Next Generation Science Standards (*NGSS*) and *Common Core State Standards (CCSS)* Connections

Once Upon a Life Science Book: 12 Interdisciplinary Activities to Create Confident Readers

Chapters 1–3 introduce the book, the reading strategies, and principles of argumentation.

Chapter 4. A-Maze-ing Worms

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- The lab asks students to make a claim and provide evidence. It does not explicitly tell them to include reasoning. Instruct students to include "Reasoning" in their response.
- Address the information-processing aspect more deeply by asking students to make inferences about the mealworms' sensory receptors based on the mealworms' responses or lack of response to stimuli.
- Explicitly address the crosscutting concept of patterns by asking students: what kind of data patterns indicate that a mealworm responds to a stimulus? What kind of data pattern would suggest the stimulus does not affect the mealworm?

Standard MS. Structure, Function, and Information Processing		
Performance Expectation The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below. MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.		
Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Planning and Carrying Out Investigations	Students design and carry out an experiment to see how different stimuli affect mealworm behavior.
	Analyzing and Interpreting Data	Students use data from their own experiment to support their claim.

	Engaging in Argument From Evidence	Students write an argument to support their claim about how mealworm behavior is affected by the stimulus of their choosing. Students read about a claim made by a biologist regarding learning in *C. elegans* and analyze the evidence he provides for that claim.
Disciplinary Core Idea	**LS1.D: Information Processing** Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories.	Students observe information processing at the macro level in mealworms.
Crosscutting Concept	Patterns	Both the articles and the activity illustrate that scientists look for patterns in data to make claims.
	***CCSS* Connections**	
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. **CCSS.ELA-Literacy.RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. **CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Reading Strategies: comprehension coding and reading in groups (both of which require citing specific chunks of text). Comprehension coding requires students to note when their prior knowledge conflicts with what the text says. Students outline the argument made by a practicing scientist about the role of dopamine in learning.
Writing Standards	**CCSS.ELA-Literacy.WHST.6-8.1** Write arguments focused on discipline-specific content. **CCSS.ELA-Literacy.WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.	Students write an argument to support their claim about how mealworm behavior is affected by the stimulus of their choosing. Students compare and contrast their own experiment with one conducted by a practicing scientist.

Chapter 5. Cells R Us

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

The lab asks students to make a claim and provide evidence. It does not explicitly tell them to include reasoning. Instruct students to include "reasoning" in their response.

Standard
MS. Structure, Function, and Information Processing

Performance Expectations
The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectations listed below.

- MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Asking Questions and Defining Problems	Students brainstorm and select a question they can answer based on observations of several types of cells.
	Engaging in Argument From Evidence	Students make a claim to answer the question they have selected and defend it based on their lab data.
Disciplinary Core Idea	**LS1.A: Structure and Function** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	Students observe cells and then read about cells. Students observe cell parts and then read about the function of those parts.
Crosscutting Concept	Structure and Function	Students observe cell parts and read about how those structures function in the cell.
***CCSS* Connections**		
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.4** Determine the meaning of symbols, key terms, and other domain-specific	Using context clues to find the meaning of new words

	words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics. **CCSS.ELA-Literacy.RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.	The writing prompt requires that students use what they learned in the lab and the reading in order to have sufficient information for the FBI agent.
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Prompt: Agent Mildew has just started working for the FBI. It's his first day on the job, and he has been given some cells that were collected from a crime scene. He needs your help to figure out if the cells come from a plant, animal, or bacteria. Write a letter to Agent Mildew explaining what he should look for under the microscope to know what kind of cells he has.

Chapter 6. Healing Powers

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- In the *NGSS*, the topic of mitosis has been moved to high school. Therefore, the *NGSS* standards below are for grades 9–12 and the *Common Core State Standards* address grade bands 6–8 and 9–10.
- This lesson begins with a video activity. Try introducing that activity with a phenomenon that will be common to students—for example, they fall and scrape a knee or elbow. Ask what happens in their body to get new skin? Where does the skin come from? Accept all answers and then move to the video activity. After the activity, ask students if they have any more guesses for where their new skin comes from. Tell them that they can use the reading to refine their answers.
- The focus in the *NGSS* (thankfully!) is on the big picture of mitosis, rather than the stages. If your state has adopted the *NGSS*, skip the cell cycle diagram worksheet.
- Directly address the crosscutting concept of stability and change by pointing out that the goal of the changes made by Andre's skin cells is to maintain homeostasis in his skin covering.

Standard
HS. Inheritance and Variation of Traits
Performance Expectation

The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Developing and Using Models Constructing Explanations	Students watch a video model of mitosis and study visual representations, record observations, and make predictions. Prompt: If Andre asked you how his body got new cells, what would you tell him?
Disciplinary Core Idea	**LS1.B: Growth and Development of Organisms** In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)	The silent video provides students with a model for mitosis. Students use the reading to create an explanation for what takes place.
Crosscutting Concept	Stability and Change	Students observe how changes in a cell produce more cells, while those changes help maintain homeostasis when new cells are needed.
	***CCSS* Connections**	
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). **CCSS.ELA-Literacy.RST.9-10.7** Translate quantitative or technical	Reading Skill: Previewing diagrams and illustrations

	information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	
Writing Standards	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. **CCSS.ELA-Literacy.WHST.9-10.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Students translate their original descriptions of mitosis into a correct scientific description, using proper terms. Students explain to Andre what happened to his skin.

Chapter 7. No Bones About It

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- The lab asks students to make a claim and provide evidence. It does not explicitly tell them to include reasoning. Instruct students to include "Reasoning" in their response.
- The *NGSS* do not include classification for middle school students. However, the main point of this lesson is to compare the muscular and skeletal systems of grasshoppers with that of humans. The grasshopper dissection will motivate students to be interested in that idea! You can de-emphasize the content that relates to characteristics of arthropods (it is a secondary point in the lesson already). Skip the graphic organizer for this chapter.

Standard MS. Structure, Function, and Information Processing		
Performance Expectation The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below. MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.		
Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Engaging in Argument From Evidence	Students use their dissection activities to decide which part of a grasshopper serves as its skeleton.
Disciplinary Core Ideas	**LS1.A: Structure and Function** In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are	Students observe the relationship between the human skeletal and muscular systems and then compare them to those systems in

	groups of cells that work together to form tissues and organs that are specialized for particular body functions.	the grasshopper.
Crosscutting Concept	Structure and Function	Students should infer that the outer covering of the grasshopper is the skeleton because it has the same function as the human bones.
***CCSS* Connections**		
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. **CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Students work through the dissection by reading instructions and answering questions. Reading Skill: Identifying text signals for examples and lists.
Writing Standards	**CCSS.ELA-Literacy.WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research.	Students use the article to prepare an explanation for an absent classmate. They must also draw from their lab, as the article only contains part of the information needed.

Chapter 8. The Case of the Tree Hit Man

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- Plant structure and function are not part of the *NGSS* for middle school. However, the article for this chapter is also about photosynthesis, which is important in the *NGSS*. Replace the "Plant Police Academy" with the modeling Photosynthesis activity from *www.calacademy.org:8080/sites/default/files/assets/docs/pdf/photosynthesisroleplay_lesson.pdf* (many thanks to Karen Kraus for making me aware of this great resource). Save Part 2 of the activity (cellular respiration) for later.
- Have students consider the question in Part 3 of the Plant Police Academy (asking which direction food and water travel in a plant) before reading the article. This would make an easy "warm up" task for the beginning of class.
- Continue with the lesson as written, but you may wish to skip the graphic organizer.

Standard (based on the changes described above)
MS. Matter and Energy in Organisms and Ecosystems
Performance Expectation

The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practice	Constructing Explanations	Students use the information from the article and their exploration to create an explanation for how the hit man killed the tree.
Disciplinary Core Ideas	**LS1.C: Organization for Matter and Energy Flow in Organisms** Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. **PS3.D: Energy in Chemical Processes and Everyday Life** The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen.	The photosynthesis modeling activity helps students see the chemical reaction of photosynthesis, while also emphasizing the sources and locations of the reactants. The article follows the product (glucose) as it moves through the plant for storage.
Crosscutting Concepts	Energy and Matter: Flow, Cycle, Conservation Systems and System Models	Students observe the flow of energy and matter in the photosynthesis modeling activity, and then see more detail of the system in the article.
	***CCSS* Connections**	
Reading Standard	**CCSS.ELA-Literacy.RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	Reading Skill: Previewing diagrams and illustrations
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts,	Writing Prompt: The town of Magnolia Springs has decided to

	including the narration of historical events, scientific procedures/ experiments, or technical processes.	prosecute the tree hit man. You are the police detective called in to explain the case to the jury. Explain how the hit man killed the tree, and include a diagram to help them understand.

Chapter 9. A Gene for Drunkenness?

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

The *NGSS* ask students to examine environmental versus genetic influences specifically on size and growth. However, students are much more interested in understanding how their own bodies work and looking at environmental versus genetic influences on a trait such as alcoholism will engage them and help them to think much more deeply. I suggest using this topic first before talking about growth or using it to extend the topic after using growth to introduce the idea of interactions between environmental and genetic influences on a trait.

Standard MS. Growth, Development, and Reproduction of Organisms		
Performance Expectation The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below. MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.		
Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practice	Developing and Using Models	In the game How Do the Chips Stack Up, students use a visual model of risk to represent the genetics and experiences that may affect their client.
Disciplinary Core Idea	**LS3B. Variation of Traits** Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.	Both the activity and article examine the interplay between genes and the environment for the topic of alcoholism.
Crosscutting Concept	Cause and Effect	The activity, the reading, and the writing prompt require students to think about the complicated systems involved in cause and

		effect with genetics. By the end of the reading, students can answer the question "How would you describe what causes alcoholism?"
***CCSS* Connections**		
Reading Standard	**CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Reading Strategy: Chunking
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Writing Prompt: Your friend says that because his dad and grandpa both had heart attacks, he knows he will have one, too. What would you say to him?

Chapter 10. Oh! I Gotta Pee!

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- This lesson requires students to investigate the interactions between the digestive, circulatory, and excretory systems. However, they may not be thinking about the systems in those terms. You may need to explicitly point out to students that this lesson illustrates the connections between those systems.
- Change the writing prompt at the end of the lesson to the following:

> *Your little brother says that after he drinks, a tube takes the liquid from his stomach to his bladder. Make a counter-claim: "What really happens when he drinks?" Use the structures you saw during the activity as evidence to support your claim and refute your brother's claim. Be sure to include your reasoning.*

Standard MS-Structure, Function, and Information Processing		
Performance Expectation The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below. MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.		
Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practice	Engaging in Argument From Evidence	Make a claim: How does water go from drinking to urination? Use the structures you saw during the activity as evidence to support your claim. Be sure to include your

		reasoning.
Disciplinary Core Idea	**LS1.A: Structure and Function** In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.	Students look for the interactions between the three systems in the production of urine.
Crosscutting Concepts	Systems and System Models Structure and Function Stability and Change	Students will see that the interaction between systems is complicated as they try to piece together the flow of liquid. The article (in particular) points out structure and function and talks about the concept of homeostasis.
***CCSS* Connections**		
Reading Standard	**CCSS.ELA-Literacy.RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.	Reading Skill: Pause, retell, and compare
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.1** Write arguments focused on *discipline-specific content*.	The revised writing prompt asks students to summarize their learning in the form of an argument.

Chapter 11. A Crisis of Crabs

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

After students read the article, provide the data below. Ask, "Does this data support the argument made in the article? Why or why not?" (Note that Columbus, GA is a city in southern Georgia. Rainfall there is being used as a proxy for rainfall reaching the estuary).

Year	Inches of Precipitation Columbus, GA	Hard Crab Harvest (pounds)
1996	43.72	5,791,288
1997	50.92	6,808,290
1998	32.78	5,037,747
1999	26.39	3,901,226
2000	35.59	3,202,634
2001	38.41	2,702,493

2002	44.09	3,188,992
2003	56.43	1,857,755
2004	48.99	3,066,851
2005	62.51	4,387,042
2006	38.84	4,076,881

Source: Data for rainfall are from *www.weather.gov/ffc/rainfall_scorecard.* Data for harvest are from *http://coastalgadnr.org/sites/uploads/crd/pdf/FMPs/BlueCrabFMP.pdf.*

Standard
MS-Matter and Energy in Organisms and Ecosystems

Performance Expectations
The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectations listed below.

- MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Developing and Using Models	Students develop a model of ecosystem activity for a local ecosystem. They use a model of a more complex ecosystem to determine how loss of blue crabs could affect other species.
	Analyzing and Interpreting Data	Students analyze and interpret data on blue crab harvest and rainfall to decide if it supports an argument.
Disciplinary Core Ideas	**LS2.A: Interdependent Relationships in Ecosystems** Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth	Students observe the inter-relatedness of organisms in a local ecosystem and read about a more complicated aquatic ecosystem. Students use food webs to determine relationships between species and what might happen if a species were removed or if an abiotic factor changed.

	and reproduction. Growth of organisms and population increases are limited by access to resources. **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	
Crosscutting Concept	Systems and System Models	Students generate connections between parts of an ecosystem that they observe. They read and diagram about a much more complicated ecological system.
	***CCSS* Connections**	
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. **CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Reading Skill: Pause, Retell, and Compare The graphic organizer for this chapter helps students understand the organization of the text.
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Writing prompt: Study the diagrams that you have of your school yard ecosystem andthe ecosystem of the blue crab. What similarities do you see? What differences are there? Which similarities would you expect to see in many other ecosystems?

Chapter 12. The Outsiders

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

Classification is not included in the *NGSS*. If your school has discontinued teaching classification, you might use this chapter to illustrate the variety of single-celled organisms and ways in which cell organelles show up in unusual places. It also illustrates the way that new evidence leads scientists to reconsider earlier conclusions.

Standard MS. Structure, Function, and Information Processing		
Performance Expectation The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectation listed below. MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.		
Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practice	Engaging in Argument From Evidence	Student study Euglena and make arguments as to whether they are plants or animals. Students read about arguments that scientists made historically about the place of protists.
Disciplinary Core Idea	**LS1.A: Structure and Function** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	Students observe Euglena and then read about other single-celled eukaryotes.
Crosscutting Concept	Patterns	Students consider how scientists historically grouped organisms by looking at patterns in structure and function.
***CCSS* Connections**		
Reading Standard	**CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Reading Skill: Chunking
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Writing prompt: Do scientists ever change the way they classify things? What might cause them to change the way something is classified?

Chapter 13. Some Like It Hot

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

Please note that if you have the first printing of this book (you can look in the front cover to check), it has errors in the activity for this chapter. You can find corrected pages at *https://wheelertoppen.files.wordpress.com/2012/10/penguin_journeys.pdf*.

Standard
MS. Natural Selection and Adaptations

Performance Expectations
The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectations listed below.

- MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practice	Analyzing and Interpreting Data	Students collect data from several rounds of "reproduction" of penguins and look for changes in the frequency of traits.
Disciplinary Core Ideas	**LS4.B: Natural Selection** Natural selection leads to the predominance of certain traits in a population, and the suppression of others. **LS4.C: Adaptation** Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	In the simulation, students observe the frequency of traits changing in two different environments. Then they read about a range of specific adaptations that penguins have developed in cold and warm climates.
Crosscutting Concepts	Cause and Effect	Students answer the question "Did the penguins choose to adapt to their environment?" to help them recognize that the environment drives adaptation.

	Stability and Change	Students read about how changes become more stable once a species has adapted to a new environment.
***CCSS* Connections**		
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. **CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Students use complex instructions for the simulation. Reading Skill: Text Signals for Compare and Contrast
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Writing prompt: What physical adaptations do these foxes have that make them suited to their environment? What behavioral adaptations can you think of that might be useful for these foxes?

Chapter 14. Bacteria

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- The lab asks students to make a claim and provide evidence. It does not explicitly tell them to include reasoning. Instruct students to include "Reasoning" in their response.
- The *NGSS* do not include classification for middles school. This lesson can be used in the context of cells to expand student understanding of bacterial cells structures.

Standard MS. Structure, Function, and Information Processing		
Performance Expectations The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectations listed below. • MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. • MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.		
Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Planning and Carrying out Investigations	Students design an experiment to measure bacteria in several places, select a method of measurement,

	Analyzing and Interpreting Data Engaging in Argument From Evidence	and write an argument based on their results.
Disciplinary Core Idea	**LS1.A: Structure and Function** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	The article describes the cell structure of bacterial cells.
Crosscutting Concept	Scale, Proportion, and Quantity	A bacterium's small size makes it difficult to see, even with a light microscope. Students experience the rapid life cycle of the bacteria as they become visible colonies.
***CCSS* Connections**		
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*. **CCSS.ELA-Literacy.RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.	Reading Skill: Finding the meaning of new words Prompt: Many people think all bacteria cause disease. Is this true? Write a paragraph that supports your answer.
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Writing prompt: This exploration lends itself to sharing the results. Have your students write a letter to the principal or school newspaper describing their experiment and what they found. They should include relevant information from the reading. How concerned should the school be about their findings? Send the best letters to the principal or newspaper.

Chapter 15. Hunting the Ancient Whales

***NGSS* Adaptations: Tips for making this lesson more three-dimensional**

- The lab asks students to make a claim and provide evidence. It does not explicitly tell them to include reasoning. Instruct students to include "Reasoning" in their response.

- You will want to have your students look at pictures of embryos of various developing animals to meet MS-LS-4-3. Whales and dolphins are not usually included in comparative embryo pictures. When you do this, show your students an image of a dolphin embryo, which show the hind-limb bud forming (it is later resorbed). One such image can be found at *www.tmmsn.org/education/dolphin_anatomy/dolphin_embryo.htm*.

Standard
MS-Natural Selection and Adaptation

Performance Expectations
The materials/lessons/activities outlined in this chapter are just one step toward reaching the performance expectations listed below.

- MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
- MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

Dimension	***NGSS* code/citation**	**Matching student task/question taken directly from activity**
Science and Engineering Practices	Planning and Carrying out Investigations Analyzing and Interpreting Data	After learning about the data collected by scientists studying whale evolution, students write about what data they would collect to understand bat evolution.
Disciplinary Core Idea	**LS4.A: Evidence of Common Ancestry and Diversity** The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent.	The article describes several lines of evidence that scientists have used to piece together whale evolution. After reading, students are asked to describe how whales changed as they evolved from land animals to sea animals. Then they complete a graphic organizer to review how each type of data contributed to the big picture.

	Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.	
Crosscutting Concept	Patterns	Students consider patterns in the fossil evidence to put together a potential time line of whale development. Then they read about how patterns in fossils, DNA, soil, and genetics tell the whale story.
	***CCSS* Connections**	
Reading Standards	**CCSS.ELA-Literacy.RST.6-8.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*. **CCSS.ELA-Literacy.RST.6-8.5** Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	Reading Skill: Making sense of scientific names Students use the graphic organizer to sort out the role that each piece of evidence played in the evolutionary argument made by the author.
Writing Standard	**CCSS.ELA-Literacy.WHST.6-8.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.	Writing Prompt: Bats pose a similar evolutionary problem to whales. They are also mammals, but they fly like birds. Bat evolution is not as well documented as whales because bat skeletons are tiny and do not fossilize well, but scientists are making some progress. Give students the handout Going Batty and ask them to think about how they would research the evolution of bats if they were scientists.