





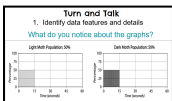
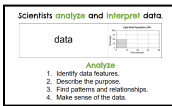
<b>Unit of Inquiry Name:</b> Loving Life	~120 minutes	<b>Lesson # 4</b>
<b>Learning Event 2:</b> Students make sense of patterns and relationships in observations and data through representation, analysis, and interpretation.		
<b>NGSS 3 Dimensional Lesson Concept:</b> Construct an argument with evidence that different traits of the same species provide advantages in surviving and reproducing that cause some traits to increase and others to decrease or change over time.		
<b>SEP 3-LS4-2 Constructing Explanations and Designing Solutions.</b> Use evidence to construct an explanation. <b>DCI 3-LS3-1: Variation of Traits.</b> Different organisms vary in how they look and function because they have different inherited information. <b>3-LS4-2: Natural Selection.</b> Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates and reproducing. <b>CCC 3-LS4-4: Cause and Effect.</b> Cause and effect relationships are routinely identified and used to explain change.		
<b>Anchor Phenomenon:</b> Plants and animals have unique life cycles and inherited traits that help them survive and thrive. ( <a href="#">Life Cycle of a Butterfly</a> ) <b>Lesson Investigative Phenomenon:</b> <a href="#">Peppered Moth Natural Selection</a> and Selection/ Varieties of Fruit		
<b>ELD Language Target:</b> Exchanging information and ideas with others through oral collaborative discussions on a range of social and academic topics (SL.3.1, 6; L.3.1, 3, 6), Connecting and condensing ideas (W.3.1-3, 5; SL.3.4, 6; L.3.1, 3, 6) - Making inferences based on observations and evidence		
<b>Key Vocabulary:</b> gratitude, survival, traits, natural selection, varieties, selection		
<b>Habits of Mind #12 &amp; 15:</b> (12) Responding with Wonderment and Awe (15) Thinking Interdependently: Working together! Teamwork!		

Materials Needed	Prepare
<ul style="list-style-type: none"> <li><a href="#">Resource Slides: Lesson 4</a></li> <li>Nature Journals</li> </ul>	<ul style="list-style-type: none"> <li>Share <a href="#">Peppered Moth Game</a> over Google Classroom.</li> <li>Share <a href="#">Resource Slides: Lesson 4</a> on the screen with students.</li> <li>Review <a href="#">Phenomenon Wall</a> before starting the lesson to review the goals of the lesson.</li> <li>Share the <a href="#">Lesson 4 Student Celebration of Learning</a> slides as a formative assessment for students to complete individually after Lesson 4.</li> </ul>



<div><p>Trails of the monarch caterpillar:</p></div> <div><p>Trails of the monarch butterfly:</p></div> <div><p>Look at Your Nature Journals</p><p>List all of the traits you have observed</p><ul style="list-style-type: none"><li>• Color</li><li>• Shape</li><li>• Size</li><li>• Behaviors</li><li>• Measurements</li></ul></div> <div><p>TRAITS We Have Observed</p><table border="1"><tr><td></td><td></td><td></td></tr></table><p>Which traits might help a living thing survive?</p><p>_____ would be helpful because _____.</p></div> <div><p>Peppered Moth</p><div><p>I see...</p><p>I think...</p><p>I wonder...</p></div></div>				<p><b>DCI 3-LS3-1: Variation of Traits.</b></p> <p><b><i>What traits do we recognize of the monarch butterfly caterpillar?</i></b></p> <p><b><i>And what traits do we recognize of the monarch butterfly after its metamorphosis?</i></b></p> <p><b><i>Do you think you would be able to recognize a monarch caterpillar or a monarch butterfly in the wild, based on these characteristics?</i></b></p> <p><b><i>Let’s all take a minute to look at our Nature Journals and think about the plant or animal we’ve been focusing on. In your groups, list as many specific traits that you’ve observed. Think about size, color, shape, things that are quantifiable (that you can count or measure) or behaviors you’ve observed.</i></b></p> <p><b><i>Choose someone from your group to share 3-5 traits of your plant or animal with the class. I will record them on our slide, so we can see a variety of traits.</i></b></p> <p><b><i>Looking at these traits you observed, do you see any traits that might help a living thing survive? Why might that be helpful?</i></b> Invite students to use the sentence frame to share helpful traits. Students may share about camouflage at this point, but it is not necessary. It will most likely come up in the next question.</p> <p><b><i>Here is the insect we are going to learn more about today. It is called a peppered moth. Turn and Talk to a partner about what you see, what you think and what you are wondering.</i></b> Partners turn and talk about what they notice. Select a few students to share out their ideas. Do not validate or correct any of their thinking, this is initial thinking that will continue to develop over the course of the lesson.</p>	<p>Students share the traits they recognize of the monarch caterpillar.</p> <p>Students share traits they recognize of the monarch butterfly.</p> <p>Students share whether they think they would recognize monarch caterpillars or butterflies in the wild based on their traits.</p> <p>Students work in their groups to list traits of their plants and animals.</p> <p>Students share the traits of their plants and animals as the teacher records them on the slide.</p> <table><tr><th>Expected Student Response</th></tr><tr><td><ul style="list-style-type: none"><li>• Bright coloring on the flowers is helpful because it attracts pollinators.</li><li>• A sharp beak is helpful so the bird can collect food and eat.</li><li>• Green skin is helpful because the caterpillar can camouflage and stay safe.</li></ul></td></tr></table>	Expected Student Response	<ul style="list-style-type: none"><li>• Bright coloring on the flowers is helpful because it attracts pollinators.</li><li>• A sharp beak is helpful so the bird can collect food and eat.</li><li>• Green skin is helpful because the caterpillar can camouflage and stay safe.</li></ul>
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Lesson 4  
Explore/  
Explain  
(Inside)  
50 minutes



## DCI 3-LS4-2: Natural Selection.

**Great work identifying traits that make plants and animals unique, scientists! We are going to jump into an activity right now that will give us the chance to see how different traits provide advantages for survival. We are going to learn about this through experience by pretending that we're birds.**

**In just a moment, you will get the chance to play the Peppered Moth Game. First, you will choose a forest - either the Light forest or the Dark forest.**

**Once you choose your forest, you will be taken to a new screen where you will become a bird trying to eat moths. You will move the bird with your mouse and eat the moths by clicking on them. As you play, the game will be collecting data. You will see a graph changing and recording the data from the game. It will organize the data.**

**Data are facts and statistics, or information, collected together for reference or analysis. Once data is collected and organized, we, as scientists, will analyze and interpret the data. Step 1 is to identify the data features and details.**

### What do you notice about the graph?

Allow students to discuss with a partner, then invite them to share observations to discuss whole group. By asking clarifying questions to probe thinking and rephrasing using related vocabulary, ensure that you highlight the following graph features.

- Title - Light and Dark Moth Populations
- Units on x and y axis - Tells you the amount of moths

Possible facilitator questions:

**What are these graphs all about?**

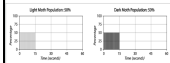
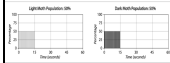


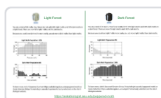

**What do the numbers across the bottom tell us, the x axis?**

**What do the numbers up the side measure?**

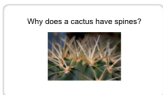
Students discuss initial analysis of graph features.  
Select students share out observations.

### Expected Student Response

- The graph is about light and dark moth populations.
- As we move from left to right, it shows us how much time has gone by.
- Up and down tells you the percentage of that kind of moth.

<div><p>2. Describe the Purpose</p><p>What can we learn from this data?</p></div> <div><p>3. Identify Initial Patterns</p><p>Do you notice any patterns so far?</p></div> <div><p>PEPPERED MOTHS</p></div> <div><p>Scientists analyze and interpret data.</p><p>data</p><p>Interpret!</p><ol style="list-style-type: none"><li>1. Connect back to purpose of the data.</li><li>2. What do the data and patterns tell you?</li><li>3. What claim does the data support?</li><li>4. How will you communicate about the data?</li></ol></div> <div></div> <div><p>After interpreting the data,</p><p>What <b>claim</b> can we make about light and dark colored moths?</p></div>	<p><b>Next, let's think about the purpose of collecting this data.</b></p> <p>Possible facilitator questions:</p> <p><b><i>What can we learn from this data?</i></b></p> <p><b><i>What data do we have so far?</i></b></p> <p><b><i>Do you notice any patterns?</i></b></p> <p><b><i>Now, we're ready to play the Peppered Moths Game. You will find the link to the game in Google Classroom - <a href="https://askabiologist.asu.edu/peppered-moths-game/play.html">https://askabiologist.asu.edu/peppered-moths-game/play.html</a>. Click on the link to play the Peppered Moths game. You'll have 5 minutes to hopefully play twice - once in the light forest and once in the dark forest. Please, save the results from your game and we'll look at the results from a few of your games when we come back together as a class.</i></b></p> <p><b><i>Great job interacting with the game! I was already hearing observations you are making about the data and patterns you are noticing.</i></b></p> <p><b><i>Let's come together to continue analyzing and interpreting the data. To interpret, we first come back to the purpose of our data and think about what it tells us.</i></b></p> <p>When students return, show the example results on the slide and have them compare their percentages and results.</p> <p><b><i>What does the data tell you?</i></b></p> <p>Possible Facilitator Questions:</p> <p><b><i>Which moths were more likely to get eaten in the light forest? Why?</i></b></p> <p><b><i>Which moths were more likely to survive?</i></b></p> <p><b><i>Which moths were more likely to get eaten in the dark forest? Why?</i></b></p> <p><b><i>Which moths were more likely to survive?</i></b></p> <p><b><i>After interpreting the data, what <b>claim</b> can we make about light and dark colored moths?</i></b></p>	<table><tr><th>Expected Student Response</th></tr><tr><td><ul style="list-style-type: none"><li>• We are going to see how many of each kind of moth there is in the forest after we play the game.</li><li>• In this graph, they have been playing for 15 seconds. The game will go on for a minute.</li><li>• The percentages haven't changed, there are half light and half dark still. The percentages are the same, equal.</li></ul></td></tr></table> <p>Students play the Peppered Moths Game and save results so that they can share with the class or compare with other students.</p> <p>Students share their results from the game.</p> <p>Students make comparisons between their results and use evidence to construct an explanation for why dark moths are more likely to survive and thrive in the dark forest and why light moths are more likely to survive and thrive in the light forest.</p>	Expected Student Response	<ul style="list-style-type: none"><li>• We are going to see how many of each kind of moth there is in the forest after we play the game.</li><li>• In this graph, they have been playing for 15 seconds. The game will go on for a minute.</li><li>• The percentages haven't changed, there are half light and half dark still. The percentages are the same, equal.</li></ul>
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Explain/  
Reflect



There is a [link to a detailed article](#) you can read excerpts from about the natural selection of peppered moths with your students, or you could [play the video explanation](#) of the true story behind the peppered moths game which also explains the concept of natural selection.

***How might we record our data and explanation of the natural selection of peppered moths on this table together?***

Begin filling out the table with students, but leave gaps that they can fill out in their formative assessment.

**SEP 3-LS4-2 Constructing Explanations**

**CCC 3-LS4-4: Cause and Effect.**

Record students' thinking and demonstrate how they can complete this same table during their formative assessment at the end of this lesson.

***Examples of adaptations and traits that help animals survive and thrive in their environment are everywhere and all around us! Let's see if we can explain how other traits help plants and animals survive and thrive:***

***Why does a cactus have spines?***

***Why do leopards have spots?***






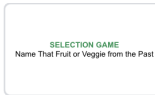
***Why are flowers bright colors?***

***Why do the underside of monarch butterfly wings look like this?***

***Why have monarch butterflies adapted to become poisonous?***

Students tell the teacher whether dark moths or light moths are more likely to survive in each forest and come up with an explanation to explain why. Their explanations may be about traits, adaptations and/or camouflage.

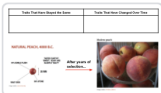
Students share responses to each question, sharing their thoughts and prior knowledge in response to each question.

 <p>Peppered moths have adapted to be able to act as camouflage about their environment. The color of the moths changes from pale to dark to match the color of the tree bark. This is a type of natural selection.</p>	<p><b><i>We have learned about how natural selection led to changes over time of peppered moths' traits and we have identified examples of other plant and animal traits that have changed over time through natural selection.</i></b></p>	
<p><b>SESSION 2</b> Launch</p>     	<p><b><i>Now, we're going to look at how traits can be selected over time by humans. We're going to try and answer the question:</i></b></p> <p><b><i>How can we select certain traits to pass on to offspring?</i></b></p> <p><b><i>We'll start by exploring how farmers, who are constantly using science, have selected certain traits in apples over time to create all of the different apple varieties we know and love, today.</i></b></p> <p>Watch the <a href="#">Mystery Science Q&amp;A clip: What's the biggest apple in the world?</a> The video is linked from the image on the slide.</p> <p>Watch the whole first clip 2:27 and then have students discuss: <b><i>Where do all of these different apples come from?</i></b></p> <p>Stop second video clip at 3:08 before the unrelated engineering challenge.</p> <p>Ask students how farmers and scientists select seeds to grow sweeter and larger apples. If they have dry erase boards, you can ask them to list the traits of apples they would most like to select and hold them up for everyone to see and compare.</p> <p><b><i>Most food we eat has been selected to look and taste the way it does over time. We're going to play a game to see if we can recognize fruits and vegetables that have been selected to look and taste quite differently over time.</i></b></p> <p><b>DCI 3-LS3-1: Variation of Traits.</b></p>	<p>Students share ideas about where they think these different apples come from.</p> <p>Students share how farmers and scientists select seeds to grow sweeter and larger varieties. Students all share what traits they would select for their dream apples.</p> <p>Students share a definition or example of traits.</p> <p>Students guess what each fruit from the past is called, today.</p> <p>Students share the traits that led to their guess.</p>



<div data-bbox="111 159 266 253"> <p>What TRAITS are the same? What TRAITS have changed over time?</p> <p><b>Trait:</b> something that makes one plant, animal or person different from another</p> </div> <div data-bbox="111 358 266 451"> <p>Can you name this fruit from the past?</p> <p>Use traits you can see as evidence for your guess.</p> </div> <div data-bbox="111 516 266 609"> <p>Use traits you can see as evidence for your guess.</p> </div> <div data-bbox="111 873 266 966"> <p>Can you name this vegetable from the past?</p> <p>Use traits you can see as evidence for your guess.</p> </div> <div data-bbox="111 1023 266 1115"> <p>Use traits you can see as evidence for your guess.</p> </div> <div data-bbox="111 1255 266 1347"> <p>Can you name this fruit from 4000 B.C.?</p> <p>Use traits you can see as evidence for your guess.</p> </div>	<p><b><i>In this next activity, we are going to compare what traits are the same and what traits have changed over time?</i></b></p> <p><b><i>Can someone define what a trait is in their own words or give an example?</i></b></p> <p>Give students an opportunity to try and identify the fruit on the slide (banana). If they have dry erase boards, they could each write their guess and hold it up at the same time.</p> <p><b><i>What traits can you see as evidence for your guess?</i></b></p> <p><b><i>Let's record traits that have stayed the same in bananas and traits that have changed over time.</i></b></p> <p>Record what students share on the chart. This will demonstrate what they will need to do on their formative assessment slides.</p> <p>Give students an opportunity to try and identify this vegetable (carrots). If they have dry erase boards, they could each write their guess and hold it up at the same time.</p> <p><b><i>What traits can you see as evidence for your guess?</i></b></p> <p><b><i>Let's record traits that have stayed the same in carrots and traits that have changed over time.</i></b></p> <p>Record what students share on the chart.</p> <p>Give students an opportunity to try and identify this fruit (peaches).</p> <p><b><i>What traits can you see as evidence for your guess?</i></b></p> <p><b><i>Let's record traits that have stayed the same in peaches and traits that have changed over time.</i></b></p>	<p>Students share what traits stayed the same (the peel around soft fruit, the basic shape, etc.) and what traits changed (the color of the peel, the seeds inside, etc.).</p> <p>Students guess what this vegetable from the past is called, today.</p> <p>Students share the traits that led to their guess. Students share what traits stayed the same and what traits changed over time in the carrot.</p> <p>Students guess what the fruit from the past is called, today. Students share the traits that led to their guess.</p> <p>Students share what traits stayed the same and what traits changed over time for the peach.</p> <p>Students guess what this fruit from the past is called, today.</p> <p>Students share the traits that led to their guess.</p> <p>Students share what traits stayed the same and what traits changed over time for the corn.</p>
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Record what students share on the chart.

Give students an opportunity to try and identify this vegetable (corn).

***What traits can you see as evidence for your guess?***

***Let's record traits that have stayed the same in corn and traits that have changed over time.***

Record what students share on the chart.

Watch and discuss the [2:39 minute clip "Corn is King"](#) from pbs.

***Your parents are from a different generation than you. Your grandparents are a different generation than your parents or you. Can one of you put in your own words what generation means?***

***What does it mean to plant and farm for the seventh generation? Can anyone put that into their own words?***

***Let's look at this quote from the short video:***

***"Native Americans feed a population of 100 million people by developing new foods from wild plants - the potato, the tomato, peanuts, chocolate, and dozens of varieties of beans and squash. Today, these crops provide 60% of the world's grown food."***

***What does this quote mean to you?***


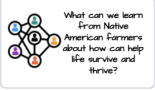
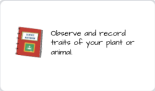


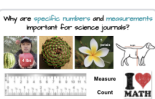
***We're going to watch one more [short clip](#) of a Native American, Zuni, farmer named Jim Enote (Eh-note) who has a powerful message about how important it is to listen to nature and the plants and animals if we want to help them survive and thrive.***

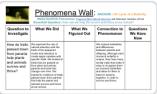



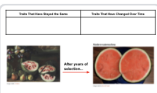
A student explains what generation means.


A student explains how farming for the seventh generation means planning for a long way in the future.

Students explain what they think the quote means and how Native Americans must have used selection to change the traits of wild plants into the foods we know and love, today.

Students share what we can learn from Native Americans from the clips we watched and how we

 	<p><b><i>What can we learn from Native American farmers that can help life survive and thrive?</i></b></p>	<p>can learn from their relationship with nature and plan for the future to help life survive and thrive.</p>
<p>Lesson 4 SESSION 2 Explore/ Explain (Outside)  30 minutes</p>    	<p><b><i>Great work identifying traits of plants and animals and exploring how those traits help plants and animals survive and thrive! Now, we are going to go outside and look closely at our plant or animal and record some of the traits we notice in our nature journals.</i></b></p> <p><b><i>We are going to experience a Zoom In, Zoom Out nature journaling exercise with John Muir Laws.</i></b></p> <p><b><i>During today's nature journaling exercise, we will challenge ourselves to record details and use numbers to record specific traits.</i></b></p> <p><b><i>Before we get started, let's get our journals and supplies ready.</i></b></p> <p>Students can watch the Zoom In, Zoom Out John Muir Laws Nature Journaling video together or on their own before working on a zoomed in page of their nature journal - focusing on the traits of their chosen plant or animal.</p> <p>Review the specific measurements and numbers that would be helpful to gather while observing their plant or animal.</p> <p><b><i>Remember, when you are zooming in and out on your plant or animal, look for the traits you observe to record and think about how those traits help your plant or animal survive and thrive.</i></b></p> <p>When students return to class, have them record data about the caterpillars and sprouting corn seeds.</p> <p><b><i>Let's record the traits we notice in our caterpillars and sprouting corn seeds. What do can we do to help the plants and animals in our classroom survive and thrive?</i></b></p>	<p>Students get their science journals.</p> <p>Students watch the John Muir Laws: Zoom In, Zoom Out lesson and then work on creating their own zoomed in journal entry with traits labeled.</p> <p>Students go outside with their science journals to observe and record the traits of the plant or animal in their journals.</p> <p>Students record observations and models of the plants and animals in the classroom and share what we can do to help them survive and thrive. Students care for plants and animals.</p>

<p>Lesson 4 Reflect/ Evaluate</p> <p>15 min.</p>     	<p><b><i>Scientists, you have done some great work, today, understanding natural selection and how to select different traits for survival and thriving! We have also learned about the incredible contributions of Native Americans to farming! We also went out to the schoolyard and zoomed in and out on the traits of your plants and animals. Let's work on writing down what we figured out, how it connects to the phenomenon of the life cycle of a butterfly and what new questions we have.</i></b></p> <p>Complete the Phenomenon Wall with students.</p> <p><b><i>Scientists, I am so proud of all of your hard work! Now, you are going to get to celebrate your knowledge and share what you've learned on a set of Google Slides you will find on Google Classroom. (<a href="#">Formative Assessment on Google Classroom</a>)</i></b></p> <p><b><i>You will find the slides on Google Classroom. The prompt will ask you to open the slides, which will make a copy for you, complete the first three slides and then take a picture of your nature journal with the traits of your plant or animal labeled to share on slide 4.</i></b></p> <p>Create an <b>Assignment</b> where students will have their own copy of the <a href="#">Lesson 4 Student Celebration of Learning</a> (that link will force a copy for you to share with students on Google Classroom.)</p> <p>Name your Assignment: <b>Loving Life Lesson 4 Celebration of Learning</b></p> <p>Add the <a href="#">Lesson 4 Student Celebration of Learning</a> link.</p> <div data-bbox="1087 954 1264 1112"> <p>Add Create</p> <p>Google Drive</p> <p>Link</p> <p>File</p> <p>YouTube</p> </div> <div data-bbox="304 1250 619 1429"> <p>Students can view file</p> <p>Students can edit file</p> <p>Make a copy for each student</p> </div> <p>Make a copy for each student to edit on their own, which you can look over as a formative assessment to see how well students are understanding traits and the natural selection Peppered Moths exercise from Lesson 4.</p>	<p>Students share 'What We Figured Out' about traits being passed down from parents and how those traits help plants and animals survive and thrive.</p> <p>Students make a 'Connection to the Phenomenon' of the life cycle of a monarch butterfly and discuss the traits and behaviors of a monarch butterfly that help it survive and thrive. (For example: how the monarch butterfly has adapted to look like dead leaves on the inside of its wings and is poisonous to eat by eating milkweed as a caterpillar.) Students share the 'Questions We Have Now'.</p>
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	<p>Walk students through the slides they will see in Google Classroom before they work on completing them individually. Remind students that they completed similar slides as a class and now it's time for them to celebrate what they know.</p>	<p>Students complete their Lesson 4 Celebration of Learning slides and turn them in on Google Classroom as a formative assessment for teachers to check in on students' understanding.</p>
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Written by Cady Staff Hwang

Please join the Loving Life Curriculum Discussion at <https://forms.gle/FJ5QPpDxW87CkaT76> to provide feedback on this lesson.