscopied gene can create an entirely new trait in the child that neither parent had.

4. According to the cat lady, how did Kitty Perry get her 6th toe? (1:39 - 2:05)

Kitty Perry got her 6th toe by inheriting a mutated gene. Years ago, a mutation occurred in the toe gene of her ancestor, which caused a 6th toe. This mutated gene was passed down over generations and eventually passed down to Kitty Perry.

5. What type of mutation does the cat lady have? (2:57-3:15)

The cat lady has a mutation in the gene that helps us see in full color. Due to this mutation, the colors red and green look the same to the cat lady.

6. When Mosa reflected on the Peppered Moths, she realized that a mutation helped to benefit the moths. Explain the mutation that occurred in the Peppered Moths and how it helped the moths to survive. (3:37-3:55)

Peppered Moths have either dark wings or light wings. The original gene caused light wings, but due to a mutation, some moths had dark wings. This “dark-wing” mutation helped the moths to hide from predators against the dark-colored tree bark.

7. A mutation is responsible for creating what we now know as cauliflower. List two other mutant organisms that were displayed in the “Magnificent Mutations” show. (4:20-5:00)

Answers may include: Mutant organisms displayed in the “Magnificent Mutations” show include a green apple, a dog with two differently-colored eyes (Heterochromia), and a modern day whale.

8. What did Mosa figure out? What mutations of modern day whales can you find? (5:07-6:00)

Mosa determined that features of modern day whales are due to a series of mutations that occurred over millions of years. Student findings will vary. Examples of mutations are as follows:

When comparing ancestor species of the whale, one can notice how hind legs receded, shortened and eventually vanished over time, front legs morphed into flippers, the nose elongated, nostrils changed position from the front of the skull to the blowhole located on the top of the modern day whale skull, the tail became more muscular and powerful, and the body elongated over time. All of these changes allowed the whale to become better adapted to surviving in water.

Quiz :

1. Genes determine our:
 - a. Parents
 - b. Traits**
 - c. Chromosomes
 - d. Mutations
2. The stripes on a chromosome represent different types of:
 - a. Patterns
 - b. Colors
 - c. Genes**
 - d. Mutations
3. Which of the following best describes a mutation?
 - a. A change in a gene**
 - b. A section of a chromosome that codes for a particular trait
 - c. Anything that can damage a gene
 - d. A distinguishing quality that can be passed from one generation to another
4. True or False: All mutations are harmful.
 - a. True
 - b. False**
5. A mutation could cause which of the following:
 - a. Two different-colored eyes
 - b. Extra toes on a foot
 - c. Color blindness
 - d. All of the above**
6. True or False: Mutations can cause a species to change in appearance over time.
 - a. True**
 - b. False