Smithsonian | SCIENCE *for the classroom*

WHAT EXPLAINS SIMILARITIES AND DIFFERENCES BETWEEN ORGANISMS?

Overview and Lesson Sampler, Grade 3

LIFE SCIENCE

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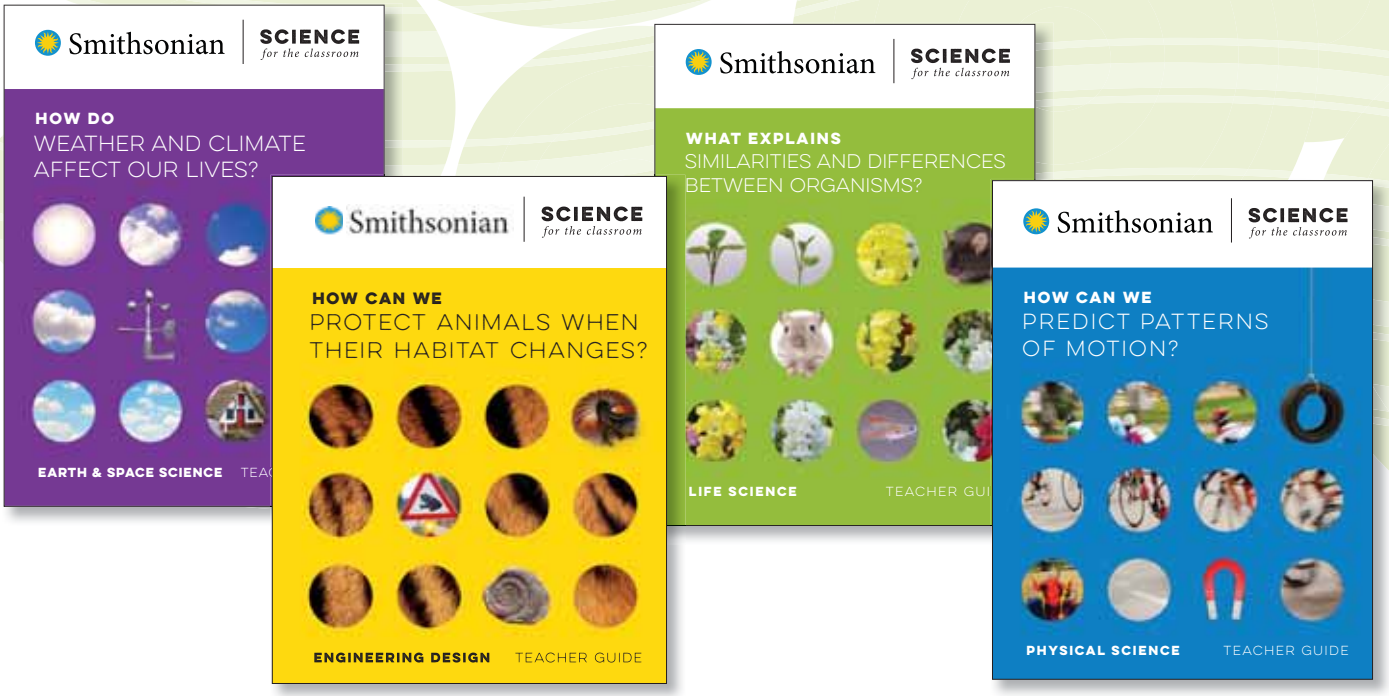

Smithsonian Science for the Classroom, Grade 3

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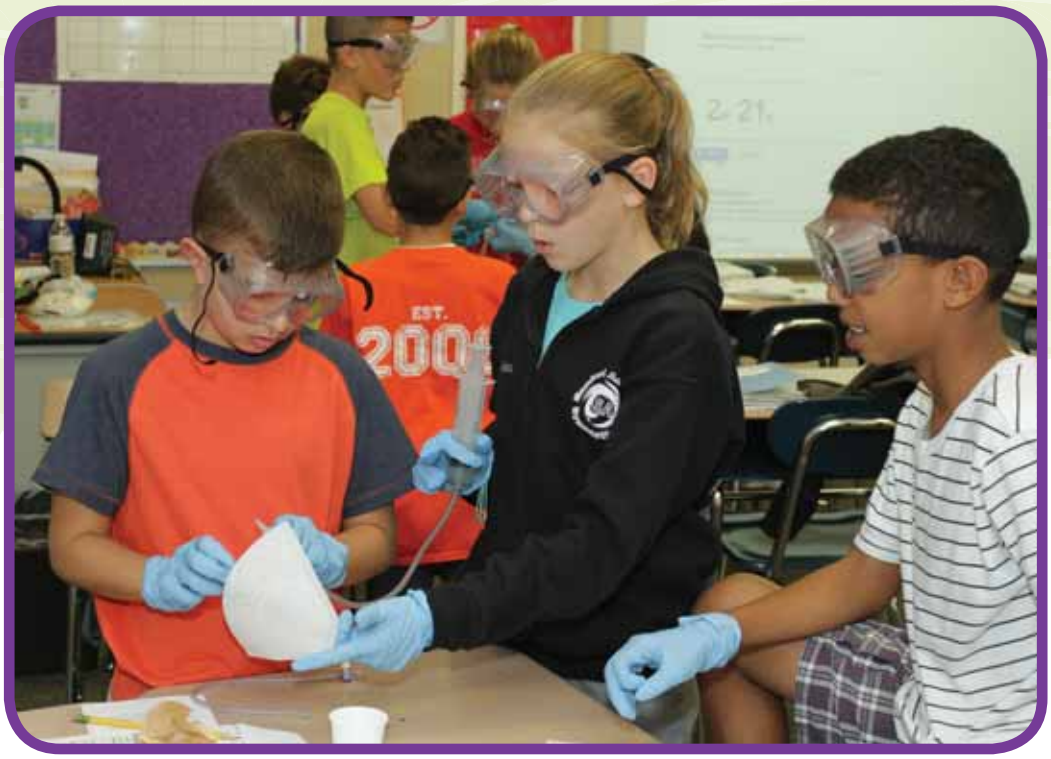
All New for NGSS—*Smithsonian Science for the Classroom*™ for Grades 1–5

For decades, the Smithsonian Science Education Center has been a leader in providing curriculum, professional development, and leadership development in support of inquiry-based science education. The release of the Next Generation Science Standards (NGSS) triggered key shifts in curriculum, instruction, and assessment.

The vision laid out by the NGSS explicitly requires performances that blend content, practices, and crosscutting concepts. The Smithsonian Science Education Center responded with a new generation of high-quality curriculum materials for Grades 1–5—*Smithsonian Science for the Classroom*.

***Smithsonian Science for the Classroom* was developed to:**

- Meet the Next Generation Science Standards through intentional curriculum design
- Support for teachers as they learn to implement new standards
- Incorporate findings from education research on how students learn
- Center on coherent storylines that flow logically from lesson to lesson as students work toward explaining phenomena or designing solutions to problems
- Broaden access to world-class Smithsonian collections, experts, and resources
- Include instructional supports to ensure all students can meet the standards
- Seamlessly incorporate a comprehensive assessment system to monitor student progress



Smithsonian Science for the Classroom Curriculum Framework—Designed for the Next Generation Science Standards

Module titles introduce phenomena or define problems

Life Science	Earth and Space Science	Physical Science	Engineering Design
Grade 1			
How Do Living Things Stay Safe and Grow? *1-LS1-1 • 1-LS1-2 • 1-LS3-1 • K-2-ETS1-1* **Supporting:** Engineering Design	**How Can We Predict When the Sky Will Be Dark?** *1-ESS1-1 • 1-ESS1-2 • 1-PS4-2* **Supporting:** Physical Science	**How Can We Light Our Way in the Dark?** *1-PS4-2 • 1-PS4-3 • 1-LS1-1 • K-2-ETS1-1* **Supporting:** Life Science and Engineering Design	**How Can We Send a Message Using Sound?** *K-2-ETS1-1 • K-2-ETS1-2 • K-2-ETS1-3 • 1-PS4-1 • 1-PS4-4* **Supporting:** Physical Science
Grade 2			
How Can We Find the Best Place for a Plant to Grow? *2-LS2-1 • 2-LS2-2 • 2-LS4-1 • K-2-ETS1-1* **Supporting:** Engineering Design	**What Can Maps Tell Us About Land and Water on Earth?** *2-ESS2-2 • 2-ESS2-3 • 2-PS1-1* **Supporting:** Physical Science	**How Can We Change Solids and Liquids?** *2-PS1-1 • 2-PS1-2 • 2-PS1-3 • 2-PS1-4 • K-2-ETS1-1* **Supporting:** Engineering Design	**How Can We Stop Soil From Washing Away?** *K-2-ETS1-1 • K-2-ETS1-2 • K-2-ETS1-3 • 2-ESS1-1 • 2-ESS2-1* **Supporting:** Earth and Space Science
Grade 3			
What Explains Similarities and Differences Between Organisms? *3-LS1-1 • 3-LS3-1 • 3-LS3-2 • 3-LS4-2 • 3-ESS2-2* **Supporting:** Earth and Space Science	**How Do Weather and Climate Affect Our Lives?** *3-ESS2-1 • 3-ESS2-2 • 3-ESS3-1 • 3-5-ETS1-1* **Supporting:** Engineering Design	**How Can We Predict Patterns of Motion?** *3-PS2-1 • 3-PS2-2 • 3-PS2-3 • 3-PS2-4 • 3-5-ETS1-1* **Supporting:** Engineering Design	**How Can We Protect Animals When Their Habitat Changes?** *3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 3-LS2-1 • 3-LS4-1 • 3-LS4-3 • 3-LS4-4* **Supporting:** Life Science
Grade 4			
How Can Animals Use Their Senses to Communicate? *4-LS1-1 • 4-LS1-2 • 4-PS4-2 • 4-PS4-3 • 3-5-ETS1-1* **Supporting:** Physical Science and Engineering Design	**What Is Our Evidence That We Live on a Changing Earth?** *4-ESS1-1 • 4-ESS2-1 • 4-ESS2-2 • 4-ESS3-2 • 4-PS4-1 • 3-5-ETS1-1* **Supporting:** Engineering Design and Physical Science	**How Does Motion Energy Change in a Collision?** *4-PS3-1 • 4-PS3-2 • 4-PS3-3 • 4-LS1-1 • 3-5-ETS1-1* **Supporting:** Engineering Design and Life Science	**How Can We Provide Energy to People's Homes?** *3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 4-PS3-2 • 4-PS3-4 • 4-ESS3-1* **Supporting:** Physical Science and Earth and Space Science
Grade 5			
How Can We Predict Change in Ecosystems? *5-LS1-1 • 5-LS2-1 • 5-PS1-1 • 5-PS3-1* **Supporting:** Physical Science	**How Can We Use the Sky to Navigate?** *5-ESS1-1 • 5-ESS1-2 • 5-PS2-1 • 3-5-ETS1-1* **Supporting:** Physical Science and Engineering Design	**How Can We Identify Materials Based on Their Properties?** *5-PS1-1 • 5-PS1-2 • 5-PS1-3 • 5-PS1-4 • 5-LS1-1* **Supporting:** Life Science	**How Can We Provide Freshwater to Those in Need?** *3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 5-ESS2-1 • 5-ESS2-2 • 5-ESS3-1* **Supporting:** Earth and Space Science

Smithsonian Science for the Classroom Curriculum Overview

20 phenomena- and problem-based modules from the Smithsonian are **setting the standard in 3D learning and 3D assessment**

Coherent Storylines

- Coherent storylines build toward students answering a question or solving a problem
- Begin with the end in mind—students start with the big idea and then work progressively through tasks that build to a culminating science or design challenge

Teacher Support

- Investigations engage your students in 3D tasks and assessments
- Three-dimensional assessment system includes pre-assessment, formative assessment, student self-assessment, and a summative written assessment and performance assessment, accompanied by scoring rubrics
- From misconception support to ELL strategies, Teacher Guides provide everything you need to transition to NGSS and 3D instruction and assessment

Proven Results

- Research-based instruction proven to raise test scores in science, reading, and math
- Effective science and engineering instruction at every grade level
- Smithsonian Science Stories Literacy Series provides all students with access to the Smithsonian's research, scientists, and world-class collections while integrating science content and literacy

Provide Everything You Need to Meet the NGSS Standards

- Teacher support, step-by-step investigations, guiding questions, literacy, assessment, and hands-on materials

Bring the expertise of the Smithsonian's world-class collections, experts, and resources into your classroom.

AT THE SMITHSONIAN
Smithsonian Institution Gardens staff see migrating monarchs in their gardens every year. Sometimes they tag them. This helps scientists track and conserve them.

AT THE SMITHSONIAN
These greenhouses in Maryland are run by Smithsonian Institution Gardens.

Patterns of Life, Grade 3 Student Literacy Reader

Lesson design supports the NGSS teacher

Keep an Eye Out!

What to Look for in a *Smithsonian Science for the Classroom* Module:

Coherent Learning Progression

- Concepts and Practices Storyline shows how concepts build from one lesson to the next within the module using the 5-E model

NGSS Support at Point of Use

- Explanations at point of use explicitly define how students are engaging in the Science and Engineering Practices and Crosscutting Concepts

Literacy and Math

- ELA and Mathematics connections to Science overlap with student engagement in the science and Engineering Practices
- *Smithsonian Science Stories* On-Grade and Below-Grade Literacy Series
- STEM Notebooks

Misconception Identification

- Reveals common misconceptions students may have and offers ways to address them in the lessons

Technology Integration

- A balance between hands-on investigation and technology

Grade 3

Smithsonian | SCIENCE *for the classroom*

WHAT EXPLAINS SIMILARITIES AND DIFFERENCES BETWEEN ORGANISMS?

LIFE SCIENCE TEACHER GUIDE

Summary

In this module, students will explore variation of traits in individuals, patterns of life cycles, and how the environment can affect expression of traits. In the first focus question, students will observe the variations in traits among individual Wisconsin Fast Plants. They will also complete a pedigree model for California condors. Students will then analyze two generations of Wisconsin Fast Plants to identify possible patterns of inheritance, while noting that not all traits can be explained this way. In the second focus question, students plan and carry out an investigation to determine how environmental factors can affect plant growth. They also explore climate regions and consider how climate can influence plant growth. In the third focus question, students investigate plant life cycles and analyze several animal life cycles to determine patterns. In the fourth focus question, students use information from a reading to learn about how variation in traits can affect reproductive success. Then, students analyze the results of a fair test about snapdragon flower color and determine that one color provides an advantage. Students also use mathematical skills to analyze how fur color affected the survival rate of mice. In the final focus question, students explore information about a research project involving Trinidadian guppies. They compare and contrast two field sites where the research occurred, and then analyze and interpret data from the study. Students use this information to support a claim about whether a trait in the guppies is primarily a result of inheritance or an environmental factor.

Concepts and Practices Storyline

Focus Question 1: What can an organism get from its parents?

1

Lesson 1: Alike and Different
Individuals of the same species can have different traits.

Students carry out an investigation to make observations of a variety of traits in Wisconsin Fast Plants and analyze data to reveal patterns of similarities and differences between individuals.

2

Lesson 2: A Family Portrait
Traits can be inherited within families.

Students obtain and evaluate information from a text on a unique trait in California condors and use a pedigree model to uncover a pattern of inheritance.

3

Lesson 3: Plants Have Parents, Too
Some, but not all, traits can come from one or both of an organism's parents.

Students carry out an investigation to compare the traits of plants with those of their parents and use patterns to construct an explanation for which traits are likely inherited.

Focus Question 2: What can an organism get from its environment?

4

Lesson 4: Nature and Nurture
Many factors can vary within an organism's environment.

Students ask testable questions about environmental factors that could affect the traits of plants and collaboratively plan fair tests of two factors.

5

Lesson 5: Pen Pal Plants
Plants that grow well in one geographic region do not always grow well in other regions.

Students obtain and evaluate information from a text about the effect of environmental factors on plant growth.

6

Lesson 6: Pack Your Bags!
Climate is an area's typical weather conditions, and climate varies in different geographic regions.

Students obtain climate data from texts to create and analyze a class map that reveals patterns in temperature and precipitation in different climate zones in North America.

7

Lesson 7: Fair-Weather Fronds
Differences in environmental factors such as light and water can cause otherwise similar plants to develop different traits.

Students analyze the results of an investigation into whether environmental factors can affect plant traits and revise an explanation about the cause of plant traits.

Focus Question 3: How do organisms change throughout their lives?

8 **Lesson 8: Plant Patterns**
Plants have diverse life cycles, but all share some similarities.
Students carry out an investigation to make observations of patterns in a variety of plant life cycles.

9 **Lesson 9: Animal Stories**
Animals have diverse life cycles, but all share a common pattern of birth, growth, reproduction, and death.
Students obtain and evaluate information from a text on the life cycles of an animal, communicate it to peers, and analyze both for common patterns in life cycles.

10 **Lesson 10: The Cycles of Life**
All organisms have commonalities in their life cycles, and reproduction is necessary to sustain life.
Students use a model to understand the essential role of reproduction in the continuation of life and develop a model to represent common patterns in life cycles for all living organisms.

Focus Question 4: How could being different be an advantage?

11 **Lesson 11: Busy Bees**
Bees aid plant reproduction by serving as pollinators, and pollinators can prefer flowers with certain traits over other flowers.
Students obtain and evaluate information from a text to generate testable questions about the effect of flower traits on pollination success.

12 **Lesson 12: Snapdragon Science**
If bees prefer one color of flower over another, plants with the preferred color of flower will get more chances to reproduce.
Students analyze and graph data from an investigation into how snapdragon flower color affects bumblebee visits.

13 **Lesson 13: Tricky Traits**
A variation in a trait can give an organism an advantage in one context but not in another.
Students use mathematics to compare predator attacks on light and dark mice in different environments and construct an explanation to answer the question of whether having a certain fur color causes them to have an advantage.

Featured lesson uses informational text to explore and explain phenomena

Science Challenge

Focus Question 5: Why are some guppies more colorful than others?

14 **Lesson 14: Guppy Mystery Part 1**
Guppies are brighter orange in one stream than in another, and the streams vary in a number of environmental factors.
Students analyze data from field notes about the environmental conditions in two streams where guppies live and ask questions about their possible effects.

15 **Lesson 15: Guppy Mystery Part 2**
Guppies can get brighter orange coloration from food that is only available in some streams but not others. This is an example of variation that is primarily caused by an environmental factor.
Students analyze and interpret data from the results of an investigation to make a claim about the cause of the guppies' bright orange spots.

Every module ends with a performance task

Focus Question 3: How do organisms change throughout their lives?

Daily NGSS support

LESSON 9: **ANIMAL STORIES**

	Student Objectives	Misconceptions	Disciplinary Core Ideas
E **Explore** **Explain** **Class periods:** 1 **Preparation time:** 10 minutes **Vocabulary:** birth, egg, reproduction	Obtain and evaluate information from a text on the life cycle of an animal, and communicate this information to peers. Analyze and interpret data to look for common patterns in the life cycles of diverse animals.	Insect lives do not have many stages. Babies do not look different from adults.	**LS1.B**: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

Good Thinking! videos for misconception support @ ScienceEducation.si.edu/goodthinking


9

Science and Engineering Practices*	Crosscutting Concepts*	ELA and Math Connections	Extensions
Obtaining and evaluating information Communicating information Analyzing and interpreting data	**Patterns**	**Reading: Informational text** Range of reading and level of text complexity (RI.3.10) **Speaking and listening** Comprehension and collaboration (SL.3.1)	**Literacy: Story of My Life** Students write a short story from the perspective of one of the animals from the "Ages and Stages" reading.

Daily ELA and math support

*** Science and Engineering Practices and Crosscutting Concepts that are assessed in the lesson are in bold.**

Teachers notes:

9

Obtain and evaluate information

Focus Question:
How do organisms change throughout their lives?

9

Class periods: 1

LESSON 9: **ANIMAL STORIES**

Objectives

- **Obtain and evaluate information from a text on the life cycle of an animal, and communicate this information to peers.**
- **Analyze and interpret data to look for common patterns in the life cycles of diverse animals.**

E Explore
Explain

Lesson Background Information

In this lesson, students will collect data from a reading about the life stages of an animal. After each pair has become "experts" on their animal, they will meet with another pair who read about a different animal. The group will work together to decide what both animals have in common. The animals in the reading—a gray tree frog, monarch butterfly, California sea lion, and koala—were chosen for their diverse life cycles. An amphibian has both aquatic and land-based stages. A butterfly also has a dramatic metamorphosis, including time in a chrysalis. A koala joey lives in its mother's pouch, while a sea lion mother has no pouch. However, students should find that even these animals all have some basic commonalities in their life cycles: birth, growth, reproduction, and death.

Vocabulary
birth
egg
reproduction

Figure 9.1 A monarch caterpillar will grow into an adult butterfly. Both were found in Smithsonian Gardens.

Materials

For each student

- STEM notebook*
- 1 Lesson 9 Notebook Sheet

For each pair of students

- Smithsonian Science Stories Literacy Series: *Patterns of Life*

*needed but not supplied

Preparation

1. Write the lesson title and focus question on the board.
2. Plan to group students into pairs, and later, to combine pairs into groups of four.
3. Make a copy of the Lesson 9 Notebook Sheet for each student.

Procedure

9

Getting Started

1. Ask students to recall what they learned so far about similarities and differences between different plants as they grow and develop. Use the following guiding questions to have students share their initial ideas about how animals grow and change throughout their lives:
   - **Do you think animals go through similar or different stages to plants?** (I don't know; they don't start as seeds; they do grow and sometimes change as they get older.)
   - **What about different species of animals—do they go through similar or different stages to each other?** (I don't know; I think some animal babies look like little adults; some animal babies look nothing like the adults.)
2. Let students know that in this lesson they will work in pairs to read about an animal and become "experts" on its life stages.

Activity

1. Group students into pairs and pass out a reader to each pair.
2. Ask pairs to use the table of contents to turn to "Ages and Stages."
3. Assign one of the following sections to each pair (gray tree frog, monarch butterfly, California sea lion, or koala).
4. Have pairs read only their section all the way through once.
5. Hand out a copy of the Lesson 9 Notebook Sheet to each student.
6. Have pairs work together to use the information in the reading to complete the table on the notebook sheet. An example of a completed notebook sheet is shown in Figure 9.2.

ELA Connection RI.3.1, 3.2, 3.7, 3.10; W.3.3.B

Ages and Stages

Animal Gray tree frog

Stage	What happens
Start of life	Starts as egg that hatches
Young	Lives in water as a tadpole, eats and grows
Adult	Gets arms and legs, lives on land and lays 1,000 or more eggs
End of life	Dies after 7-9 years

Figure 9.2. Example of completed Lesson 9 Notebook Sheet

Obtaining and evaluating information

Students read a text on an animal's life cycle and organize key information from the text into a table.

Teacher tip

Partners can alternate looking for the information for each row. The other partner should decide if they agree and see if they can point to a sentence in the text that provides the information.

Point-of-use teacher support

Communicating information

Students present the information they have gathered in a clear, concise way their peers can understand.

7. Once pairs have discussed and completed their sheets, have them meet with another pair who has become experts on a different animal. (Gray tree frog experts should meet with California sea lion experts, and monarch butterfly experts should meet with koala experts.)
8. Tell each pair to take turns presenting the information about their animal.

Diverse learner support

ELL strategy
Suggest students each take one minute to share out their idea and for the other members to verbally summarize their idea afterward. This will ensure equal participation (1).

Patterns

Students find similarities between two animal life cycles and write down a pattern common to both.

9. The group should work together to decide on a common pattern in life stages that they see in both animals. After discussing, everyone should write or draw this pattern in their STEM notebooks.

ELL strategy
Ask ELL students to draw in their STEM notebooks. Diagrams that include text and images of science processes help them assimilate new information (9).

Analyzing and interpreting data

Students work together to analyze the similarities and differences between the life cycles of two animals.

ELA Connection RI.3.9 SL.3.1, SL.3.4

Figure 9.3. Example of a common pattern students could write about their two animals. Visual formats may vary.

Bringing It All Together

1. Bring the class back together again. Use the following guiding questions to facilitate a class discussion about the diversity of animals the students studied:

   - **What was a difference you found between your two animals at the start of life?**
     (Our animal started as an egg, but the other pair's animal started as a baby.)
   - **What was a difference you found between your two animals when they were young?**
     (Our animal changed shape from caterpillar to butterfly, but the other pair's animal stayed the same shape and just got bigger.)
   - **What was a difference you found between your two animals when they were adults?**
     (Our animal laid over a thousand eggs, but the other pair's animal just had one baby.)
   - **What was a difference you found between your two animals at the end of their life?**
     (Our animal died in less than a year, but the other pair's animal can live to be 15 years old.)

Comprehension and collaboration

ELA Connection SL.3.1, SL.3.2, SL.3.3

9

Misconception

Students may not realize that insect lives have so many stages or that the "babies" can look so different from the adults (10). The story of the monarch butterfly will help them learn that insect lives do go through many stages, but that they still have commonalities with all animals.

Misconception support

2. Next, discuss the patterns of similarities students came up with:

   - **What common pattern did you find in both animals?**
     (Both were born, grew, became adults, reproduced, and eventually died.)

3. Tell students that scientists look for patterns like these to make claims about the natural world.

Nature of science

Students learn that scientific findings are based on recognizing patterns.

4. Let students know that in the next lesson they will combine what they have learned about plants and animals to develop a model that applies to all living organisms.

Assessment

Formative Assessment

Assessment tools aligned to the three dimensions of NGSS

Use this table to provide timely, actionable feedback for individual students on their successes and areas for improvement, as well as to plan any necessary whole-class remediation. Revisit the Common Misconceptions table in the module overview to familiarize yourself with other possible difficulties.

Assessed Task
Activity: Step 9 (STEM notebook)

Concepts and Practices	*Indicators of Success*	*Indicators of Difficulty*
Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	☐ Students recognize similarities across diverse animal life cycles, including (but not limited to) birth, growth, reproduction, and death. ☐ Student patterns include reproduction as a key stage.	☐ Students write stages that are specific to certain animals, like metamorphosis. ☐ Students do not include reproduction as a key stage.
☐ Obtaining, evaluating, and communicating information	☐ Students' patterns show that they comprehended the information in the text and that they effectively communicated key information to their partners.	☐ Students' patterns show that they either did not comprehend the key details of their text or did not communicate effectively with partners to understand the key details about the second animal.
☐ Patterns	☐ Students recognize a common pattern of similarities in the life cycles of two very different animals.	☐ Students do not see a common pattern between the two animals (they may note details that relate to only one).

9

Differentiated learning

Remediation

For students having difficulty detecting a pattern, ask guiding questions. First, remind students that a pattern can be described as a repeated series of objects or events. Ask, What events happened in the life of their animal? What events happened in the life of the other group's animal? Do they see any similarities between the types of events? Tell them to think about their animal again. Did the events in their animal's life happen in a specific order? What about the animal in the other group? Did the events in its life happen in the same order?

Enrichment

Technology integration

@ Navigate to **ScienceEducation.si.edu/variation**. Follow the instructions to locate the Monarch Life Cycle video and make sure it is ready to play for students. Ask students to watch the video and listen to the narration. Challenge students to translate the visual representation of the emergence into a written format, perhaps as a graphic organizer, drawing, or comic strip.

Extension

9

Literacy: Story of My Life

Materials

For each student

- STEM notebook*
- Smithsonian Science Stories Literacy Series: *Patterns of Life*

*needed but not supplied

Procedure

Ask students to turn to the section called "Ages and Stages" and review the four animals in the reading. Tell them to select one of the four animals and one part of that animal's life cycle. Have students write four sentences about "their" life at that stage. Use the following questions as prompts:

- Where are you living?
- What do you look like?
- Where are your family members?
- What do you like to eat?

Teachers notes:

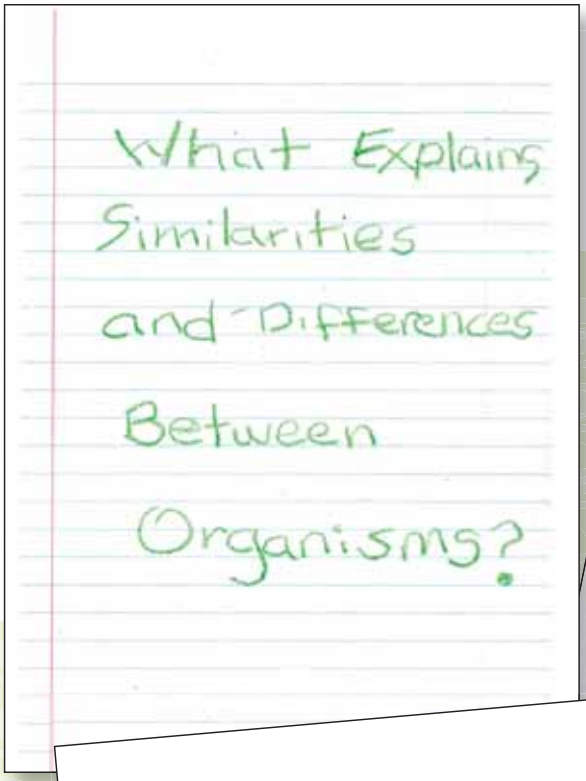
9

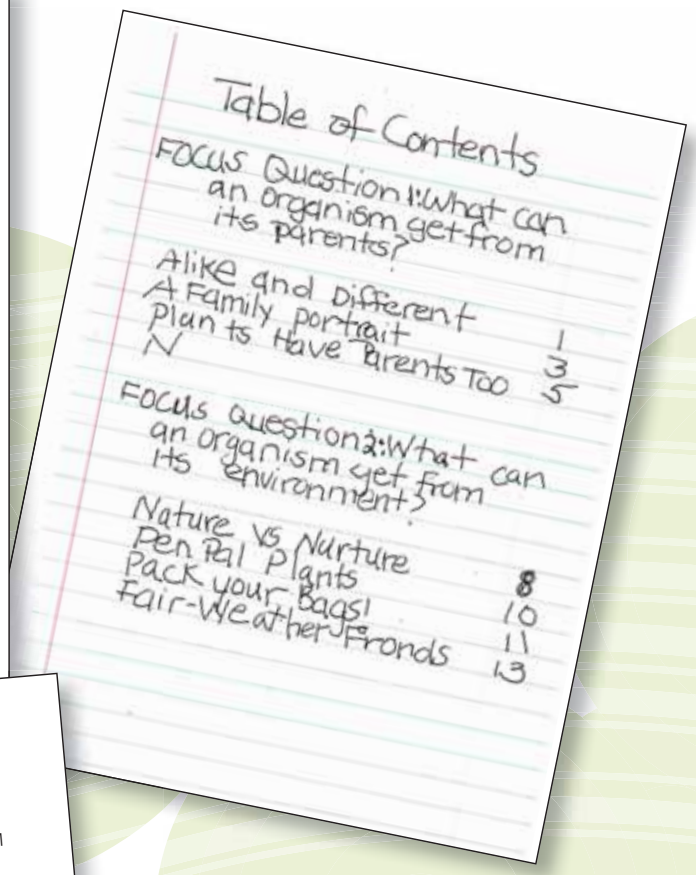
Provide Opportunities for Students to Think, Act, Reflect, and Communicate Like Scientists and Engineers

Anyone with a question can be a scientist! *Smithsonian Science for the Classroom* gets students thinking, acting, reflecting, and communicating like scientists and engineers.

Scientists and engineers explore and investigate, read to gather information, record their data, and reflect on their ideas. *Smithsonian Science for the Classroom* provides students with:

- Hands-on investigations that integrate literacy through the *Smithsonian Science Stories* Literacy Series, available in both on-grade and below-grade reading levels.
- Multiple lessons dedicated to reading, writing, speaking, and listening to gather information to support claims
- STEM Notebooks built by students to keep records of their questions, predictions, claims linked to evidence, and conclusions. Lesson notebook sheets scaffold student thinking and provide opportunities for students to explain phenomena, communicate their design for solutions, and self-assess.
- Math integrations that offer opportunities for students to represent and interpret data and quantitatively describe and measure objects, events, and processes.





What I Already Know

Write or draw your answers on a blank page in your STEM notebook.

1. Make a drawing for each of the following. Use arrows to show time passing.
   a. The life stages you think *all* animals go through.
   b. The life stages you think *all* plants go through.

   Do you see any patterns in your two drawings? If so, what are they?

2. Your teacher will show you two horses.
   a. What could cause the similarities?
   b. What could cause the differences?

   Use evidence in your answer.

3. Your teacher will show you a map.
   a. How is the environment in Point A different from Point B?
   b. One pine tree seed is planted at Point A. The same day, another pine tree seed is planted at Point B. Would the two trees look the same after 10 years? Explain your answer.

Explaining phenomena

Ages and Stages

Animal _____

Stage	What happens
Start of life	
Young	
Adult	
End of life	

Using text to obtain and evaluate information

READING 5

AGES AND STAGES

Have you ever slipped on your shoes only to find out that they are too tight?

Or maybe you put on your jacket and your arms stuck out of the sleeves.

Humans, like all animals, go through different stages of growth and development.

Gray Tree Frog

A gray tree frog begins its life as an **egg**.

After 3 to 7 days, a **tadpole** hatches from the egg.

The tadpole lives in the water. It is small and looks kind of like a fish.

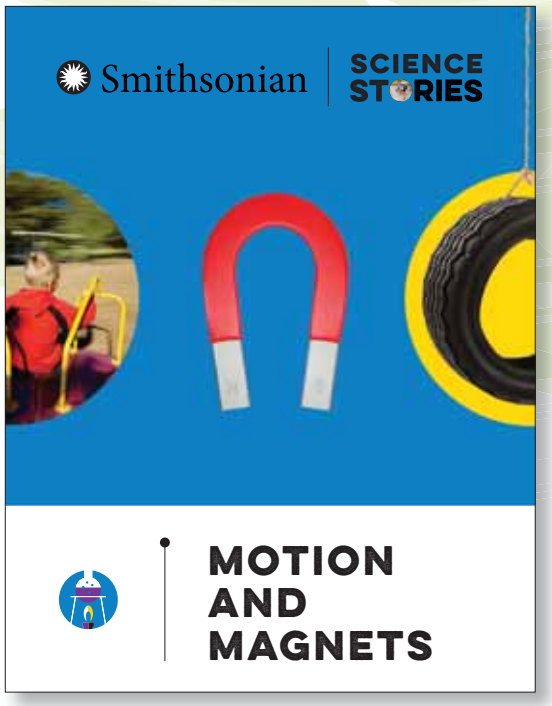
Gray tree frogs begin their lives as eggs.

29

Module-Specific On-Grade, Below-Grade, and Spanish Nonfiction Literacy Supports Every Module of the *Smithsonian Science for the Classroom* Program.

Life Science: *What Explains Similarities and Differences Between Organisms?*

Earth/Space Science: *How Do Weather and Climate Affect Our Lives?*



Physical Science: *How Can We Predict Patterns of Motion?*

Engineering Design: *How Can We Protect Animals When Their Habitat Changes?*

Smithsonian | SCIENCE STORIES

Connecting student literacy to science in the real world

PATTERNS OF LIFE

TABLE OF CONTENTS

READING 1

BIRDS OF A FEATHER p.1

California condors and their tail feathers (680L)

READING 2

A TALE OF TWO TREES p.10

How different climates affect the growth of a tree (530L)

READING 3

ENGINEERING ENVIRONMENTS p.18

Using greenhouses to grow plants (720L)

READING 4

FROM SEED TO SEEDLING p.22

The first stages of plant growth (600L)

Bring the expertise of the Smithsonian into your classroom

READING 5

AGES AND STAGES p.29

Stages of animal development (790L)

READING 6

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AGES AND STAGES

Have you ever slipped on your shoes only to find out that they are too tight?

Or maybe you put on your jacket and your arms stuck out of the sleeves.

Humans, like all animals, go through different stages of growth and development.

Gray Tree Frog

A gray tree frog begins its life as an **egg**.

After 3 to 7 days, a **tadpole** hatches from the egg.

The tadpole lives in the water. It is small and looks kind of like a fish.

Gray tree frogs begin their lives as eggs.

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AGES AND STAGES

Gray tree frog tadpoles are small and look like fish.

The tadpole spends its time eating and growing.

It turns into a frog about 45 to 65 days after it hatches.

This process is called **metamorphosis**. All amphibians go through metamorphosis.

In the gray tree frog, this is the change in body shape from a tadpole to an adult frog.

The tadpole may be as small as 3 centimeters (just over 1 inch) long when it first hatches.

After changing to a frog, it can measure up to 5 centimeters (2 inches) long.

The length of each life stage for the gray tree frog can vary.

Right after metamorphosis, the gray tree frog is bright green.

It is considered an adult after 2 years.

Its color will change to green, brown, or gray when it becomes an adult.

AGES AND STAGES

When the caterpillar is about to become an adult, it forms a case around itself.

The case is called a **chrysalis**.

This stage lasts 8 to 15 days.

Monarch butterflies have a blue-green chrysalis with golden spots.

The body structure of the monarch changes as it moves through this stage.

Then an adult butterfly emerges from the chrysalis.

A monarch caterpillar forms a chrysalis around itself.

Bring the Smithsonian into your classroom

AT THE SMITHSONIAN

Smithsonian Institution Gardens staff see migrating monarchs in their gardens every year. Sometimes they tag them. This helps scientists track and conserve them.

As an adult, the butterfly will spend most of its time trying to reproduce.

These butterflies mate in the spring just before they migrate back to their summer homes.

After migration, females lay their eggs on milkweed plants.

A female will usually lay a single egg on each plant.

They lay around 700 eggs over a few weeks.

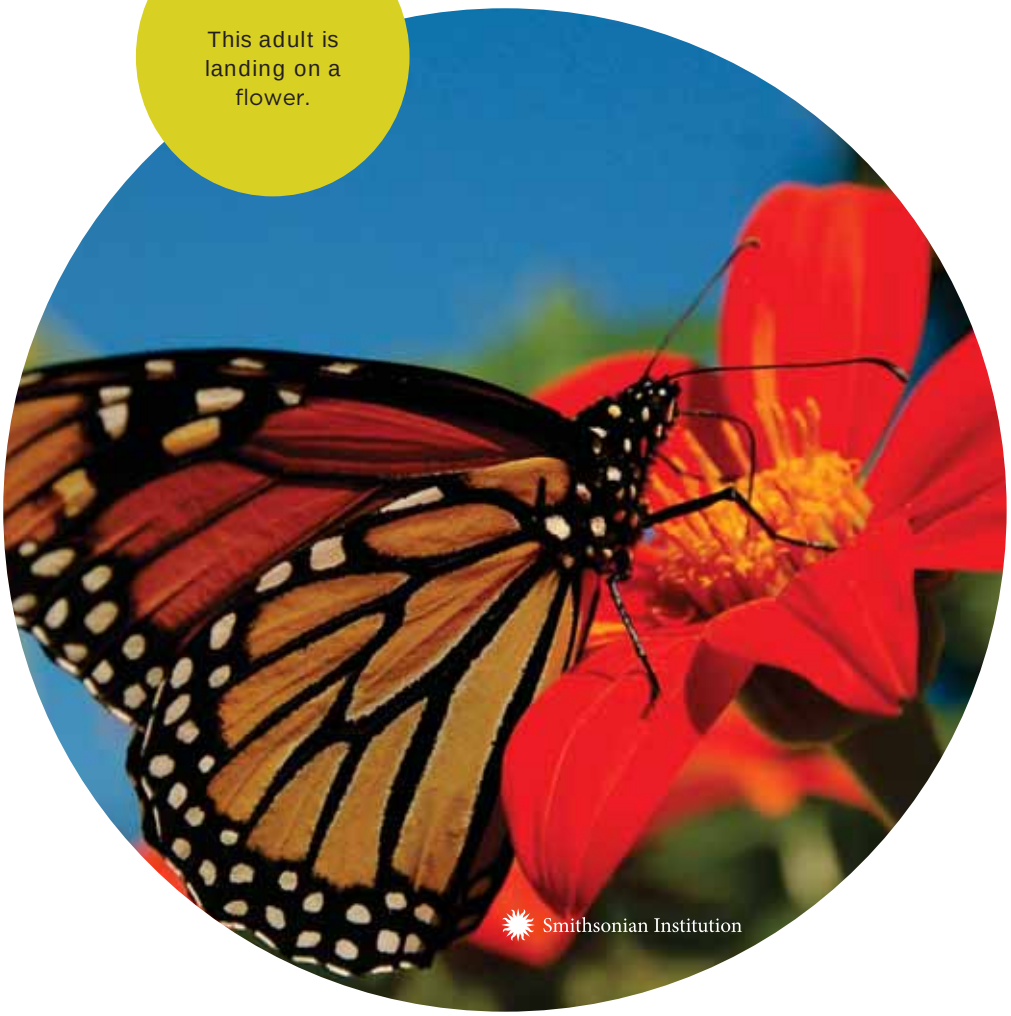
They produce a glue-like substance that helps each egg stick to the plant.

The parents do not care for their young after the eggs are laid.

AGES AND STAGES

The adult butterfly can live up to 6 to 9 months if it migrates during the winter.

If it does not migrate, it will die after about 2 to 6 weeks.



35

Newborn sea lion pups stay close to their mother.

California Sea Lion

A sea lion is born as a baby called a pup. Only the mother cares for the pup.

The pup stays with its mother for several days after it is born.

They spend time together learning how the other smells and sounds.

AT THE SMITHSONIAN

Two of the Smithsonian National Zoological Park's sea lions were rescued as pups. They were orphans found on a beach in California.

An adult sea lions rests on a rock.

After a few weeks, the pup will stay by itself for short periods while the mother searches for food.

When she returns, she can find her pup by its familiar smells and sounds.

While its mother hunts, the pup will stay in a group of other young sea lions.

The pup will drink milk from its mother to help it grow.

It will stay with her for at least 4 months and sometimes for more than a year.

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Sea lions form groups known as rookeries during breeding season.

The sea lion is considered an adult in 4 or 5 years.

Then the sea lion will begin to reproduce.

California sea lions breed, or reproduce, from May to August.

Males and females gather on beaches during this time.

They form large groups called rookeries.

Males fight and compete to get a territory and attract female mates.

Females usually give birth to a single pup about 11 months after breeding.

The sea lion can live between 15 and 20 years before dying.

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AGES AND STAGES

Koala

A newborn koala is called a joey. It is not fully developed at birth.

It is extremely small, measuring around 2 centimeters (less than 1 inch) in length.

This is about the size of a jelly bean. The newborn koala can't see or hear.

After birth, it will crawl into its mother's pouch. Koalas are a type of **marsupial**.

Baby koalas (joeys) spend the first 6 months of their lives in their mother's pouch.

All female marsupials carry their babies in a pouch.

The joey will stay in the pouch for the next 6 months getting milk from its mother and growing.

After 6 months, the growing joey will begin leaving its mother's pouch.

But it still spends time in the pouch when it wants to hide or sleep.

The joey will also hitch rides on mom's belly.

Once koala joeys leave the pouch, they often ride around on their mother's backs.

Once it outgrows the pouch, the joey spends time on its mom's back.

Koalas can usually live by themselves after a year.

The koala will be considered an adult after 2 or 3 years.

Koalas typically breed between August and February.

Females usually give birth just 35 days after mating.

The koala can live for about 15 years before dying.

Adult koalas spend most of their time in trees.

The next time you are outside, look at the animals around you.

Can you tell the young from adults?

Think about how their life stages might compare to one another.

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GLOSSARY

algae: Plant-like organisms that grow in water

caterpillar: A young, developing butterfly when it looks like a worm with many legs

chrysalis: The hard case a caterpillar forms around itself in which it changes into a butterfly

climate: The average weather conditions of a certain place over a period of years

climate zones: Areas of Earth grouped together based on common climate characteristics

climatologist: A scientist who studies climate

egg: An oval or round object from which an animal such as a snake, frog, or insect is born

embryo: The first stage of development of a plant when it is still inside the seed

endangered: A species, plant or animal, that is rare and could die out

filter feeding: Getting food by separating tiny living things from water

germinate: To begin to grow

greenhouse: A glass building used for growing plants

insect: A small animal with three body sections and six legs

marsupial: A mammal born undeveloped that is carried in a pouch on the mother's belly as it grows

metamorphosis: When an animal's body changes as it develops from young to adult

nectar: A sweet liquid produced by a plant

offspring: The young of a living thing

GLOSARIO

Literacy available in Spanish

pedigree: Un diagrama o registro de los miembros de la familia de un organismo

pigmento: Una sustancia que da color a otros materiales

población: Un grupo de individuos que son de la misma especie y que viven en una cierta área

polen: Granos amarillos, parecidos al polvo que se encuentran en una flor y que ayudan a que la planta se reproduzca

polinador: Un animal o insecto que mueve polen de una flor a otra

polinización: El movimiento del polen de una flor a otra

raíz: La parte de una planta que la sostiene en su lugar a medida que crece, y almacena alimento

rasgos: Una cualidad o característica de un ser viviente

renacuajo: Una rana joven en desarrollo en una etapa en la que tiene un cuerpo redondo y una cola

reproducción: El proceso por el cual los seres vivientes producen crías

retoño: Un árbol joven

semilla: Un opbjeto pequeño producido por una planta desde la cual puede crecer una nueva planta

suculenta: Una planta con tejido carnoso que guarda agua

zonas de clima: Áreas de la Tierra que están agrupadas con base en características comunes del clima

Smithsonian | SCIENCE *for the classroom*

Life Science	Earth and Space Science	Physical Science	Engineering Design
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How Do Living Things Stay Safe and Grow? *1-LS1-1 • 1-LS1-2 • 1-LS3-1 • K-2-ETS1-1* **Supporting:** Engineering Design	**How Can We Predict When the Sky Will Be Dark?** *1-ESS1-1 • 1-ESS1-2 • 1-PS4-2* **Supporting:** Physical Science	**How Can We Light Our Way in the Dark?** *1-PS4-2 • 1-PS4-3 • 1-LS1-1 • K-2-ETS1-1* **Supporting:** Life Science and Engineering Design	**How Can We Send a Message Using Sound?** *K-2-ETS1-1 • K-2-ETS1-2 • K-2-ETS1-3 • 1-PS4-1 • 1-PS4-4* **Supporting:** Physical Science
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Grade 4			
How Can Animals Use Their Senses to Communicate? *4-LS1-1 • 4-LS1-2 • 4-PS4-2 • 4-PS4-3 • 3-5-ETS1-1* **Supporting:** Physical Science and Engineering Design	**What Is Our Evidence That We Live on a Changing Earth?** *4-ESS1-1 • 4-ESS2-1 • 4-ESS2-2 • 4-ESS3-2 • 4-PS4-1 • 3-5-ETS1-1* **Supporting:** Engineering Design and Physical Science	**How Does Motion Energy Change in a Collision?** *4-PS3-1 • 4-PS3-2 • 4-PS3-3 • 4-LS1-1 • 3-5-ETS1-1* **Supporting:** Engineering Design and Life Science	**How Can We Provide Energy to People's Homes?** *3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 4-PS3-2 • 4-PS3-4 • 4-ESS3-1* **Supporting:** Physical Science and Earth and Space Science
Grade 5			
How Can We Predict Change in Ecosystems? *5-LS1-1 • 5-LS2-1 • 5-PS1-1 • 5-PS3-1* **Supporting:** Physical Science	**How Can We Use the Sky to Navigate?** *5-ESS1-1 • 5-ESS1-2 • 5-PS2-1 • 3-5-ETS1-1* **Supporting:** Physical Science and Engineering Design	**How Can We Identify Materials Based on Their Properties?** *5-PS1-1 • 5-PS1-2 • 5-PS1-3 • 5-PS1-4 • 5-LS1-1* **Supporting:** Life Science	**How Can We Provide Freshwater to Those in Need?** *3-5-ETS1-1 • 3-5-ETS1-2 • 3-5-ETS1-3 • 5-ESS2-1 • 5-ESS2-2 • 5-ESS3-1* **Supporting:** Earth and Space Science

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