

Variation in Traits

Lesson 7b: Variation in Traits and the Environment Affect Mice

Grade 3	Length of lesson: 45 minutes	Placement of lesson in unit: 7b of 7 two-part lessons on variation in traits
Unit central question: Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?		Lesson focus question: When mice survive long enough to have babies, what will the next generation look like?
Main learning goal: Variation in traits and the environment affect which living things of the same kind survive long enough to produce young.		
Science content storyline: Trait variations, such as the color of a mouse’s fur, can affect which living things of the same kind survive in their environment and which don’t. In a particular environment, some trait variations give certain individuals a better chance of surviving and producing offspring that will carry those variations into the next generation.		
Ideal student response to the focus question: Light-colored and dark-colored mice live in a field at the base of a mountain that’s a volcano. There are variations in the fur-color trait of the mice. Some mice are white, some are tan, and some are black. After the volcano erupts, the environment of the mice changes from a light-colored environment (field) to a dark-colored environment (hardened lava). When a hawk looks over the new dark lava for a mouse to eat, it’s more likely to see the white or tan mice, so many of them won’t survive because the hawk will eat them. Because the mice with black fur blend in with the dark lava, it’s more likely they won’t be eaten, so they have a better chance of surviving long enough to have baby mice. Black-furred parents have babies that also have black fur. In the next generation of mice, there will be more baby mice with black fur than baby mice with either white or tan fur.		

Preparation

Materials

- Science notebooks
- Chart paper and markers
- Colored pencils or markers—brown, black, and white (from lesson 7a) (1 set per student)

Student Handouts

- 7.1 Cartoon Summary of Mice in a Field Environment (from lesson 7a)
- 7.2 Cartoon Summary of Mice in a Lava Environment (1 per student)

Ahead of Time

- Review the content background document, especially sections 3 and 4 on variation.
- **ELL support:** This lesson is heavily language and explanation based, so ELL students will need strong support to succeed in understanding the content and participating in the activities. Consider making visual resources from previous lessons (data tables, charts, and photographs) available for students to refer to throughout the lesson. Introduce ELL students to the lesson materials, structure, and content in advance so they know what’s expected of them and can follow along and participate. In particular, review key science concepts, review part 1 of the story from lesson 7a, introduce part 2 of the story, and familiarize students with the handout. As needed, review the words *next generation*, *inherit/inheritance*, *inherited traits*, *offspring*, *variation*, *produce young*, *most likely*, and *survive long enough*. Introduce the phrase *equal chance of surviving*.

Lesson 7b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
4 min	<p>Link to previous lesson: Students consider how the unit central question relates to the story about mice in a field environment.</p>	<ul style="list-style-type: none"> Variation in fur color and the environment where mice live affect which mice survive and, therefore, what the next generation of mice will look like.
1 min	<p>Lesson focus question: The teacher reviews the focus question from the previous lesson: <i>When mice survive long enough to have babies, what will the next generation look like?</i> Then the teacher revisits the unit central question: <i>Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?</i></p>	
10 min	<p>Setup for activity: The teacher tells students the second part of a story about mice living in a field near the top of a mountain. Students predict which variation in the fur-color trait will give the mice a survival advantage when the environment changes.</p>	<ul style="list-style-type: none"> Trait variations among individuals of the same kind of living thing can affect which of them survive and which don't when the environment changes.
10 min	<p>Activity: Students complete a cartoon summary showing which mice (tan, white, or black) will survive long enough in the changed environment to produce young.</p>	<ul style="list-style-type: none"> When the environment changes, some trait variations in living things of the same kind, such as fur color in mice, give certain individuals a survival advantage.
10 min	<p>Follow-up to activity: Students share their cartoon summaries and construct explanations stating why they think the tan, white, or black mice will survive long enough to have babies in the changed environment.</p>	<ul style="list-style-type: none"> The living things that survive in a changed environment will be more likely to produce young that have the same trait variations as their parents, such as fur color.
10 min	<p>Synthesize/summarize today's lesson: Students consider whether variation in the fur-color trait gives some mice a survival advantage in different environments and whether a particular trait variation will become more common in the next generation of mice. Then the teacher summarizes key science ideas from the unit.</p>	<ul style="list-style-type: none"> Trait variations and the environment affect which living things of the same kind survive long enough to produce young (babies). The trait variations of individuals that survive and produce offspring become more common in the next generation.

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			<p>Do you think all of the mice in our story have an equal chance of surviving if the environment changes? That’s what we’ll investigate in today’s lesson.</p> <p>ELL support: Since ELL students may not be familiar with the phrase <i>equal chance of surviving</i>, discuss what it means during the lesson preview.</p> <p>NOTE TO TEACHER: <i>Make sure students understand what the phrase “equal chance of surviving” means.</i></p>		
1 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher reviews the focus question from the previous lesson: <i>When mice survive long enough to have babies, what will the next generation look like?</i> Then the teacher revisits the unit central question: <i>Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 4.</p> <p>In this lesson, we’ll continue thinking about our focus question from last time: <i>When mice survive long enough to have babies, what will the next generation look like?</i></p> <p>The information we gather to help us answer this question will also help us answer our unit central question: <i>Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?</i></p>		
10 min	Setup for Activity		Last time, I told you a story about mice that live in a field near the top of a mountain.		

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		Ask questions to elicit student ideas and predictions.	<p>Show slide 7.</p> <p>Eventually, some of the mice came back looking for food. The hawks came back too, looking for mice to eat.</p> <p>Now let’s review the whole story one more time. As you look at each picture on the slides, think about the changes that took place in the environment. Also think about the fur-color trait of the mice and whether it matters in their survival.</p> <p>NOTE TO TEACHER: <i>Return to slide 5 and tell students parts 1 and 2 of the story again, advancing the slides as indicated.</i></p> <p>Show slide 8.</p> <p>So which mice do you think are more likely to survive in the changed environment? Why do you think so?</p> <p>Turn and Talk: Discuss these questions with an elbow partner. Then write your predictions and reasoning in your science notebooks using the sentence starter on the slide:</p> <p><i>I predict more [tan/white/black] mice will survive in the changed environment because _____.</i></p> <p>ELL support: To reinforce English-language development and ELL students’ understandings of</p>		

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			<p>the science content, have students practice completing this sentence orally during the lesson preview.</p> <p>Whole-class share-out: Let’s hear some of your predictions. Which color of mice do you think are more likely to survive in this changed environment, and why do you think so?</p> <p>NOTE TO TEACHER: <i>This class discussion will prepare students for completing handout 7.2 (Cartoon Summary of Mice in a Lava Environment), but keep it brief. You might want to begin by asking for a show of hands to find out whether students made the same predictions. As students share their predictions and ideas, record them on chart paper. Students will revisit their predictions during the activity follow-up.</i></p>	<p>I think the tan mice will survive because there are more of them.</p> <p>I think the black mice have a better chance of surviving because they blend in with the black lava, and the hawks won’t see them.</p> <p>Before, there were grass and plants in the environment, and the tan mice blended in better. But now there’s hard, black lava, and the black mice blend in better. Since the hawks won’t see them as</p>	<p>Tell us more about your thinking.</p> <p>Does blending in matter? In what ways?</p>

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				easily, more of the black mice will survive.	
10 min	<p>Activity</p> <p>Synopsis: Students complete a cartoon summary showing which mice (tan, white, or black) will survive long enough in the changed environment to produce young.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> When the environment changes, some trait variations in living things of the same kind, such as fur color in mice, give certain individuals a survival advantage. 	<p>Select content representations and models matched to the learning goal and engage students in their use.</p> <p>Make explicit links between science ideas and activities during the activity.</p> <p>Engage students in using and applying new science ideas in a variety of ways and</p>	<p>In our last lesson, we worked together on a cartoon summary showing which mice were more likely to survive in the field environment.</p> <p>Show slide 9.</p> <p>Today I'd like you to complete another cartoon summary on your own. This time, think about which mice are more likely to survive after their environment changed and the hardened lava from the volcano turned the ground black.</p> <p>Will variations in the fur-color trait affect which mice survive in their new environment?</p> <p>Keep your earlier predictions in mind as you complete your summaries.</p> <p>NOTE TO TEACHER: <i>Distribute handout 7.2 (Cartoon Summary of Mice in a Lava Environment) and walk students through the directions for each box. If you think students will benefit from working together on the handout, allow them to complete it with a partner.</i></p> <p><i>To help students visualize this new scenario from the hawks' perspective, ask them to imagine that they're hawks flying over the field. As they look down from the sky, which mice would be easier to</i></p>		

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		contexts.	<p><i>see? Which mice would be harder to see? It might also help to remind students of the desert simulation and the colors of pom-pom beetles that were easier for lizards to see in each environment.</i></p> <p>Although this handout is almost the same as the one from last time, the environment has changed, so your answers may be different. Before we begin, let's review the directions for each box and think about what the hawks might see as they look down at this new environment from the sky.</p> <p>NOTE TO TEACHER: <i>During the activity, circulate around the room and observe whether students are connecting to key science ideas about traits, trait variation, the environment, survival, and traits in the next generation.</i></p> <p><i>Students should realize that the black mice are more likely to survive in this changed environment and produce the next generation of mice with black fur. Note whether students reach this conclusion before the follow-up discussion.</i></p>		
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students share their cartoon summaries and construct explanations stating why they think the tan, white, or black mice will survive long enough to have</p>		<p>Show slide 10.</p> <p>Let's revisit your predictions before sharing your cartoon summaries. Before the activity, some of you thought more of the <i>[tan, white, black]</i> mice would survive.</p> <p>NOTE TO TEACHER: <i>During this discussion, refer to the student predictions you recorded earlier</i></p>		

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	<p>babies in the changed environment.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> The living things that survive in a changed environment will be more likely to produce young that have the same trait variations as their parents, such as fur color. 	<p>Ask questions to elicit student ideas and predictions.</p> <p>Engage students in constructing explanations and arguments.</p> <p>Make explicit links between science ideas and activities after the activity.</p> <p>Highlight key science ideas and focus</p>	<p><i>on chart paper.</i></p> <p>Did any of you change your minds as you completed the cartoon summary? Why?</p> <p>Show slide 11.</p> <p>Now let’s talk about the cartoon summaries you completed. As you share your summaries and drawings, explain how you figured out which variation or variations in the fur-color trait would help them survive in this changed environment.</p> <p>NOTE TO TEACHER: <i>You might display one or two student summaries on a document reader during this discussion. Build a consensus among students that mice with the black fur-color trait are more likely to survive in this darker lava environment.</i></p> <p>So do we all agree that the mice with black fur-color trait are more likely to survive in this lava environment?</p> <p>If these mice survive long enough to have baby mice, which fur color do you think the babies will have? Why do you think so?</p> <p>Show slide 12.</p> <p>These questions relate to our focus question, <i>When mice survive long enough to have babies, what will the next generation look like?</i></p>		

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		question throughout.	<p>Use the sentence starter on the slide to write an answer to this question in your science notebooks.</p> <p><i>I think the next generation of mice will have [tan/white/black] fur because _____.</i></p> <p>Make sure to include evidence from the cartoon summary in your explanation. Also try to use the science words from our word wall in your answers.</p> <p>NOTE TO TEACHER: <i>For this writing activity, you may want to provide more than one sentence starter for students to choose from. If time allows, have students discuss the question with an elbow partner before writing down their explanations. Then create a summary statement as a class. This will enable you to gauge which students grasp the science concepts and which students still need help. Remind students that offspring often resemble their parents, as is the case with fur color in mice and their offspring.</i></p> <p><i>Encourage students to use vocabulary terms from this unit in their explanations, including trait, variation, trait variation, inherited traits, environment, survive, tan/white/black mice, produce young/offspring/baby mice, and next generation. Make sure these and other vocabulary words from this unit are displayed on a word wall so that students can refer to them.</i></p>		

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10 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students consider whether variation in the fur-color trait gives some mice a survival advantage in different environments and whether a particular trait variation will become more common in the next generation of mice. Then the teacher summarizes key science ideas from the unit.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Trait variations and the environment affect which living things of the same kind survive long enough to produce young (babies). The trait variations of individuals that survive and produce offspring become more common in the next generation. 	Engage students in making connections by synthesizing and summarizing key science ideas.	<p>Show slide 13.</p> <p>Now let's revisit our unit central question, <i>Do all of the mice living in the same environment, such as a field or forest, have an equal chance of surviving?</i></p> <p>Show slide 14.</p> <p>Turn and Talk: Think about the mice in the field environment <i>before</i> the volcano erupted and talk with an elbow partner about the questions on the slide.</p> <ul style="list-style-type: none"> • Which variation in the fur-color trait gave the mice more of a survival advantage <i>before</i> the volcano erupted? • Which color of mice (tan, white, or black) do you think would become <i>more common</i> over time if the environment stayed the same? Why do you think so? <p>Whole-class discussion: Let's hear your ideas. Do you think all of the mice have an equal chance of surviving in a field environment? Why or why not?</p> <p>Show slide 15.</p> <p>Turn and Talk: Now think about the mice in the lava environment <i>after</i> the volcano erupted and talk with your partner about the questions on the slide.</p> <ul style="list-style-type: none"> • Which variation in the fur-color trait gave the mice a survival advantage <i>after</i> the volcano 		

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		Summarize key science ideas.	<p>erupted?</p> <ul style="list-style-type: none"> Which color of mice (tan, white, or black) do you think would become <i>more common</i> over time in the lava environment? Why do you think so? <p>Whole-class discussion: Let’s hear your ideas. Do you think all of the mice have an equal chance of surviving in a lava environment? Why or why not?</p> <p>NOTE TO TEACHER: <i>Help students understand that living things don’t have an equal chance of surviving in their environment. Survival depends on trait variations and the environment. If the environment changes, the trait variations that enable living things to survive will likely be different from the variations that enabled living things to survive in the previous environment. So variation in traits and the environment matter in the survival of living things.</i></p> <p>Show slide 16.</p> <p>In this unit, we investigated trait variation in many kinds of living things—from ladybugs to carrots and leaves, from desert beetles to moths, birds, cacti, and mice.</p> <p>We discovered that variation in traits <i>and</i> the environment affect which living things of the same kind survive long enough to produce young, or babies.</p>		

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			<p>When the environment changes, living things with trait variations that blend into the environment have a better chance of surviving.</p> <p>Living things of the same kind that <i>survive</i> pass on their trait variations to the next generation, and over time, these variations become more common.</p> <p>Show slide 17.</p> <p>So traits, variation, and the environment all matter in the survival of living things of the same kind and their ability to pass on their traits to the next generation.</p> <p>Next time you see beetles, cacti, cats, or mice, think about the trait variations that help these living things survive in their environment!</p>		