Variation in Traits
Lesson 7a: The Next Generation of Mice

Grade 3	Length of lesson: 45 minutes	Placement of lesson in unit: 7a 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. There are variations in the fur-color trait of the mice. Some mice are white, some are tan, and some are black. Initially, the environment of the mice is a light-colored field or meadow. When a hawk looks over the field for a mouse to eat, it's more likely to see the white or black mice, so many of them won't survive because the hawk will eat them. Because the mice with tan fur don't show up as well in the light-colored field, it's more likely they won't be eaten, so they have a better chance of surviving long enough to have baby mice. Tan-furred parents have babies that also have tan fur. In the next generation of mice, there will be more baby mice with tan fur than baby mice with either white or black fur.

Preparation

Materials Needed
- Science notebooks
- Chart paper and markers
- Colored pencils or markers—brown, black, and white
  (1 set per student)

Student Handouts
- 7.1 Cartoon Summary of Mice in a Field 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) 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 participate. In particular, review key science concepts, introduce the story, and familiarize students with the handout. As needed, review the words *inherit/inheritance*, *inherited traits*, *offspring*, *variation*, *produce young*, *most likely*, and *survive long enough*. Introduce the following vocabulary terms: *next generation*, *main predator*, *spot the mice*, and *swoop down*.

Lesson 7a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	**Link to previous lesson:** Students share what they learned from the desert model about how trait variations and the environment affect which beetles survive long enough to produce young. Then they consider what the next generation of beetles will look like.	• Variation in the color trait and the environment affect what the next generation of beetles will look like.
1 min	**Lesson focus question:** The teacher introduces the focus question, *When mice survive long enough to have babies, what will the next generation look like?*	
5 min	**Setup for activity:** Students consider how key science ideas about traits, variation, survival, and the environment apply to mice.	• Trait variations among individuals of the same kind of living thing affect which individuals survive in their environment and which don't.
10 min	**Activity:** The teacher tells students the first 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 more mice a survival advantage in this environment.	• In a particular environment, some trait variations, such as fur color in mice, give individuals of the same kind of living thing a better chance of surviving.
15 min	**Follow-up to activity:** Students complete a cartoon summary showing which mice (tan, white, or black) will survive long enough in their environment to produce young.	• The living things that survive in a particular environment will be more likely to produce young that have the same trait variations as their parents, such as fur color.
8 min	**Synthesize/summarize today's lesson:** Students review key science ideas from the cartoon summary of mice in a field environment. Then they answer the focus question based on the summary.	• 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.
1 min	**Link to next lesson:** Linking to the next lesson, the teacher asks students to consider what will happen when the mice's environment in the story changes and whether the tan mice will still be more likely to survive long enough to produce young.	

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5 min	**Link to Previous Lesson** **Synopsis:** Students share what they learned from the desert model about how trait variations and the environment affect which beetles survive long enough to produce young. Then they consider what the next generation of beetles will look like. **Main science idea(s):** • Variation in the color trait and the environment affect what the next generation of beetles will look like.	Engage students in making connections by synthesizing and summarizing key science ideas.	**Show slides 1 and 2.** Let's think about our desert model and what we learned about traits and variation from the beetles. **NOTE TO TEACHER:** *Keep this review of the key science ideas brief. Don't encourage a lot of discussion at this point.* What trait of the desert beetles varied? Who can summarize in your own words whether the *color* of the beetles made a difference in their survival? Make sure to include your evidence from the data tables we created. Who can summarize in your own words whether the *environment* where the beetles live made a	The beetles were different colors. The color trait. The color of the beetles mattered because some colors blended in better with the environment. The data we collected showed that beetles with those colors survived longer because the lizards couldn't see them as well.	What is the trait that varied?

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			difference in their survival? Make sure to include evidence for our simulations.	With the first piece of fabric, more of the *[X color]* beetles survived. The environment where the desert beetles live. No. When the fabric was browner, more of the *[Y color]* beetles survived. Yes, because more *[Y color]* beetles survived. Our data table. The beetles that didn't match the environment got eaten, and the ones that did match survived.	What did the fabric represent? Did we get the same result when the environment changed? Did variation in the color trait matter in the changed environment? Where did the evidence come from? Tell us more about what you mean by

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					"didn't match" and "did match."
		Summarize key science ideas.	In our last lesson, we learned that animals *inherit* traits from their parents. The color of the beetles is one example of an *inherited trait*. That means the baby beetles got their color from their parents. If only black beetles live in an environment, what will the next generation of beetles look like? Great discussion! So we discovered from our desert model that both the environment and variations in the beetles' color trait affected whether or not they survived long enough to have babies. Today we'll apply everything we've learned about traits, variation, the environment, and survival to a real situation.	Black beetles will have only black baby beetles.	Does anyone disagree? Why?
1 min	**Lesson Focus Question** **Synopsis:** The teacher introduces the focus question, *When mice survive long enough to have babies, what will the next generation look like?*	Set the purpose with a <u>focus question</u> or goal statement.	**Show slide 3.** In this lesson, we'll investigate mice instead of beetles. Our focus question is *When mice survive long enough to have babies, what will the next generation look like?*		

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			Write this question in your science notebooks and draw a box around it. **NOTE TO TEACHER:** *Write the focus question on the board for students to refer to throughout the lesson.*		
5 min	**Setup for Activity** **Synopsis:** Students consider how key science ideas about traits, variation, survival, and the environment apply to mice. **Main science idea(s):** • Trait variations among individuals of the same kind of living thing affect which individuals survive in their environment and which don't.	Link science ideas to other science ideas.	**Show slide 4.** First, let's find out what you already know about mice by listing some of their *traits* and possible *variations*. What *traits* do mice have? **NOTE TO TEACHER:** *The purpose of these questions is to engage students in the subject matter of today's lesson. If students know very little about mice, don't spend time educating them at this point.* What do you know about the *environment* where mice live?	Mice are small. People scream when they see them. They have four feet. They have big ears. They have fur. They live in barns and on farms. They live in fields.	*Questions to ask:* • Is that a trait in the mice or people? • Are there any variations in those traits? • Do all mice look the same? Tell me more about mice living on farms. What do mice need from their

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					environment?
			What might a mouse be afraid of? What kinds of animals might eat a mouse?	Cats. Hawks. Coyotes.	
			Earlier, someone mentioned that one trait of a mouse is fur. Do you think the fur-color trait of mice shows any variations or differences?	Some mice are brown, and some mice are white. I saw pictures of mice.	What's your evidence?
		Make explicit links between science ideas and activities **before** the activity.	**Show slide 5.** Today we'll look at the fur-color trait in mice and think about whether variations in this trait might help mice survive in their environment. Do you have any ideas about whether variations in the fur-color trait of mice might give them a better chance of surviving? **NOTE TO TEACHER:** *Based on the desert model, some students might say that the mice will survive better if they match the color of their environment.* We'll also think about what the next generation of mice from surviving parents might look like.		

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10 min	**Activity** **Synopsis:** The teacher tells students the first 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 more mice a survival advantage in this environment. **Main science idea(s):** • In a particular environment, some trait variations, such as fur color in mice, give individuals of the same kind of living thing a better chance of surviving.	Engage students in using and applying new science ideas in a variety of ways and contexts.	Next, I'm going to tell you the first part of a story about mice on a mountain. Listen carefully to the story and think about the fur-color trait of the mice. **ELL support:** Share the story with ELL students ahead of time, making sure they understand the actors, the scenario, and the potential action. Phrases such as *main predator*, *spot the mice*, and *swoop down* may be unfamiliar to them, so provide additional language support as needed. **Show slide 6.** A lot of mice lived in a field near the top of a mountain. Most of the mice were light brown, or tan, in color, but this trait varied. Other mice were black or white. Hawks were the mice's main predator. This means that the hawks liked to eat mice. As the hawks flew over the field, they would spot the mice and swoop down to catch them. Whenever a hawk caught a mouse, the hawk would eat it. Look at the picture on the slide and think about the environment where the mice live. Don't forget about the hawks! They're part of the environment too.		
		Make explicit links between science ideas and activities	Now think about the *color variation* of the mice. Some mice are tan, some are white, and some are black.		

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		during the activity.	Which color variation will help the mice survive best in this environment? **NOTE TO TEACHER:** *Ask for a show of hands indicating which color of mouse (tan, black, or white) students think will survive best in their environment. Record the results on chart paper. If responses vary widely, ask, "Which mice will the hawk see more easily in this environment? Which mice blend in better, and which don't?"* *To help students visualize this 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 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.* Do we all agree that the mice with tan fur are more likely to survive in this environment?	I think the tan mice will survive best because there are more of them. I think all colors of mice will survive because there are a lot of mice for the hawks to eat. Fur color doesn't matter because all of the mice are food for the hawks. You can see the black mice and the white mice easier in this picture. The tan mice blend in better. The hawks won't see the tan mice as easily.	Tell us more about your thinking. So are you saying that the color of a mouse's fur doesn't matter? Does anyone disagree? Does blending in matter? In what ways?

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			Which *color* of mice do you think will live long enough to have baby mice?	The tan mice.	Why do you think that?
		Ask questions to elicit student ideas and predictions.	**Show slide 7.** Now let's think about the baby mice. If two mice with tan fur have a baby, what color fur do you think the baby will have?	The baby's fur could be any color. Because we saw that the kittens weren't the same color as their parents.	Why do you think that?
			What if I told you that the color trait is inherited from the parent mice? What color do you think the baby mouse would be? **NOTE TO TEACHER:** *If the color variation in the kittens and cats from the previous lesson confuses students, tell them that the color trait in mice is like the color trait in beetles, both of which are inherited from the parents.*	The baby would be tan too. I guess the color trait is different for cats.	
15 min	**Follow-Up to Activity** **Synopsis:** Students complete a cartoon summary showing which mice (tan, white, or black) will survive long enough in their	Make explicit links between science ideas and activities **after** the activity.	**Show slide 8.** This is a lot to think about, isn't it? Let's review some key science ideas about the mice: • The mice show variation in the fur-color. Some mice are tan, some are white, and some are black.		

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	environment to produce young. **Main science idea(s):** • The living things that survive in a particular environment will be more likely to produce young that have the same trait variations as their parents, such as fur color.	Summarize key science ideas. Select content representations and models matched to the learning goal and engage students in their use. Engage students in analyzing and interpreting data and observations.	• Some variations in fur color help the mice blend into their environment better so the hawks can't see them as easily. These trait variations give the mice a better chance of surviving. • The mice that survive long enough can have baby mice. • The baby mice will have the same color variation as their parents. **Show slide 9.** Let's look at these science ideas another way by completing a cartoon summary of the story as a class. This activity will help us visualize all of our science ideas about the mice and what happens to them. **NOTE TO TEACHER:** *Distribute handout 7.1 (Cartoon Summary of Mice in a Field Environment) and walk student through the directions for each box.* **ELL support:** Go over the handout directions with ELL students during the lesson preview to make sure they understand what they're being asked to do. You may want to complete the handout together for practice so they can participate more fully during the actual activity. Let's read through the handout and then complete each box together.		

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			NOTE TO TEACHER: *Complete the handout as a class, unless you think students understand the directions well enough to work with a partner. Students will complete another cartoon summary in the next lesson, at which point they may have enough understanding to complete it on their own or with a partner.* *As you fill in box 2, students may think that all of the white and black mice will be eaten. Help them realize that some of the white and black mice will survive, just not as many as the tan mice.*		
8 min	**Synthesize/Summarize Today's Lesson** **Synopsis:** Students review key science ideas from the cartoon summary of mice in a field environment. Then they answer the focus question based on the summary. **Main science idea(s):** • Trait variations and the environment affect which living things of the same kind survive long enough to produce young (babies). The trait variations of	Highlight key science ideas and focus question throughout. Engage students in making connections by synthesizing and summarizing key science ideas.	**Show slide 10.** Throughout this lesson, we've been thinking about this focus question: *When mice survive long enough to have babies, what will the next generation look like?* Today we used a cartoon summary to help us visualize our story about the mice and explore how variations in the fur-color trait might help the mice survive long enough to have babies. Let's review what we discovered. **NOTE TO TEACHER:** *For this review, project either the class summary or a student's summary on a document reader.* What are the variations in the fur-color trait of the mice?	The mice are tan, white, and black.	

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	individuals that survive and produce offspring become more common in the next generation.		Which colors of mice do the hawks eat more of? Which fur-color trait do most of the surviving mice have? Which fur-color trait will the next generation of mice be more likely to have? **Show slide 11.** Now I'd like you to write an answer to the focus question in your science notebooks using the sentence starter on the slide: *When mice survive long enough in a field environment to have babies, the next generation will look like _____.* Make sure to include key science ideas from our cartoon summary in your explanations. **Whole-group share-out:** So how did you complete the sentence on the slide? **NOTE TO TEACHER:** *Invite as many students to share their sentences as time allows.*	The hawks eat more of the white and black mice. Most of the surviving mice have tan fur. Because more of the tan mice survive, there will be more baby mice with tan fur.	

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1 min	**Link to Next Lesson** **Synopsis:** Linking to the next lesson, the teacher asks students to consider what will happen when the mice's environment in the story changes and whether the tan mice will still be more likely to survive long enough to produce young.	Link science ideas to other science ideas.	**Show slide 12.** Today you heard a story about mice living in a field near the top of a mountain. Most of the mice had tan-colored fur, but some had black or white fur. Hawks flew over the field and swooped down to catch any of the mice they spotted. The mice with tan fur blended into their environment better, so more of them survived than the black or white mice. What do you think might happen if the mice's environment changes? Will the mice with tan-colored fur still be more likely to survive long enough to have babies? Stay tuned for part 2 of our story!		