

Genetic Variation Lesson 1: “The Solve”

Educator’s Resource Guide

Objective:

In the Solve, students will:

1. solve a mystery involving asexual vs. sexual reproduction and communicate their findings.
2. create a mind map to explore relationships among complex genetic vocabulary.

Time Required: 45-80 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
<ul style="list-style-type: none">• Student Guide (<i>includes student agenda and vocabulary handout</i>)• Genetic Variation Episode• Computer with speakers• Scissors• Glue or Tape	None	<ul style="list-style-type: none">• Developing and Using Models• Constructing Explanations or Arguments From Evidence

Episode Description:

When algae accuse two frogs of lying about being siblings, Mosa is called to the scene. How can these frogs *possibly* be related if they look so different from one another? Mosa and her team observe the algae colony and the frog family at the genetic level to discover crucial differences in reproduction that may explain why the frog siblings look so different while the algae look exactly alike. Now, when it comes time to find the frogs’ father, it’s up to the students to select the correct one based on Mosa’s findings!



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 Genetic Variation 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 Genetic Variation.
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.

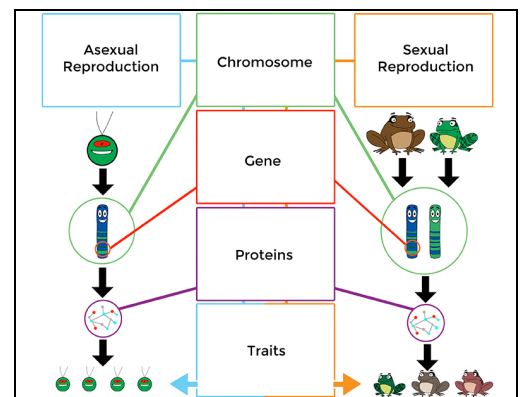
1. Students may complete the Mind Map **digitally**. Follow the directions below. (15 minutes)
 - a. Go to <https://mosamack.com/home/genetic-variation>
 - b. Select **Lesson 1: The Solve**.
 - c. Select **Vocabulary** and complete **Part 1**: matching terms with definitions.
 - d. Complete **Part 2**: 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: Genetic Variation Lesson 1: *The Solve*.
 - b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Genetic Variation unit.

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

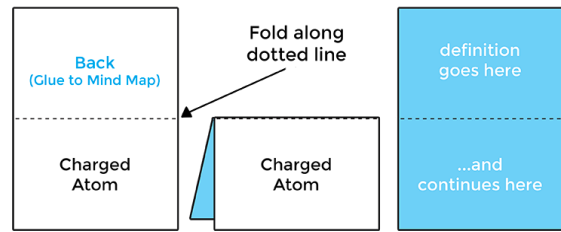
Name: _____ Date: _____

1. What is the term for a sequence of DNA that codes for a certain protein?
a. Chromosome
b. Trait
c. Gene
d. DNA
2. The Voles all look identical. What type of reproduction do they do?
a. Asexual
b. Sexual
c. Individual
d. Combined
3. Genetic variation describes offspring that have different traits, such as Paulie and Nicole. Offspring with different traits must be a result of:
a. Asexual reproduction
b. Sexual reproduction
4. Why do Paulie and Nicole have so many different traits?
a. Paulie got more DNA from their mom, while Nicole got more DNA from their dad.
b. Paulie and Nicole both got half their DNA from mom and half from dad, but they got different genetic combinations.
c. Paulie and Nicole are not actually related.
d. Paulie's DNA has a lot of mutations, which are very common.
5. What is another reason for genetic variation besides sexual reproduction?
a. Partial mating
b. Asexual reproduction
c. Unequal chromosome distribution
d. Mutation



- 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.

1. 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

Episode Questions

1. Why does the algae think that Paulie and Nicole are not siblings? (1:15) *Because they have different physical traits or are not identical.*
2. Where do traits come from? (2:15) *Chromosomes or DNA*
3. There are sections of DNA called genes. What do genes do? (2:25) *Genes direct how the body makes proteins, to give it a certain color or shape, or a way of behaving*
4. How do the algae make babies? (2:54) *They replicate or reproduce, splitting their cells to form more cells*
5. What does the chromosome suggest as one reason why the frogs look different? (3:30) *A mutation, or a typo, occurred in the DNA, making them look different*
6. When Mosa and her team zoom in on Rose's eggs, what do they notice is different than the reproduction of the algae? (6:45) *Genes are coming from two different sources, mother and father, and swap some genes. At 5:50, a frog sperm cell is shown fertilizing a frog egg cell (Emphasize that this sperm came from a male frog).*
7. Why do the algae all look identical while the frogs look different? (Answer Video) *Algae reproduce asexually, meaning all the mother's genes are passed on to the child. Frogs reproduce sexually, meaning that the frog offspring get a mix of genes from both mother and father*
8. Help Mosa solve the mystery. Which Frog did Mosa pick and why? (Answer Video) *Frog #3 because that father frog had all the traits that the children had and the mother did not have.*
Tip: Explain to students that the frogs have traits that are made up of a combination of their moms and dads genes. Frogs, like all organisms that reproduce sexually, get one allele from each parent.

Quiz:

1. What is the term for a sequence of DNA that codes for a certain protein?
 - a. Chromosome
 - b. Trait
 - c. **Gene**
 - d. DNA
2. The Volvox algae all look identical. What type of reproduction do they do?
 - a. **Asexual**
 - b. Sexual
 - c. Individual
 - d. Combined
3. Genetic variation describes offspring that have different traits, such as Paulie and Nicole. Offspring with different traits must be a result of:
 - a. Asexual reproduction
 - b. **Sexual Reproduction**
4. Why do Paulie and Nicole have so many different traits?
 - a. Paulie got more DNA from their mom, while Nicole got more DNA from their dad.
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 - c. Unequal chromosome distribution
 - d. **Mutation**