

**Grade 3:** Life Science Module: Unit 1

# Lesson Sequence 5: Variation and Survival

## Lesson Sequence 5: Variation and Survival

### Overview

**Total Time: 1.5 hours of instruction (divided into two sections)**

In this lesson sequence, students begin to answer the second half of the Unit 1 guiding question—why does how an organism looks matter? They explore how variation of traits in bullfrogs and water lilies can provide advantages in surviving (camouflage in bullfrogs) and reproducing (water lily pollination).



### Lesson Sequence Focusing Question and Big Ideas

**What is the cause and effect relationship between variation of traits and the possible advantage an organism has in surviving, finding a mate, and reproducing?**

- When an organism “matches” or is better suited for a particular environment, it is more likely to survive, find a mate, and reproduce.
- Variation of traits within a species causes some organisms in that species to be better matched for their environment than others in the species.

### Long-Term Target Addressed (Based on NGSS)

Construct an explanation of the observed relationships between variations in characteristics among animals or plants of the same species and the relative advantages in surviving, finding mates, and reproducing. (Based on NGSS 3-LS4-2)

This lesson sequence explicitly addresses:

#### Science and Engineering Practices:

- **Constructing Explanations:** Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. *Students identify evidence that supports the explanation that “There is a cause and effect relationship between variation and surviving and reproducing.”*

#### Crosscutting Concepts:

- **Cause and Effect:** Cause and effect relationships are routinely identified and used to explain change. *Students identify the cause and effect relationship of an organism having a preferential trait and surviving better.*

#### Disciplinary Core Ideas:

- **LS4.B: Natural Selection:** Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. *Students look at variation of traits of both bullfrogs and water lilies to construct an explanation for why some bullfrogs or some water lilies may be more likely to survive or reproduce than others in the same species.*



### Lesson Sequence Learning Target

- I can support an explanation about how the variation of traits in organisms might provide an advantage in surviving, finding a mate, and reproducing.

## Ongoing Assessment

- Student science notebook: Variation and Survival entry
  - Water Lily Preference Explanation
- Scientists Meeting: Building Understanding

## Agenda

**Total Time: 1.5 hours of instruction**

### Section 1

#### 1. Opening

A. Reviewing Learning Target and Focusing Question (10 minutes)

#### 2. Constructing Explanations

A. Variation and Camouflage in Bullfrogs (35 minutes)

### Section 2

#### 1. Constructing Explanations

A. Flower Variation and Pollination in Water Lilies (25 minutes)

– *Optional Extension: Additional Pollinator Study*

– *Optional Extension: Water Lily Coffee Filter*

B. Constructing an Explanation: Beetles and Water Lilies (10 minutes)

#### 2. Evaluating and Communicating Information

A. Scientists Meeting: Building Understanding (10 minutes)

## Teaching Notes

### Purpose of lesson sequence and alignment with NGSS standards:

- In this lesson sequence, students investigate the cause and effect relationship between how an organism looks and how well it can survive (a Disciplinary Core Idea).
- In Section 1, students examine a series of pictures of bullfrogs to see the variation in patterns and colorations. They also note the environments and make predictions about how well the bullfrog will survive in its given environment (a Disciplinary Core Idea).
- In Section 2, students closely read an article about the preferences of pollinators. They apply this understanding by crafting a paper water lily and then analyzing which flower is most likely to be pollinated and therefore reproduce. Finally, students use the information from the bullfrog and water lily study to orally construct an explanation (a Science and Engineering Practice) about the cause and effect relationship (a Crosscutting Concept) that variation in characteristics among animals or plants of the same species may provide advantages in surviving, finding mates, and reproducing.

### How it builds on previous work in the Life Science Module:

- In Lesson Sequence 3, students learned the role of pollinators in plant reproduction. Students build on that learning in this lesson sequence by reading about the traits that bugs prefer when pollinating flowers.

### How it connects to the CCSS Standards and EL Education's Language Arts Grade 3

#### Module 2:

- Some of the freaky frogs that students are studying in Language Arts Grade 3 Module 2 employ camouflage.
- The student explanations in Section 1 are an opportunity for students to write informatively (CCSS ELA W 3.2.).
- The text in Section 2 provides students with the opportunity to practice reading informational texts (CCSS ELA RI.3.1).
- The Scientists Meeting in Section 2 provides students with the opportunity to practice their speaking and listening skills while collaborating in whole group discussions (CCSS ELA SL.3.1).

#### Possible student misconceptions:

- A common misconception is that animals can intentionally change their appearance to become better camouflaged. In reality, animals cannot decide that they want to look a particular way and then have that appearance. Ask: "If you wanted to have blue hair, could you think about it hard enough and then have your hair turn blue?"

#### Possible broader connections:

- Connect to students' lives by discussing examples of local animals that are well camouflaged in their environment. (Example: brown squirrels match the bark of trees well.)

#### Areas where students may need additional support:

- Students may need additional support with constructing explanations. This lesson sequence is the last time they will practice this skill before the assessment. Note who may need additional instruction or practice in preparation of the assessment.
- For students who need additional support organizing their ideas in conversation, provide discussion questions from the Scientists Meeting in advance and provide ample processing time.
- For ELLs and students who may need additional support with reading and/or writing: Strategically pair students with a peer model.

#### Down the road:

- In the Unit 1 summative assessment in Lesson Sequence 6, students construct an explanation. Similar to Lesson Sequence 4, the work in this lesson sequence provides important practice for students and can be used as formative assessment for students' comfort level with this skill.

#### In advance:

- Read each section and complete the Preparing to Teach: Self-Coaching Guide.
- Prepare technology necessary to display two photos of frogs:
  - <https://www.flickr.com/photos/snowpeak/7943586958/>
  - <https://www.flickr.com/photos/eiriknewth/200926250/>

- Prepare technology necessary to play the bullfrog slideshow (<http://www.arkive.org/american-bullfrog/lithobates-catesbeianus/image-G136899.html>).
- Print out the image of two water lilies in color (see supporting materials). Alternatively, you could prepare technology necessary to display the image of two water lilies:
  - [https://www.flickr.com/photos/tanaka\\_juuyoh/2809725738/](https://www.flickr.com/photos/tanaka_juuyoh/2809725738/)
- Make copies of “Pollination: Bugs and Flowers Work Together.”
- Post: Unit 1 guiding question, lesson sequence focusing question, lesson sequence learning target, Concepts Scientists Think About anchor chart, Scientists Do These Things anchor chart, Plant Life Cycle models, and Norms of a Scientists Meeting anchor chart.

### Optional extensions:

- *Additional Pollinator Study*: Research the preferences of other pollinators. See: <http://www.fs.fed.us/wildflowers/pollinators/animals/index.shtml>.
- *Water Lily Coffee Filter*: Make coffee filter water lilies and construct an argument about which flower is likely to be pollinated by which bug. Directions included in supporting materials.

### Vocabulary

**survival**: to continue to live; to not die

**trait**: a characteristic of an organism

**cause and effect**: when something happens and then results in something else happening

**reproduce**: when a male and female parent produce offspring

**camouflage**: coloration that matches surroundings

**pollination**: when pollen mixes between flowers, which allows for seeds to be made

### Materials

#### General Materials

- ✓ Student science notebook (from Lesson Sequence 1; one per student)
  - Variation and Survival entry (page 20 of student science notebook)
- ✓ Concepts Scientist Think About anchor chart (begun in Lesson Sequence 2; added to in Section 1; see supporting materials)
- ✓ Two pictures of frogs (one each to display; see Teaching Notes)
- ✓ Scientists Do These Things anchor chart (begun in Lesson Sequence 2; added to in Section 1; see supporting materials)
- ✓ Bullfrog slideshow (slideshow; play in entirety; see Teaching Notes)
- ✓ Image of two water lilies (one to display; see Teaching Notes)
- ✓ “Pollination: Bugs and Flowers Work Together” (one per student)
- ✓ Norms of a Scientists Meeting anchor chart (begun in Lesson Sequence 1)
- ✓ Unit 1 guiding question (from Lesson Sequence 1)
- ✓ Constructing Paper Water Lilies (optional)

#### Science-Specific Materials (gathered by the teacher)

N/A

## Section 1: Opening

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### A. Reviewing Learning Target and Focusing Question (10 minutes)

- Invite students to open their **student science notebook** to the **Variation and Survival entry** <sup>(1)</sup>.
- Direct students' attention to the posted lesson sequence guiding question and lesson sequence learning target, and read them aloud:
  - “What is the cause and effect relationship between variation of traits and the possible advantage an organism has in surviving, finding a mate, and reproducing?”
  - **“I can support an explanation about how the variation of traits in organisms might provide an advantage in surviving, finding a mate, and reproducing.”**
- Remind students that they have previously observed that all siblings are a little different <sup>(2)</sup>.
- Using a total participation technique, invite responses from the group:
  - **“Do you think these differences could have any effect on organisms' survival?”**
- Draw students' attention to the **Concepts Scientists Think About anchor chart** and point out the “Cause and Effect” column <sup>(3)</sup>.
- Tell students that when they wonder if the differences, or variation, in traits between siblings might affect their survival, they are acting as scientists. Scientists look for relationships between things in order to make predictions about what will happen <sup>(4)</sup>.
- Add the definition to the anchor chart under the “Cause and Effect” column:
  - **“Events have causes. Cause and effect relationships are identified, tested, and used in explanations.”**
- Provide students with time to jot down their own ideas about the focusing question and learning targets in their student science notebook in the Variation and Survival entry under the “Opening” section.

### Preparing to Teach: Self-Coaching Guide

1. How well are my students using their student science notebooks?
2. Would a picture of siblings from a previous lesson sequence be useful here?
3. What experience do my students have with looking for cause and effect?
4. What examples can I give to make these concepts clearer?

## Section 1: Constructing Explanations

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### A. Variation and Camouflage in Bullfrogs (35 minutes)

- Ask students to imagine that they are scientists who went out into the field and took pictures of all the bullfrogs they could find in and around a pond. As scientists, they would then study the pictures for similarities and differences in skin color to make predictions about how likely the frogs are to survive based on the frogs' ability to *camouflage* <sup>(1)</sup>.

- Using a total participation technique, invite responses from the group:
  - “Where have you heard the word camouflage before? (Scaffold: Emphasize the word came in camouflage.)” (Responses will vary.)*
  - “What does it mean?” (to blend into the environment)*
- Display the **two pictures of frogs** side-by-side.
- As students view the pictures, pose questions such as <sup>(2)</sup>:
  - “Which one of these frogs is camouflaged?” (the one that is harder to see)*
  - “If you were a snake who liked to eat frogs, which one do you think you would eat? Why?” (the one that doesn’t blend into the environment, because you could see it more easily)*
  - “If you were a moth flying by, which one might you accidentally land close by?” (the one that is harder to see)*
  - “How does camouflage help an organism survive? (It helps the organism hide more easily from predators. It also helps an organism hunt its prey.)*
  - “What do you think are the benefits of matching, or being camouflaged to, your environment?” (You can hide from predators better if you are camouflaged. You can hunt things more easily.)*
  - “What is the cause-and-effect relationship between being camouflaged and survival?” (Because frogs look like their surroundings [cause], they are less likely to be seen by predators and more likely to survive [effect]. If they eat other bugs, they are more likely to be able to catch them [effect].)*
- Tell students they are going to look at a slideshow to view pictures of bullfrogs that are very well camouflaged.
- Remind students that when they observe closely, they are acting like scientists. Encourage them, as they look at the pictures, to think about the cause and effect relationship between the appearance of the frog and the frog’s ability to survive in the environment.
- Invite students to open their student science notebook to the Variation and Survival entry and put their finger on the “Constructing Explanations” section.
- Direct students’ attention to the **Scientists Do These Things anchor chart** and read the “Constructing Explanations” column.
- Tell students that they have observed a cause and effect relationship between camouflage and survival and now they are going to collect evidence from each picture to support their explanation for why having traits that match the environment helps the bullfrog survive.
- Ask students to move their finger from the “Constructing Explanations” section in the notebook to the evidence table right below it.
- Guide students through the **bullfrog slideshow**, especially photos 13–24.
- With photos 13 and 14, model for students making observations about the traits of the bullfrog, characteristics of the environment, and describing how the traits of the bullfrog match or do not match the characteristics of the environment. Demonstrate how this data should be recorded on the evidence table <sup>(3)</sup>.
- Continue to display images from the slideshow. Choose three images as a class to collect data on. Have students make their observations and record their data of the three pictures in their student science notebook.

- Once students have completed their evidence table, tell them that their evidence tables helped them identify the evidence for their explanation. Now they are going to use their evidence tables to create an explanation for what is the relationship between how a frog looks—in other words, its traits—and how well the frog survives.
- Model for students how to create an explanation using the data that was collected during the modeling of data collection as evidence for the explanation. Say:
 

***“My claim is: There is a cause and effect relationship between how a frog looks and how well it survives. A bullfrog’s traits help it survive well in its environment.”***

***“My evidence is: I saw five frogs who matched their environment. One had skin that was dark brown, and the mud that it was sitting in is a similar dark brown.”***

***“My reasoning is: So the traits of a bullfrog can camouflage it and make it hard for predators to see the bullfrog, and it will survive.”***
- Answer clarifying questions.
- Direct students’ attention back to their student science notebook, and invite them to put their finger on where it says “Explanation” under the evidence table. Tell students they will now have time to write their own explanation for why specific traits might help one of the frogs from the slideshow survive, using the evidence in their table.
- Invite students to begin constructing their explanation. If students need more room, consider having them write on paper and then staple it into their notebooks <sup>(4)</sup>.
- Circulate while students are writing and pre-select students with strong explanations to share out.
- After 10 minutes, refocus whole group.
- Ask pre-determined students to share their explanations with the group.
- Discuss with students whether a particular bullfrog would survive well in another environment based on its traits. Ask:
 

***“If we switched the bullfrogs in photos 20 and 24 and placed them in each other’s environment, do you think they would have as good of a chance of surviving? Why or why not?”***  
***(No, because they don’t match the environment as well. They would have to find a new place to hide.)***

### Preparing to Teach: Self-Coaching Guide

1. What experience do my students have with the concept of camouflage?
2. What additional questions can I ask if my students aren’t making the connection between camouflaged and survival?
3. Will I make an evidence table on the white board? Will I show the students my teacher science notebook? How/where will I model collecting evidence?
4. Based on the explanations the students wrote in Lesson Sequence 4, how much time will my students need to write this explanation?

## Section 2: Constructing Explanations

### A. Flower Variation and Pollination in Water Lilies (25 minutes)

- Remind students that they now know how variation in a bullfrog's body color and patterns can help the frog survive.
- Using a total participation technique, invite responses from the group <sup>(1)</sup> <sup>(2)</sup>:

*“How might the frog call variation, which you learned about in Lesson Sequence 4, help that organism survive and reproduce in a specific environment?” (Having a louder frog call, or particular sounding call, might help a frog find a mate and thus be able to reproduce and help its species survive.)*

*“How might plants be different from one another, and how might that help them survive?” (Responses will vary.)*

- Display the **image of two water lilies**.
- Tell students to look closely, and ask them:

*“What is different about these two water lilies?” (Responses will vary but students will likely note color and size)*

*“Does it look like one of them is being visited by a bug?” (Yes, it appears there is a beetle on the white one.)*

*“Why might the beetle go to the white water lily and not the pink one? Is there a relationship here?” (Responses will vary but may include a cause and effect relationship)*

- Tell students that they are going to read an article about how flowers can have traits that help them attract pollinators, such as bees and other bugs.
- Ask:

*“Why do plants want to attract bugs?” (Plants are pollinated by bees and other insects.)*

- Remind students that pollination is what has to happen to some plants before they can produce seeds, which is what happens in the plant life cycle so that plants can reproduce (as discussed in Lesson Sequence 3).
- Distribute **“Pollination: Bugs and Flowers Work Together.”**
- Tell students that they will work hard as readers today to learn about why some bugs may prefer to pollinate some water lilies over other water lilies <sup>(3)</sup>.
- Invite students to open their student science notebook to the Variation and Survival entry and find the Water Lily: Pollination Preference of Beetles model.
- Tell students they are going to have the opportunity to independently read the text now. Remind them they are looking for evidence about why the beetle was on the white flower in the photo. They are going to take notes by drawing a basic flower and labeling it. Model as necessary <sup>(4)</sup>.
- Ask students to begin reading. Circulate and support them as they read and record characteristics <sup>(5)</sup>.
- After 10 minutes, ask students to turn to and talk to an elbow partner:
 

*“What characteristics did you write down? What similarities and differences are there between our notes?”*
- Refocus whole group.

- Using a total participation technique, invite responses from the group:
  - “Based on your reading, what characteristics do beetles prefer in flowers?” (strong smell, a dull color, and big bowl-like flowers)
  - “How did you show this information in your notebook?” (Responses will vary.)

### Preparing to Teach: Self-Coaching Guide

1. If my students aren't coming up with any ideas about plants, what specific traits can I ask about? (fragrance, color, height of flower)
2. How can I leverage the learning from Lesson Sequence 3?
3. After previewing the text, how much time will my students need with this text?
4. Some students may benefit from having a basic flower shape to tape into their notebook. Then they can provide the labels based on the reading. How can I provide that for them?
5. In Unit 2, students will draw a pond explanatory model. Based on the flower model I see here, what kind of support will my students need?

### B. Constructing an Explanation: Beetles and Water Lilies (10 minutes)

- Point out to students that they have been doing the steps of constructing an explanation:
  - They observed a relationship between the beetle and the white flower.
  - They collected evidence from the reading.
  - They identified which evidence supports the explanation by drawing a picture.
  - Now they are ready to construct an explanation.
- Ask students to turn and talk when an elbow partner to construct an oral explanation:
  - “Looking at the water lilies and using your Water Lily: Pollination Preference of Beetles model in your student science notebook, why would we observe a beetle on the white water lily?”
- Circulate while students are talking and pre-select students with strong explanations to share out <sup>(1)</sup>.
- After 5 minutes, refocus whole group.
- Tell students they will now have a chance to hear an explanation from a classmate. As the classmate shares out an explanation, students should listen closely for the three parts of an explanation: claim, evidence, and reasoning.
- Tell students to:
  - Hold up one finger when they hear a claim.
  - Hold up two fingers when they hear some evidence.
  - Hold up three fingers when they hear some scientific reasoning.
- Ask pre-determined students to share their explanations with the group.
- If time permits: Remind students of how pollination relates to the water lily's life cycle. So having a pollinator visit a water lily is very important. Ask students to return to the Plant Life Cycle models from Lesson Sequence 3 (posted on the wall) and add details about pollination to the reproduction phase of the life cycle <sup>(2)</sup>.

## Preparing to Teach: Self-Coaching Guide

1. According to the text, beetles seem to have a preference for white or dull colored flowers. Thus, the white flower may be more attractive. How can I be sure my students understand that a “preference” doesn’t mean that a beetle will visit only the white flower, but that being white may provide a slight advantage to the flower?
2. How can I have students add this to the posted life cycle?

## Section 2: Evaluating and Communicating Information

### A. Scientists Meeting: Building Understanding (10 minutes)

- Ask students to bring their science notebooks and gather for a Scientists Meeting.
- Direct students’ attention to the **Norms of a Scientists Meeting anchor chart**. Using a total participation technique, invite responses from the group:
 

***“What are the norms of a Scientists Meeting?” (take turns talking, build on one another’s ideas, disagree respectfully, ask questions to clarify information)***
- Remind students that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher.
- Tell students the goal of this meeting is to build understanding about how variation in an organism’s traits can affect how likely it is to survive, find a mate, and reproduce.
- Invite students to open their science notebooks to the Variation and Survival entry and find the “Constructing Explanations” section.
- Direct students’ attention to the posted **Unit 1 guiding question** and select a volunteer to read it aloud:
  - “Why does an organism look the way it does, and why does it matter?”
- Using a total participation technique, invite responses from the group:
 

***“What have you learned that will help you answer the second half of the question?” (How an organism looks, or its physical traits, can affect its survival and reproduction.)***
- Help students put their ideas into a general statement using a sentence stem:
  - “There is a cause and effect relationship between \_\_\_\_\_ and \_\_\_\_\_.” (There is a cause and effect relationship between how an organism looks and how well it will survive.)
- Remind students that this is the first step in constructing an explanation: making a claim.
- Using a total participation technique, invite responses from the group:
 

***“What information or evidence have we collected to support this claim?” (the evidence about the bullfrog and water lily)***
- Encourage students to build on one another’s ideas:
 

***“Can someone paraphrase what Student A said?”***

***“Who thinks something similar to Student A?”***

***“Who thinks something different from Student A?”***

***“Can you add to what Student A said?”***

- Remind students to use the information in their science notebooks as evidence as they participate in the conversation about why variation in traits may provide some organisms an advantage in surviving, finding a mate, and reproducing.
- To help students think about the way that variation can provide an advantage, pose questions such as <sup>(1)</sup>:

*“We know that organisms in the same species don’t look exactly like each other. How do we know that?” (Students observed this pattern in the bullfrog slideshow and collected evidence for it in Lesson Sequence 2.)*

*“If bullfrogs look slightly different and one is more camouflaged than the other, which one is more likely to complete its life cycle and reproduce?” (the more camouflaged one)*

*“What about flowers? We know that flowers can be different heights and different sizes. What if one flower is bigger and more bowl-shaped, and another is smaller and lower in the water. Which one is more likely to get pollinated and reproduce? Why?” (the bigger one)*

*“Why is it important for an organism to reproduce?” (This allows for more organisms of the species to be born.)*

- If conflicting information arises, help students challenge one another’s ideas respectfully:
  - “Why do you think you have different conclusions from Student A’s?”*
  - “With what in Student A’s argument do you disagree? On what points do you agree? What evidence do you have to support those ideas?”*
- Direct students’ attention to the Scientists Do These Things anchor chart and give students specific positive feedback on their ability to construct an explanation about their learning. (Example: “I heard a lot of students using evidence in their explanations.”)
- Under “Constructing Explanations” on the Scientists Do These Things anchor chart, add an example:
  - Bullfrog and water lily variation of traits helps organisms survive in specific environments.

### Preparing to Teach: Self-Coaching Guide

1. What probing questions can I ask if they are not getting it?

*Note: The purpose of this meeting is to provide students with a chance to verbally organize the explanations that they will write during the Summative Assessment in Lesson Sequence 6. Encourage full-group participation in both listening and speaking.*