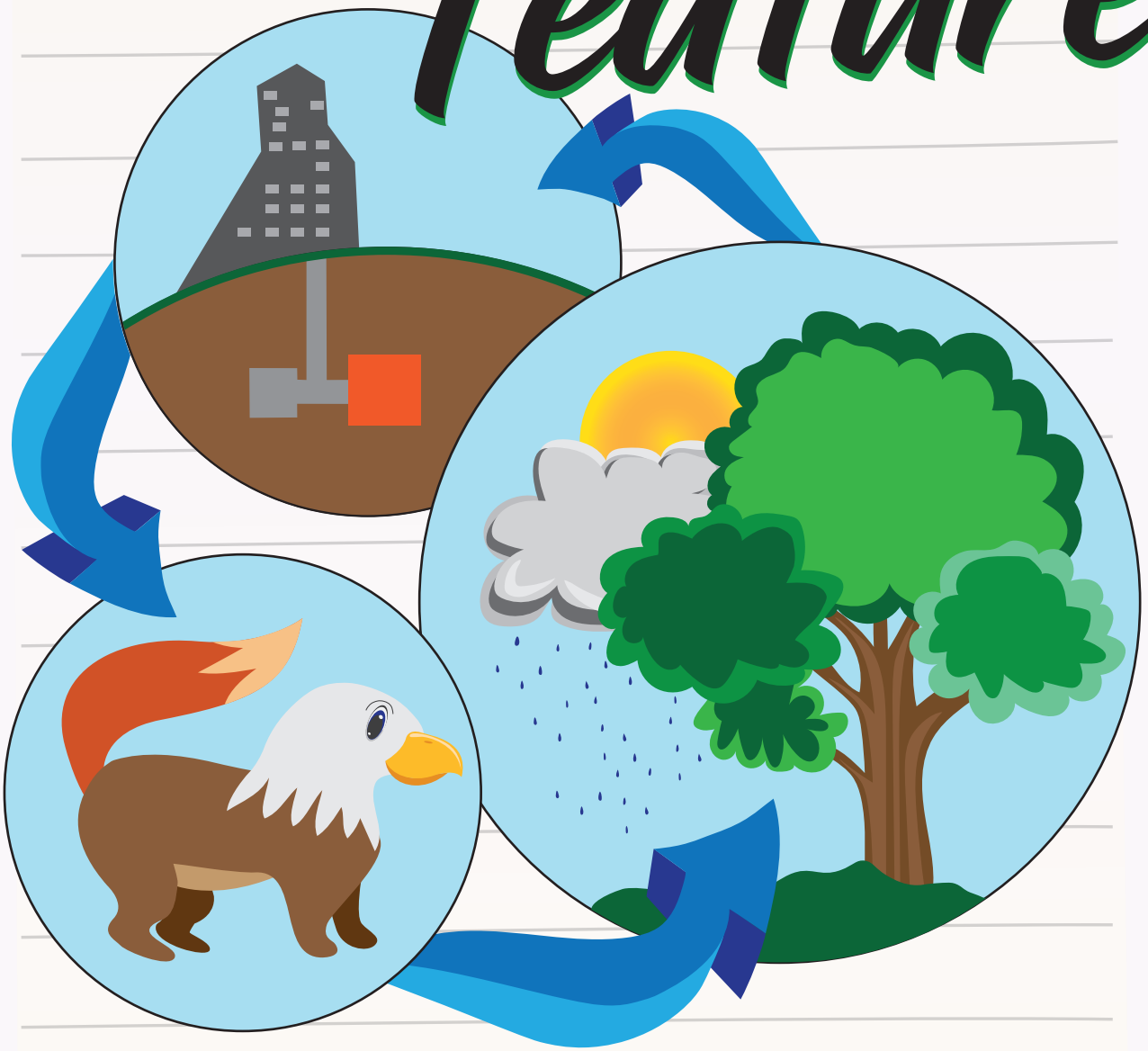
Creature Features



Education and Outreach

K-2 Curriculum Unit

Creature Features

"The Needs of Living Things"

Science Focus: Relationships Among Organisms and Their Environment

Lesson #	Lesson Title	Suggested Time
1	Basic Needs Stayin' Alive	40 minutes- part 1 40 minutes- part 2
2	Defining Relationships No Place Like Home*	40 minutes- part 1 40 minutes- part 2
3	Adaptations I Will Survive	40 minutes- part 1 40 minutes- part 2
4	Creature Mashup The "Perfect" Underground Scientist	40 minutes

* Invite family and community volunteers for Lesson 2

Creature Features (K-2)

During this unit, students explore what animals and plants need to survive. They also closely examine how certain adaptations support these needs. For the culminating activity, students create a mashup that represents the adaptations they believe would be best suited for the success of a scientist working nearly one mile below the surface at the Sanford Underground Research Facility.

Creature Features

The Needs of Living Things

Living things fascinate students in the early elementary grades. One way for young students to study living things is to put them in an observation container. Unfortunately, it is difficult to keep collected specimens alive for extended periods of time. Whether it is a jar of glowing fireflies, a curious beetle, an interesting flower, or a stunning butterfly, all living things have basic needs that must be met in order to remain alive.

Specific requirements vary from species to species, but in order to survive, animals (including humans) need water, air, nutrients/food, and shelter. Plants are living things as well, and need water, air, nutrients/fertilizer, and sunlight. These basic needs must be met by obtaining resources from the physical environment. Therefore, living things can survive only in habitats that meet their specific needs. For example, monarch butterflies lay their eggs on milkweed plants, which provide both shelter and a food source for growing monarch larvae. Therefore, a monarch habitat must include milkweed plants.

Often, a habitat is referred to as a home. A habitat is a place where an organism has everything it needs to survive; all of its basic needs are met here. Habitats vary in both size and complexity. A habitat could be as simple as a fish bowl, or as complex as a forest.

Plants, animals, and their surroundings represent a complex system of relationships. Living things are always interacting with each other, and with other factors (temperature, space, landforms) in their habitat. In fact, it is not unusual for living things to share shelters in their habitat. Living organisms depend on each other to ensure survival. Most animal babies need to be fed and cared for by their parents. Young animals (offspring) may learn to vocalize to influence behavior of parents to feed and protect them. Even pets have special needs and must be cared for by their owner. Plants often depend on animals for pollination or to distribute their seeds.

When comparing different habitats, we often find there is a great diversity in both the number and type of species. Some habitats possess a wide range of species (like the rainforests), and some have a small number of species (like the Antarctic). Even the forests of Maine differ from the forests of South Dakota due to temperature and rainfall differences. You can find certain animals or plants in one habitat that you will never find in another. But some animals and plants can be found in both! It is these differences that make the world around us so much fun to explore.

Every organism possesses certain adaptations, which help it survive in a particular habitat; some adaptations are structural. Structural adaptations are physical features of an organism like the hump on a camel, webbed foot on a duck, or spines on a cactus. Other adaptations are behavioral. Behavioral adaptations are the things organisms do to survive. For example, prairie dogs burrow to escape predators, and vines climb to reach more sunlight.

The culminating lesson, asks students to consider what adaptations might be advantageous if you were a scientist working nearly one mile-underground? Giving them the opportunity to engineer the “perfect” underground scientist.

Creature Features

Standards Addressed in the Unit

K-LS1-1 Describe patterns of what plants and animals (including humans) need to survive.

K-ESS3-1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

1-LS1-1 Design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*

1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.

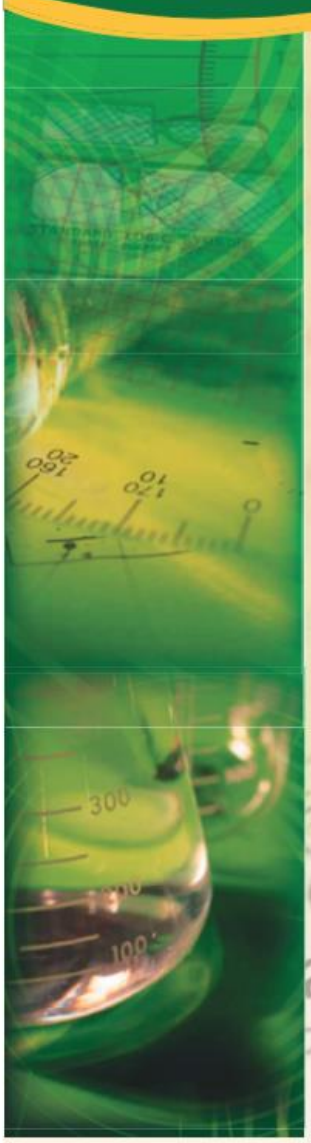
K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. (Appendix C, pg. 53)

Standards with an emphasis on engineering are marked by an asterisk (*). For more information, see the page 201and Appendix C of the South Dakota Science Standards.

Throughout this unit, students are expected to model relationships. They begin by identifying and comparing the basic needs of living organisms **(CCC: Patterns)** and helping solve the problem of how to keep specimens alive after collection by determining ways in which an organism's habitat supports its basic needs. As students delve more deeply into the relationships that exist among plants, animals, and their surroundings **(CCC: Systems and system models),** students observe living things in a variety of habitats. Students also draw connections between the various parts of living organisms and their purpose **(CCC: Structure and function)** for meeting their needs in the habitat where they live.

Additionally, students **analyze and interpret data (SEP 4)** by using observations (firsthand or from media) to describe patterns in the needs of living things. They also use basic models to illustrate their thinking **(SEP 2: Developing and using models)** about the needs, adaptations and interactions of living things. Students also obtain information first-hand, and through a variety of media, about the diversity of living things in different habitats **(SEP 8: Obtaining, evaluating and communicating information).** Lastly, students construct an underground scientist mashup and explain how each part of their scientist is particularly well suited to working in the underground environment. **(SEP 6: Constructing explanations and designing solutions)**.

Science and Engineering Practices



1. Asking questions (science) and defining problems (engineering).
2. Developing and using models.
3. Planning and carrying out investigations.
4. Analyzing and interpreting data.
5. Using mathematics and computational thinking.
6. Constructing explanations (science) and designing solutions (engineering).
7. Engaging in argument from evidence.
8. Obtaining, evaluating, and communicating information.

A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (NRC 2011)

Creature Features

Materials List

- **Teacher-Provided**

Lesson	Materials Needed
1	For launch (teacher): • 2-3 specimen containers (with dried plants/insects etc) For each small group: • Specimen container (with dried plants/insects etc.) • Hand lens For class: • Book: Little Penguin- The Emperor of Antarctica For each student: • Organism card ➢ Science notebook ➢ Glue ➢ Scissors ➢ Crayons, colored pencils, or markers • *Needs of Living Things*
2	For launch (teacher): • Video: Penguin water exit For each student: ➢ Science notebook ➢ A clipboard or other hard surface For each small group: • Hand lens ➢ Camera (optional) • Colored pencils
3	For each pair: • *Organism Card* For each student: ➢ Science notebook • *Character creation cards* (two per student) For each group of 3 students: • One habitat game board, colored tokens and card set For the class: • Video: Iktomi and the Animal Warrior Society
4	For launch (teacher): • Book: I Wish That I Had Duck Feet For each student: ➢ Science notebook ➢ Drawing and craft supplies (paper, colored pencils, colored paper, glue, pipe cleaners, colored markers, paint, etc.)

Adjusting Modules to Accommodate Your Classroom Needs

Timing

The education team at the Sanford Underground Research Facility has done its best to develop curriculum modules that are flexible and incorporate both facilitator and student supports. As you explore this module with your students, please keep in mind that these curriculum modules are grade banded. If your students are at the lower end of the grade band, or if they come to you with limited experiences in science, you should fully expect the module to take more time than designated in the facilitator's guide. This is especially true if you teach very young students.

As an effective educator, you will know how to adjust the timing of these lessons to best fit your classroom and students. Please feel free to break any of the lessons into shorter segments, over multiple days, to accommodate the learners in your classroom.

Follow-up/Practice

Lessons in this unit include 'Follow-up/Practice' sections. These are useful (optional) resources proposed to enrich classroom practices for diverse learners. These resources are not included in the time designations of the unit; if you feel your students will benefit by pursuing these resources, please plan for additional time.

Design Principles

Effective educators alter, adjust, and change their instruction depending on who is in the classroom and the extent to which those students are succeeding. Frequently, educators will augment curriculum with additions of instructional strategies. However, please keep in mind that best practices in science education have shifted from merely *learning about* to *figuring out.* These units are designed to provide opportunities for students to figure out phenomena and design solutions to problems.

This emphasis on *figuring out* represents a revolution in how we teach science at all grade levels. In their learning, students must use all three dimensions of the science standards—crosscutting concepts (CCCs), disciplinary core ideas (DCIs), and science and engineering practices (SEPs)—in an integrated fashion in order to make sense of phenomena or design solutions to problems.

Classrooms incorporating three-dimensional learning will have students build models, design investigations, share ideas, develop explanations, and argue using evidence. All of which allow students to develop important 21st century skills such as problem solving, critical thinking, communication, collaboration, and self-management. Three-dimensional learning also helps students apply new knowledge to other situations. Every student will benefit from this instructional approach.

Important Note	
Science Notebooks	**You may wish to have students set up their Science Notebooks prior to the first lesson.** Science notebooks are an important part of solidifying your students' learning. Student scientists record their observations, questions, evidence and ideas in a running record of their thinking. Science notebooks are also a great way to practice writing skills! As students develop their understanding of science concepts, they may use drawings and other illustrations- such as charts, tables, models, and graphs. The science notebook can be used by the teacher to assess the development of student understanding. Science notebooks may be a printed booklet prepared by the teacher, a bound composition, or a spiral notebook. A printable science notebook specific to this unit is available in the print masters section.

Creature Features

Lesson 1	Stayin' Alive
Overview Standard(s) & Objectives	**Overview** Students are presented with a problem- their teacher has been trying to collect specimens of living things to show to the class, but can't seem to keep them alive. Do all organisms need the same things to survive? Are there patterns in the basic needs of living things? **(K-LS1-1)** Do all organisms meet their basic needs in the same way? Is there a way to represent the special relationships between parents and offspring when it comes to survival? **(1-LS1-2)** Students will work together to answer these questions and provide their teacher with the best possible advice for keeping her specimens alive. **Building Toward** K-LS1-1 Describe patterns of what plants and animals (including humans) need to survive. Crosscutting Concept • Patterns- Patterns in the natural and human designed world can be observed and used as evidence. Science and Engineering Practice • Analyzing and Interpreting Data- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. 1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. Crosscutting Concept • Patterns- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. Science and Engineering Practice • Obtaining, Evaluating and Communicating Information- Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. **Objectives** Students • Identify the basic survival needs of plants. (Water, air, nutrients/fertilizer, and sunlight.) • Identify the basic survival needs of animals. (Water, air, nutrients/food, and shelter.) • Compare the needs of plants and animals by completing a Venn diagram.

Creature Features

	• Distinguish patterns in the basic needs of living things. • Identify ways in which an organism's habitat supports its basic needs. • Identify behavior of parents and offspring that help offspring survive.
Background Information	There are an uncountable number of living organisms in the world. However, despite the variety, there are common requirements for survival of plants and animals. **Water** All living things require water, but the amount necessary varies from species to species. Some organisms live in water; some need salt water; and others can only survive with fresh water. Plants need enough hydration to carry out photosynthesis and, for animals, water is necessary for biochemical reactions taking place within cells. **Air** Air is made of several gases, but two of the most important are oxygen and carbon dioxide. Animals breathe in oxygen and breathe out carbon dioxide. Plants use carbon dioxide (together with sunlight and water) to produce sugars (food energy) and generate oxygen as a by-product. There are air pockets in soils, and dissolved gasses in water, that enable organisms to survive in those locations. All organisms possess special organs (or structures) that help them absorb the gasses they need. For example, fish absorb oxygen from the water with their gills. Plants get air through tiny holes on leaves called stomata. **Nutrients (Food)** All living things need a source of nutrients. Nutrients are necessary for growth and maintaining health. Plants take in nutrients from the surrounding environment through their roots and leaves. These nutrients allow plants to carry out photosynthesis to make their own food. Animals, on the other hand, must eat a variety of foods (plants, and other living things) for their nutrients. Many organisms, including humans, can store nutrients. Animals can survive several days without food, but eventually food needs to be consumed in order to survive. Plants can store food in roots, trunks, and specialized underground storage structures (like potatoes). Plant food storage helps them survive through the winter when it is harder to photosynthesize. **Sunlight** Sunlight is necessary, in some way, to all living things. Primarily, the Sun serves as a heat source that warms the Earth. A plant needs sunlight so that it can produce its own food through a process called photosynthesis. Plants take in energy from the Sun and use it to produce food and generate oxygen. Animals indirectly need sunlight because many depend on plants as a food source. Sunlight also provides humans with vitamin D, a vitamin that ensures bone strength.

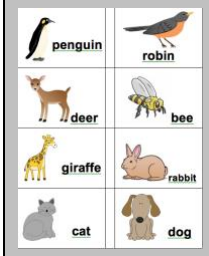
Creature Features

	Shelter Shelter protects living things from the weather and other potential dangers, like predators. Shelters may also provide living spaces that are at an ideal temperature. Most animals live in natural structures like nests, caves, or burrows. Humans are able to build structures (man-made) for shelter. **Habitat** Every living thing needs a place to live and grow. Components of an appropriate habitat include suitable temperature and adequate space. Humans have a way of helping themselves if it gets too cold or too hot. But this is not so for every living thing. If it is too cold or too hot, organisms may struggle to survive. The habitat must also have sufficient resources for survival. For example, some plants can only survive in very damp conditions, while others require a drier environment. Certain factors in an organism's environment can prevent it from surviving there. Those factors are called 'limiting factors'. They include lack of appropriate food, temperature, water, or shelter. Physical barriers like landforms and bodies of water may even prevent an organism from moving to another place when its needs can no longer be met by the current location. **Relationships** Organisms need other organisms to ensure survival. Most animal babies need to be fed and cared for by their parents; human babies are especially in need of care when young. Even pets have special needs and must be cared for by their owner.
Materials	For launch (teacher): • 2-3 specimen containers (with dried plants/insects etc) For each small group: • Specimen container (with dried plants/insects etc.) • Hand lens For class: • Book: Little Penguin- The Emperor of Antarctica For each student: • Organism card ➢ Science notebook ➢ Glue ➢ Scissors ➢ Crayons, colored pencils, or markers • *Needs of Living Things*
Prior Knowledge	Students should know the difference between living and non-living things. Students may be able to express the idea, that in order for something to be dead; it must have first been living. Humans are considered animals (not plants).

Creature Features

Launch (15 minutes)	
Engagement and Communication of Student Expectations	Ask students if they have ever collected items and put them in a container so they could watch them more closely. (*It is likely that many of the students have collected ladybugs, grasshoppers, flowers, etc. in some sort of container.)* Show the class your "specimens" and tell them that you need some advice. Explain that rocks are no problem, but no matter how careful you are, you just do not have any luck keeping plants or animals. Ask if they might be able to give you some advice. Give each small group of students a specimen container and hand lens. Have students turn and talk to their partner about what advice they have to offer that would help you keep the specimens alive. Then, as a class, do a large group sharing of advice. **Note:** *During this class conversation, you have an opportunity to discover if students know the difference between living and non-living things. This may come up naturally as students attempt to give you advice. They may suggest you poke holes in the lid, or include a handful of grass. Ask why? Use this to transition to the requirements for plant and animal survival.* Thank the students for all of their advice. Then tell the class that they made you wonder about common needs (patterns) of plants and animals. Draw a T-chart (model) on the board. Write "Plants" on one side and "Animals" on the other. Explain to the class that you will be their recorder. Students will turn and talk to a partner, and then they will share all of their ideas. Ask them, *"What do animals (including humans) need to survive?"* ***Note:*** *It may be necessary to begin by using familiar examples like dogs, cats or horses. Expect students to be able to recognize that these animals all need food to eat, water to drink and air to breathe. They might also suggest that animals need clothing and shelter in order to keep warm and dry. Record all students' ideas on chart paper or on the whiteboard.* Then ask students, *"What do plants need in order to survive?"* Perhaps students have cared for plants. Maybe they have seen lawns or gardens being watered. Again record all ideas. ***Note:*** *If students do not suggest light as a need of plants, simply ask them if they think plants need light. You could help them reason out the answer by asking if gardens are planted in covered areas or in open areas. Expect them to make the connection that gardens would not do as well if they were planted under a cover, but may thrive in an open area with lots of sunshine. It may also be interesting to consider if animals need light to survive? (*Animals indirectly need sunlight because many depend on plants as a food source. Sunlight also provides humans with vitamin D, a vitamin that ensures bone strength.)

Creature Features

	As a group, review the lists generated and see if any of the suggestions describe the same notion- such as home and shelter. Keep in mind your role as recorder. Do your best to encourage active participation of all students. Circle similar ideas in one color to help visualize the connections. Assist the students as they try to identify the similarities in each list. Now pare down the lists to determine a pattern in the very basic needs for each. This may be an opportunity to discuss the difference between needs and wants. ***Note:*** *Both plants and animals need air. Plants need carbon dioxide (a gas that animals exhale), and animals need oxygen (a gas that plants produce). If your students go here, focus on the gases plants and animals need, not on understanding the process of photosynthesis.*
Explore (25 minutes)	
Procedure 	**Part 1- Fulfilling Basic Needs (What/Where)** 1. Ask the students to choose an organism card. *Blanks are included on USB drive if you wish to create your own.* 2. On pg 1 of the science notebook- direct students to draw a picture (model) of, or write about, their organism surviving in the place it lives. *What does it need? Where are these needs fulfilled?* **Research (optional)** If necessary, and if time allows, you might encourage students to investigate any special needs of their organism. ***Note:*** *This is a logical place for students to discuss the differences between tame and wild animals, or even native vs. cultivated plants.* *The organism cards include a handful of plant cards. You should decide in advance if you wish to include both plants and animals in this task.* *You may need to explain that shelter is a place where organisms live that protects from bad weather or other dangers. Ask the students to give examples of shelters such as a burrow for a rabbit, a doghouse for a dog, an anthill for an ant, a nest for a bird, or even plants that grow beneath trees.* As students work, circulate first to address any procedural questions and then to listen to what students are talking about and to ask probing questions to further their thinking. Encourage students to include labels where necessary. The students should draw, or write about, the actual food, water, and shelter their organism needs. Informally assess the science notebook drawings to make sure the students are grasping the concept of basic needs.

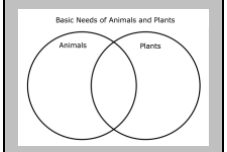
Creature Features

	Part 2- Fulfilling Basic Needs (How) 3. Read *Little Penguin- The Emperor of Antarctica.* 4. Facilitate a student discussion about the book. Ask students to first explain to a partner why the little penguin lives in Antarctica. Then in a larger group setting help students discuss: • How does the little penguin meet his needs in the Antarctic? ○ How did the little penguin's parents help him to survive? Make a list of student suggestions on the board. *(cradled little penguin on their feet and tucked him under belly flap to help protect him from cold; parents fed him with crop milk/fish/squid/krill)* ○ How do parents of other offspring behave in similar ways? ○ What did little penguin do to help himself survive? *(peeped when he was hungry; got away from a predator- lion seal- and squawked in alarm; hunted for his own food)* ○ How do other offspring behave in similar ways? *(Might also consider human babies or pets)*
Questions	**Driving Question** • What are the basic survival needs of plants and animals? **Probing Questions** • What do plants/animals need in order to survive? • What things do plants need that animals don't? • What do humans need? • Are humans plants or animals? • What do your pets need? • Where do living things get what they need to survive? • What do animals/plants eat? • Do all living things eat? • Where does a plant's food (energy source) come from? • Why do certain organisms live in certain places? • What are some ways that parents help their offspring survive? • What can organisms do to help themselves survive?
Summarize (10 minutes)	
Communicate	**Facilitate a student discussion** **Where do plants and animals get what they need?** • Review the needs listed at the start of the lesson. • Where do plants and animals get these things? (*Help students relate these needs to the places they live.)*

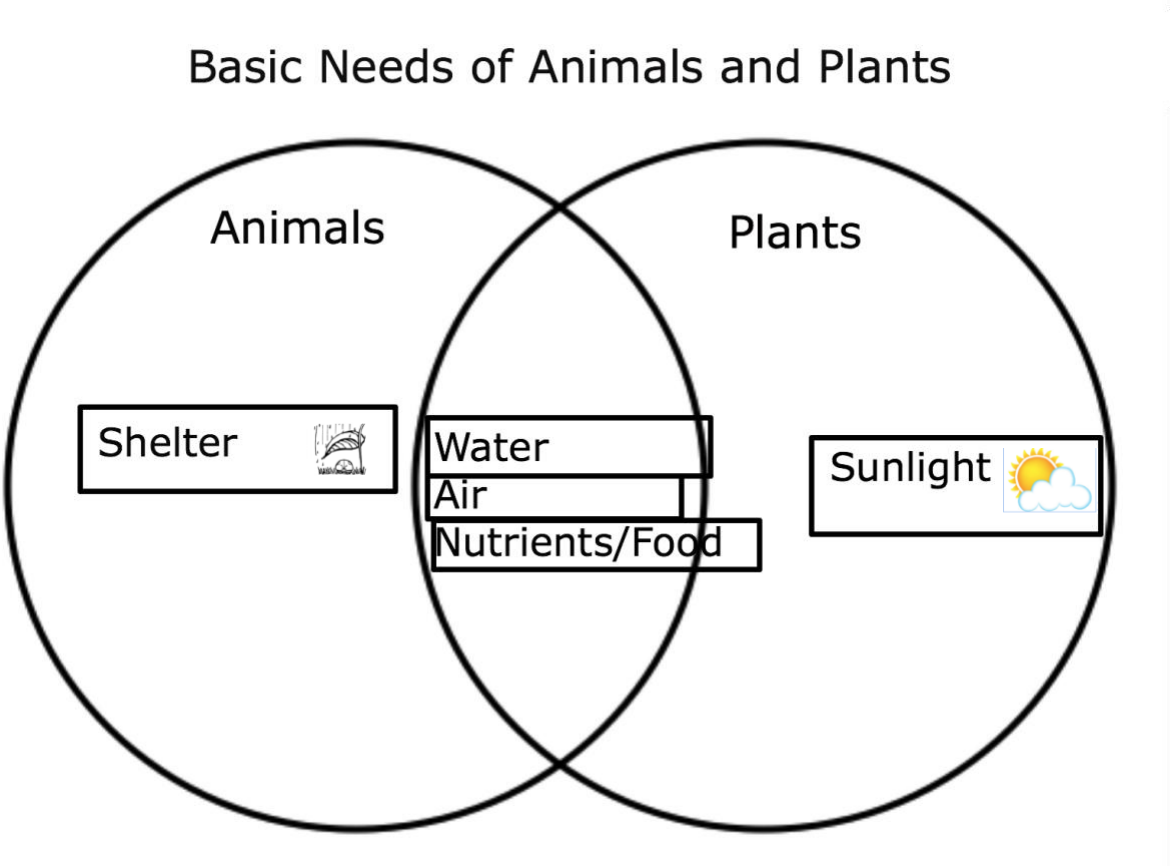
Creature Features

	As time allows, ask students to share their drawings (models) with each other- explaining how their organism's needs are met. Help students discuss the connection between the needs of different plants or animals (including humans) and the places they live. **Get students to tell you why this it is so challenging to keep collected specimens alive and what you can do in the future.** Thank the students for all of their advice. Now that you know what plants and animals need to survive, you think that you might have some ideas why you have so much trouble keeping your specimens alive. *(You cannot provide the right habitat!*-- A habitat is a place where an organism has everything it needs to survive.) *From now on, maybe the best thing to do is to keep animals in the container only a short time to observe them. After that they can be released. Students might even recommend that you simply take a picture.* *If the specimen is a plant, a long-term solution might be to collect the entire plant and pot it. If its needs can be met in the new location only.*
Terminology and Concepts to Solidify	**Habitat-** the place (or type of place) where a plant or animal lives and grows. It provides the organisms that live there with food, water, shelter and space to survive. **Model-** the generation of a physical, conceptual, or mathematical representation of objects or phenomenon. **Scientific models** are often used in the construction of scientific theories. **Nutrients-** a substance that an organism needs for the maintenance of life and for growth **Organism-** a living thing **Pattern**- Consistent and recurring characteristic **Shelter-** a structure that provides cover or protection **Specimen-** a sample collected for examination or study **Survival-** continuing to live or exist **Tame-** domesticated (an animal), or cultivated (a plant) **Venn Diagram-** A *diagram* that uses circles to represent sets, in which the relations between the sets are indicated by the intersection of the circles **Wild-** (of an animal or plant) living or growing in the natural environment; not domesticated or cultivated
Connection to Big Ideas (Phenomena)	Living things have basic needs, which must be met by obtaining resources from the physical environment. Living things survive only in environments that meet their needs.
Follow Up/Practice	Create a picture or poster to inform others about the basic needs of a plant and the basic needs of an animal. Include pictures and words. (A word bank may be provided for all students)

Creature Features

Assessment	**Compare the Needs of Plants and Animals**
 	Hand out the list of needs. (Print master pg 40)(Each page includes 6 sets) Ask each student to cut out the labels. Then discuss with a partner and create three groups. One will be things that plants need, one will be things that animals need, and one will be needs of both plants and animals. *(Venn Diagram- model)* *You may wish to look at the groupings before asking students to glue them into their science notebooks, pg 2-3. Though a suggested key is shown below, it is most important that students are able to explain their grouping- supporting their answers with logic and evidence.*

Suggested Venn Diagram key



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Optional Extension

Overview

Plants require certain things to grow successfully. They need water, light, nutrients, a substrate to grow in, and often a suitable temperature. If these are not optimal for a plant, then its ability to grow can be reduced, or even prevented.

Students can design and conduct their own experiment to explore the basic needs of plants.

(Blank recording sheets can be found at the back of the student notebook- pg 16-17)

Materials

- Newspaper
- Masking tape
- Marker
- Small, clear plastic cups
- ½ to ¾ cup potting soil, or other substrate, for each cup
- Seeds (grass)
- Water, or other liquid
- (Optional) spray bottles- can help prevent overwatering

Launch

Hold up the packet of grass seed. Ask what, specifically, grass seed would require to grow and how those things fit with the list of organism "needs". Make a list of all responses.

Explain that a variable is a factor that can be tested. Ask students to name some of the variables in this experiment (e.g., type of container, the temperature of growing area, type of liquid, amount of light, etc.).

As a class decide if there are any items on the list that could not be tested in the classroom. If so, cross those items off the list.

Explore

Tell students that they are going to do their own experiment to test the needs of plants. They will test one of the variables discussed to find out if it will affect the ability of the grass to grow.

Working in pairs, students should decide which variable they will be testing. When students design their experiments, they will construct two growing cups (a control and a variable) they should control everything, but the one variable they are exploring.

Creature Features

Variables may include, using cola instead of water, growing in sawdust instead of soil, or keeping one cup in the dark.

- Before students begin planting, give each pair a sheet of newspaper. Tell students to cover their work area with the newspaper.
- Place masking tape on each cup and label each with the student's name.
- To construct the control, students should add soil to their cup using a small spoon or measuring cup.
- Sprinkle grass seed over the top and cover lightly with soil.
- Carefully water the control. Each time students water, it should be the same amount for both variable and control.
- Construction of the second cup may vary depending on the variable chosen. Work closely with students as they construct the second cup.
- Students should write down their observations for both cups.
- Place controls in a sunny location near a window.

Allow pairs to decide *where to place their grass if they have chosen to* investigate different light sources (or lack of light), hot vs cold, etc.

Observe cups every few days and record observations in science notebooks.

Summarize

Have students share the results of their experiments.

Did their findings support what they have learned about the basic needs of plants? Why or why not?

Creature Features

Lesson 2	No Place Like Home
Overview Standard(s) & Objectives	**Overview** Students are presented with a new dilemma- their teacher has been trying to find a penguin living in South Dakota. Can the basic needs of a penguin be met in South Dakota? Students will delve deeper into the needs and diversity of living things as they explore specific habitats. (**K-ESS3-1) (2-LS4-1)** How do organisms depend on one another to survive? Students will work together to answer these questions and do their best to explain to their teacher why penguins are not found wild in South Dakota. * Invite family and community volunteers **Building Toward** K-ESS3-1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. Crosscutting Concept • Systems and System Models- Systems in the natural and designed worlds have parts that work together. Science and Engineering Practice • Developing and Using Models- Use a model to represent relationships in the natural world. 2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats. Science and Engineering Practice • Planning and Carrying Out Investigations- Make observations (firsthand or from media) to collect data which can be used to make comparisons. **Objectives** Students • Explain the relationships between the needs of different organisms and the places they live. • Describe how living organisms depend on each other in order to survive and grow in a system. • Explore the diversity of life in a local habitat by recording and organizing data on different plants and animals. • Compare the diversity of living organisms in the schoolyard to that found in a very different habitat (ie forest).

Creature Features

Background Information	Often, a habitat is referred to as a home. A place where an organism has everything it needs to survive. All of its basic needs are met here- water, air, nutrients, shelter, and sunshine. Habitats vary in both size and complexity. A habitat could be as simple as a fish bowl, or as complex as a forest. Plants, animals, and their surroundings represent a complex system of relationships. Living things are always interacting with each other, and with other things (temperature, space, landforms) in their habitat. In fact, it is not unusual for living things to share shelters in their habitat. Organisms need other organisms to ensure survival. Most animal babies need to be fed and cared for by their parents; human babies are especially in need of care when young. Even pets have special needs and must be cared for by their owner. There are many different kinds of living things in any habitat (biodiversity). This diversity is the variety of life. The presence of specific plants and animals is determined by many factors, including temperature, availability of water and nutrients, and by interactions with other species. The more diversity in a habitat, the healthier (and more resilient to change) the habitat is considered.
Materials	For launch (teacher): • Video: Penguin water exit For each student: ➢ Science notebook ➢ A clipboard or other hard surface For each small group: • Hand lens ➢ Camera (optional) ➢ Colored pencils
Prior Knowledge	Students should be able to describe the basic survival needs of plants and animals. Living things survive only in environments that meet their needs.
Launch (5 minutes)	
Engagement and Communication of Student Expectations	Tell students you have another problem that you would like their help with*: "I have been looking for a penguin to bring into class for you to observe, but I just can't seem to find one."* Explain that you've looked in the forests of the Black Hills, in the Badlands, and grasslands, along the rivers, and you just can't seem to find any penguins! You may want to use a short video clip to explain why you want to find a penguin to share, and ensure that students are familiar with penguins and their typical habitat: https://www.yout-ube.com/watch?v=A9mbCNs47FI Ask the students if they could give you some advice that might help you find one in its natural habitat. (*This should lead to a short discussion explaining reasons that you will not find penguins in South Dakota. Students may even be able to tell you that penguins are adapted to very specific habitats*)

Creature Features

Explore (35 minutes)	
Procedure	**If we can't find a penguin around here…What might we find instead?** Today we are going to learn about the variety of plants and animals that live in our schoolyard (*system*). • Have you ever noticed how many different things live around the school? • Why are they here? • Have you ever thought about how they depend on one another? **Note**: *Depending on your location, students may have an opportunity to identify and explore a variety of habitats (e.g., playground, garden, forest, parking lot) and types of living things in each habitat (e.g., trees, grasses, bushes, flowering plants, lizards, squirrels, worms, ants, lady bugs, fish)* *Young students tend to define 'plants' in a very narrow way, often failing to consider grasses, trees, or vegetables as plants. It is also common for young students to deem only vertebrates as animals. Be sure to watch for these naïve ideas and help them broaden their notions if necessary.* **Part 1- What lives in our schoolyard?** * With family and community volunteers (Learn About) Have students prepare to go outside; this includes taking his or her science notebook, clipboard, hand lens, and pencil (or colored pencils). 1. Ask each student to record observations of living things in their designated area of study. They will record their observations (text and/or drawings) in their science notebook, pg 4-5. 2. Instruct students to record their observations under either "Plants" or "Animals". 3. Students should record the types of organisms they find, as well as the number of each type. 4. If students have a name for any of these organisms, they could record the name. (Encourage students to use the names they know- they could be Lakota, Spanish, German, sign language, etc) **Students should only make observations and not touch or collect any specimens.* **Note:** *If using a camera, you may need to limit the number of photos that can be taken by each group. One way to do this is to suggest that they take only 2 photos. They could be interesting specimens, or they could be pictures of the most abundant organisms.* 5. Once back inside, create a class chart using each student's data. Data should include the types of organisms, and how many of each. • As a class, how many plants were counted? How many animals? Were they all the same kind? Which did you have names for? • Which plant and/or animal was the most abundant? • Did you find anything unusual? Why or why not? • Were the organisms in one area (types and/or numbers) different from the organisms in a different area? (diversity) Why or why not? **Optional:** create bar graph of class data showing abundance/diversity of species.

Creature Features

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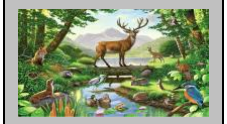
<td>  </td>
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Part 2- What are plants and animals like beyond the schoolyard?

* With family and community volunteers (Learn From)

6. Interview volunteers to find out about the plants and animals (*habitat and diversity*) in the places they have lived.
   - When you were growing up, what did *you* have in your yard? (*Plants, animals*)
   - Where was this? When was this? How was it the same/different?

Additional Practice- What if our schoolyard was in a forest?

7. Project file 'forest animals and plants' from included USB. Give students a few minutes to record the plants and animals observed in their science notebooks, pg 6-7.
8. What are some organisms that are likely to live in the forest but might not be shown in this picture?
9. As a class, identify and record representative data on the board.
   - Are the types of organisms found in this habitat the same as what you found in our schoolyard? Why or why not?
   - Do you think the organisms found in this habitat would be able to survive in your schoolyard habitat? Why or why not?
   - Which of the habitats is more diverse? How did you decide?

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Driving Questions

- What is the relationship between the needs of different plants and animals and the places they live?

Probing Questions

- Why do plants and animals live where they do?
- How do living organisms rely on each other for survival? (*systems*)
- In the schoolyard, where did you see the most plant life? Most animal life? (*abundance vs diversity*) Why?
- If you were an animal, where would you want to live in the schoolyard and why?
- If you were a plant, where would you want to live in the schoolyard and why?
- Do you think the things in the schoolyard could live somewhere different? (*Like the forest*) Why or why not?
- Do you think anything else could move into the schoolyard? Why or why not?

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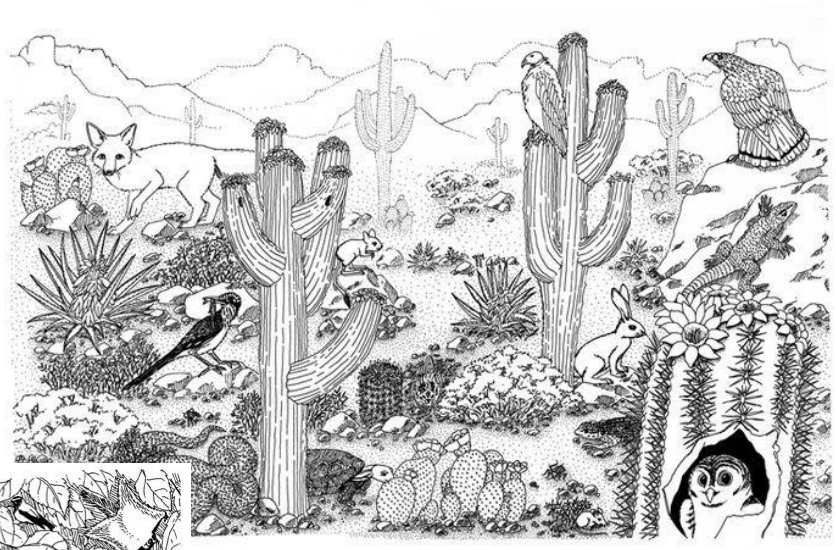
Creature Features

Summarize (10 minutes)	
Communicate	5. Ask students to explain one way in which the schoolyard supports the basic needs of one of the organisms living there. (*For example, a tree may provide shelter for a bird or a lawn may provide food for deer.)* Go around the room and have each student share an example. 6. Ask students to describe one way an organism in the schoolyard might depend on another organism for survival? (*For example, flowers may rely on humans to provide enough water to survive. A pillbug may need the shade of a plant.)* Go around the room and have each student share an example. Finally, thank students for helping you understand why you have not been able to find a wild penguin to bring for the class to observe.
Terminology and Concepts to Solidify	**Antarctic-** the southern polar region is the continent of Antarctica. The Antarctic habitat includes pack ice, mountains and the surrounding seas, and has just two seasons – summer and winter (but even summer is normally very cold). **Behavior-** the way in which an animal or person acts in response to a particular situation or stimulus. **Data-** a collection of facts, such as numbers, words, measurements, observations or descriptions of things **Diversity-** the variety of different things **Observation-** obtaining information through our senses, or by using *scientific* tools and instruments. Any data recorded during an experiment can be called an observation. **Offspring-** the 'young' of living organisms **Relationships-** the way in which two or more concepts, objects, or people are connected **Systems-** a group of interacting, interrelated, or interdependent elements forming a complex whole
Connection to Big Ideas (Phenomena)	A habitat is a place where an organism has everything it needs to survive. Plants, animals, and their surroundings represent a complex system of relationships.
Follow Up/Practice	Read the book *John Willy and Freddy McGee* to the students. If you do not have this book in your school or classroom library, a video of this book being read can be found on the included USB drive. Discuss how the guinea pigs saw the house in a different way than people normally see it. Then have every child choose an object and illustrate how it might look to a class pet. Ask students to explain how the guinea pigs have to depend on other organisms to survive. Help the students to write a caption under their illustration and then post the pictures on a bulletin board titled, "From Our Pet's Perspective".

Creature Features

Assessment	Give students pictures of two different habitats. (Print master pg 41) Ask them to circle all the organisms. Have them draw lines to show <u>relationships</u> between organisms/resources in the habitat. You could ask students to label the relationships, or you could suggest a class legend- blue arrow for water, red for food, green for shelter, etc. **Optional Extension** Ask students to compare the two habitats. Are the same organisms found in both habitats? Why are the organisms so different? Which habitat is more diverse? Why?



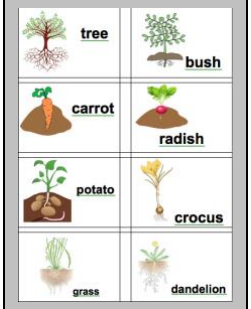
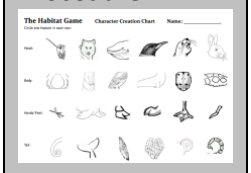
Creature Features

Lesson 3	I Will Survive
Overview Standard(s) & Objectives	**Overview** In this lesson, students develop characters **(K-2-ETS1-2)** and observe their characters' success on one of two habitat game boards in order to explore how certain structures--physical adaptations (shape of body, feet, tail, etc) determine whether organisms can meet their needs in a particular habitat. Students then design a second character for a specific habitat game board. Students collect and analyze data (the number of spaces advanced) to utilize as evidence in discussions concerning the best adaptations/function for each habitat. **Building Toward** K-2-ETS1-2 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. Crosscutting Concepts • Structure and Function- the shape and stability of structures of natural and designed objects are related to their function(s). Science and Engineering Practices • Developing and Using Models- develop a simple model based on evidence to represent a proposed object or tool. **Objectives** Students • Identify common structures of animals such as head, body, feet and tails. • Identify common structures of plants such as leaves, stems and roots. • Draw connections between the various parts (*structures*) of a living organism and their purpose for meeting the needs of that organism in the habitat where it lives (*function*). • Use a model to explore how the structures and functions of living things help them to survive, grow and meet their needs in different habitats.
Background Information	**Grasslands** Grasslands have many names—prairies in North America, steppes in Asia, and savannahs and veldts in Africa. However, they are all places where there is too little rain for trees to grow in great numbers. Instead, these lands are covered in grasses and grass-like plants that have growing points close to the soil and can keep on growing even after being nibbled by animals. Temperatures in grasslands can vary greatly between summer and winter. The summers are hot and the winters are cold. All grasslands also share a lack of shelter from predators. The dominant vertebrates in grasslands are herbivorous, or plant-eating, grazers called ungulates. Ungulates are mammals with hoofs, like horses and deer. Their long legs help them run fast to escape grassland predators. Some of the animals that inhabit temperate grasslands in North America are bison, antelope, birds, gophers, prairie dogs, coyotes, and insects.

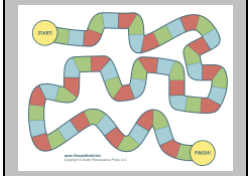
Creature Features

	Antarctica Antarctica is Earth's southernmost continent. It contains the geographic South Pole, and is the fifth-largest continent. About 98% of Antarctica is covered by ice that averages 1.9 km (1.2 mi; 6,200 ft) in thickness. Antarctica, on average, is the coldest, driest, and windiest continent. It is a desert with annual precipitation of only 8 inches along the coast, and even less inland. The temperature in Antarctica has reached −89.2 °C (−128.6 °F), though the average for the coldest part of the year is −63 °C (−81 °F). Organisms native to Antarctica include many types of algae, bacteria, fungi, plants, Protista (microscopic eukaryotes), and animals, such as mites, nematodes, penguins, seals and tardigrades. Vegetation, where it occurs, is restricted to mosses, liverworts, and only three species of flowering plant. **Biological Adaptations** An adaptation is a feature that is common in a population because it provides some improved function. Adaptations are well-suited to their function and are produced by natural selection. Adaptations can take many forms: a behavior that allows better evasion of predators, or an anatomical feature that allows the organism to access a valuable new resource. For example, mimicry of leaves by insects is an adaptation for evading predators, echolocation in bats is an adaptation for catching insects, and anteaters have elongated snouts equipped with a thin tongue that can be extended for slurping up ants in hard to reach places. Adaptations enable organisms to survive, grow, and meet their needs in a particular habitat.
Materials	For each pair: • *Organism card* For each student: ➢ Science notebook • Character creation cards (two per student) For each group of 3 students: • One habitat game board and card set, and three colored tokens For the class: Video: Iktomi and the Animal Warrior Society
Prior Knowledge	Living organisms have basic needs that must be met in order to survive. A large variety of plants and animals inhabit different habitats. These organisms meet their needs with resources found within their particular habitat.

Creature Features

Launch (10 minutes)	
Engagement and Communication of Student Expectations 	Remember how the little penguin and his parents, from *Little Penguin- The Emperor of Antarctica*, had adaptations (*physical structures and behaviors*) that allowed them to thrive in the Antarctic habitat? • What were some of those adaptations? *(Penguins have webbed feet for powerful swimming, their bodies are smooth to glide through water, their wings, shaped like flippers, helped them "fly" underwater, they have thick skin and lots of fat (blubber) to keep warm in cold weather, they also huddle together with their friends to keep warm.)* • How did these adaptations enable the little penguin and his parents to survive, grow and meet their needs? Pass out the organism cards *(replacing the plant cards used in lesson one with the new, lesson three, plant set),* one to each pair. Ask students to observe their organism for a few minutes, looking at the various physical parts (*structures*). Bring the class together again to share-out the plant and animal parts that they discovered. Make two lists on the board *(one for animal structures, and one for plant structures*). Ask students if they see any parts that all animals appear to have, as well as any parts that all plants appear to have. Circle the common plant parts in one color, and the common animal parts in a different color. Once the class is satisfied with their lists, ask them about the purpose (or *function*) of each common structure. • What do these parts do? How similar/different from each other? • Why do plants and animals have these different parts? Today we are going to explore the adaptations (*or structures)* of organisms living in two very different habitats… the Antarctic, and the grasslands of South Dakota. We will be looking at different organisms that live in each habitat, and the adaptations that enable them to thrive there… using *The Habitat Game!* *Don't worry if your students are unfamiliar with the Antarctic and South Dakota grasslands at this point… they will learn about these habitats by observing the pictures on the game boards, and discovering the adaptations specific to each through game play and discussion. You might consider using a globe or world map to point out and discuss Antarctica, and its relative position in relation to South Dakota, before beginning this exploration.*
Explore (30 minutes)	
Procedure 	**Part 1- Character Creation** 1. Pass out a character creation card to each student. (*There are two options to choose from; page 43 allows for circling one part in each row, and page 44 is adapted for cut-and-paste.)* 2. Create characters *(models*), circle or cutout one option in each row.

Creature Features



Characters will be a mashup of structures from a variety of different creatures. Have fun creating something new and imaginative!

As time allows, have students sketch a picture of their mashup character in their science notebooks (page 8).

Play *The Habitat Game*

3. Pass out a habitat game board to each group of three students. Half of the class should receive Antarctic habitat game boards, and half should receive South Dakota grassland game boards. Students should not know which game board they will receive before initial character development.

4. Allow students ten minutes to play *The Habitat Game*. When time is up, students should record the total number of spaces that their character advanced in the appropriate space on page 8 of their science notebook. To play, students take turns drawing a card from the stack, and laying it face-up creating a second stack. All players participate on every card-draw, moving their colored token the specified number of spaces on the board if their character has the adaptation (or *structure*) displayed.

5. Next, groups should swap habitat game boards and play the same characters on the other habitat board for ten minutes. Again, students should record the total number of spaces that their character advanced in their science notebook.

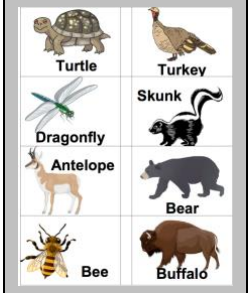
Bring students together for a discussion about their findings:

- Were any structures especially helpful on the Antarctic game board? Why or why not?
- Were any structures especially helpful on the grassland game board? Why or why not?
- Were any structures beneficial on both boards? Why or why not?
- If you knew which habitat game board you were going to play, do you think you could design a character that would function really well on that board? Why or why not?

Design Challenge (as time allows)

Pass out additional character creation cards and allow students to design a second character specifically for either the Antarctic game board, or the grassland game board. Students should play *The Habitat Game* for ten minutes with their habitat-specific characters. Allow students a few minutes to sketch these new characters into their science notebooks (page 9), and record the total number of spaces that their habitat-specific characters advanced in the appropriate space on page 9 of their science notebook.

Creature Features



Part 2- Iktomi and the Animal Warrior Society *(13 min 46 seconds)*
https://www.wolakotaproject.org/iktomi-and-the-animal-warrior-society/

Note: *Everyone loves a good story. Interestingly, the purpose and role of stories in western culture is different from the role of stories in the majority of the world's population. Communication in the western cultures tends to be linear: topic-driven, goal-driven or idea-driven. For the majority of the world's peoples and cultures, however, the story itself* ***is*** *the point. Encourage your students to sit back and relax as the story unfolds.*

1. Watch/listen to the story of Iktomi and the Animal Warrior Society.
2. Pages 10 and 11 of the student notebook have one box for each of the animals that joined the warrior society. Give students time to record each animal's special attributes/structures/behaviors. *(Drawing and/or writing)*
3. Facilitate a student discussion. Ask every student to turn and talk to a partner about each question before the larger class discussion.

- What can we learn from this story? (*We all have something special about us --talents, gifts, traits- they have many names. Sometimes we don't realize how our differences make us special until someone else recognizes them.)*
- What special attribute did each animal have? (turtle, turkey, dragonfly, skunk)
- How did each help them survive and defeat the enemy?
- What special attribute could other animals bring to the warrior society of they were invited to join? *(a chart of these animal names In a variety of languages can be found at the end of this lesson)*

Questions

Driving Question
How do the structures and behaviors (adaptations) of a living organism help it to survive in its specific habitat?

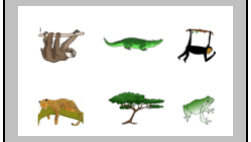
Probing Questions

- What are some structures that help animals function in cold habitats? In hot habitats? In the water?
- Do all_____ look the same? (leaves, tails, feet, etc)
- Do all_____ have the same function? (leaves, tails, feet, etc)
- Why do creatures that live in the water have trouble moving around on land?
- Could an animal found in the South Dakota grasslands survive, grow and meet its needs in Antarctica? Why or why not?

Creature Features

Summarize (10 minutes)	
Communicate	**Facilitate a student discussion** Encourage students to think about the success of the characters during the last two sessions: mashup characters on wither the Antarctic or the SD grasslands characters in various habitats; and animals in the warrior society. ***Note:*** *The encourage students to consider the habitat in the Iktomi story. It might not occur to students without prompting that this story came from South Dakota.* • Which characters were most successful? *(students might choose a specific feature to discuss or they might talk about randomly created vs habitat-specific characters)* Why? (*knowing the habitat/needs helps determine what structures are best for certain conditions)* • What evidence do you have to support your answers? • Would it be possible to create a character that does *very* well in both habitats? Why or why not? *(Birds do well in both habitats, though most migrate from Antarctica for the winter months.)* • Would it be possible to create a character that does somewhat OK in both habitats? Why or why not? *(If it were partially adapted for each habitat, possibly… though it would not be as successful as characters fully adapted to either specific habitat.)* • Do you find the same organisms in very different habitats, like Antarctica and the grasslands of South Dakota? Why or why not? (*Though bird species may be found in both Antarctica and the South Dakota grasslands, they tend to be of different species.)* • What does it mean to be well *adapted* for a particular habitat?
Terminology and Concepts to Solidify	**Adaptation-** any alteration in the structure or function of an organism that results from natural selection and by which the organism becomes better suited to survive and reproduce in its habitat. Adaptive traits may be structural, behavioral or physiological. **Average-** the sum of a group of numbers divided by the total number of numbers. **External Features-** the variety of observable parts of living things. Includes animal parts like arms, legs, head, eyes, and plant parts like leaves, stems and roots. **Function-** to work or operate in a particular way **Structure-** the way the parts of a living organism are shaped
Connection to Big Ideas (Phenomena)	The way parts of a living organism are shaped determines many of its properties and functions. Adaptations allow organisms to live successfully in their habitat (e.g. help get the food they need, to communicate with each other, and to avoid predators)

Creature Features

	Organisms living in different habitats need different adaptations (e.g. polar bear vs panda)
Follow Up/Practice	Students could draw what they believe a creature capable of surviving in both the grassland and Antarctic habitats might look like. Students should then share their pictures, explaining how their creature is adapted to life in each habitat. If your students would like to further explore the Antarctic (2 min 1 sec): https://www.yout-ube.com/watch?v=5EOwDokYReMor on the USB drive entitled "Exploring the 7th Continent (360° VR)" For further exploration of grassland habitats, consider showing the first 1 minute and 16 seconds of the "Imagine American Prairie Reserve" video: https://www.yout-ube.com/watch?v=yvDKLElOjB4. This clip is also available on the USB drive.
Assessment  Print master pg 45	Students should choose two creatures to cut out and paste into the appropriate habitat, in their science notebook on pages 12 and 13. Students should then explain why they placed these creatures in the habitat that they chose and which structures they believe will help them be successful there. *students may also choose to draw their own if other choices do not appeal to them.

Creature Features

Common Animal Names

	Lakota	Spanish	German	French
Turtle	Keya	Tortuga	Schildkröte	Tortue
Turkey	Wagleksku	Turquía	Truthahn	Dinde
Dragonfly	Susweca	Libélula	Libelle	Libellule
Skunk	Maka	Zorrillo	Skunk	Moufette
Antelope	Heton	Antílope	Antilope	Antilope
Bear	Mato	Osa(feminine) Oso(masculine)	Bär	Ourse (feminine) Ours (masculine)
Bee	Temuga	Abeja	Biene	Abeille
Buffalo	Tatanka Pté (female)	Búfalo	Büffel	Bufflonne (feminine) Buffle (masculine)
Dog	Shunka	Perra(feminine) Perro(masculine)	Hund	Chienne (feminine) Chien (masculine)
Horse	Tashunke	Caballo	Pferd	Jument (feminine) Cheval (masculine)

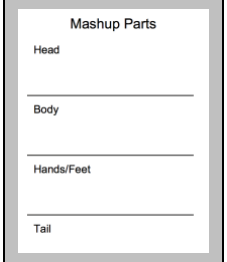
Creature Features

Lesson 4	The “Perfect” Underground Scientist
Overview Standard(s) & Objectives	**Overview** In this lesson, students will learn about the habitat of the Sanford Underground Research Facility (SURF) nearly a mile below the surface in Lead, SD. The personal protective equipment (PPE) necessary for working underground, and the unique challenges of the laboratory spaces, will be the inspiration for student-created scientist mashups. The goal is for students to design a scientist whose various parts function to solve particular problems associated with working in the deep underground laboratory **(K-2-ETS1-2)**. Students will incorporate a variety of adaptations of living organisms, make a sketch or physical model of their well-adapted underground scientist, and explain how each part of their scientist is particularly well suited to working in the underground habitat found at SURF. Students may also design a solution to a human problem that can be solved by mimicking plant or animal solutions **(1-LS1-1)**. For example, designing personal protective equipment that mimics animal scales to protect the wearer from jagged rocks. **Building Toward** 1-LS1-1 Design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. Crosscutting Concepts • Structure and Function- the shape and stability of structures of natural and designed objects are related to their function(s). Science and Engineering Practices • Constructing Explanations and Designing Solutions- use materials to design a device that solves a specific problem. K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. Crosscutting Concepts • Structure and Function- the shape and stability of structures of natural and designed objects are related to their function(s). Science and Engineering Practices • Developing and Using Models- develop a simple model based on evidence to represent a proposed object or tool.

Creature Features

	Objectives Students • Understand the challenges of working nearly a mile below the surface. • Identify adaptations of living organisms that would benefit scientists working in the underground laboratory spaces at SURF. • Produce a sketch or physical model of their scientist mashup. • Explain how their scientist mashup is specifically adapted to working deep underground.
Background Information	Sanford Underground Research Facility (SURF), located in the former Homestake Gold Mine, was a science landmark long before being converted into a dedicated science facility. Nuclear chemist Ray Davis first recognized the potential for deep science in the mid-1960s when he built his solar neutrino experiment at Homestake. In 2002, his groundbreaking research earned him the Nobel Prize in Physics. Why do scientists go so deep underground to study particles that come from the universe? Hold out your hand. On the surface, one cosmic ray passes through it every second. However, nearly a mile underground, it's about ten million times quieter! If you held your hand out underground, you would have to wait about 3 months for a cosmic ray to go through your hand. The rock acts as a natural shield, blocking most of the radiation that can interfere with sensitive physics experiments. It turns out SURF is particularly suited to large physics experiments for another reason—the hard rock is perfect for excavating the large caverns needed for big experiments. SURF also hosts experiments in other disciplines—including biology, geology, and engineering. Experiments include the search for life underground, gravitational waves and seismic activity. For more information about SURF, visit http://www.sanfordlab.org/
Materials	For launch (teacher): • Book: I Wish That I Had Duck Feet For each student: ➢ Science notebook ➢ Drawing and craft supplies (paper, colored pencils, colored paper, glue, pipe cleaners, colored markers, paint, etc.)
Prior Knowledge	What living organisms require to remain alive. How the features/structures and behaviors (adaptations) of a living organism help it to survive in its specific habitat.

Creature Features

Launch (10 minutes)	
Engagement and Communication of Student Expectations	Read and discuss the book *I Wish That I Had Duck Feet, which* has been included to help your students understand the idea of a mashup. Today you will be creating an underground scientist mashup. Your goal is to design a scientist particularly well adapted to working deep underground. Each part of your scientist should come from a creature with an adaptation you believe will help your underground scientist to survive, grow, and meet its needs in the underground laboratory.
Explore (20 minutes)	
Procedure  	1. Show the PowerPoint presentation introducing the Sanford Underground Research Facility and the personal protective equipment (PPE) required for working almost one mile below the surface. You may either present the PowerPoint file provided on the USB drive, or play the Office Mix video (also on the USB drive: 8 min 33 sec). 2. As a class, create a list of the challenges associated with doing science a mile below the surface of the earth at SURF (you may need to act as the *scribe*, or help students with writing). Next, help the class brainstorm as they suggest creature features that would be useful in addressing each challenge they listed. 3. Ask students to open their science notebooks to page 14. Support your students as they choose a living organism (plant or animal) for each structure listed on the left, which is specifically adapted for living and/or working in the Sanford Underground Research Facility. There is an optional sheet of potential scientist parts on page 46 for cut-and-paste mashup creation. 4. Allow students a few minutes to think about each of the structures listed and suggest a particular creature feature that might help his/her scientist to survive, grow, and meet its needs in the underground laboratory. Students should either write, or draw a picture, of the creature/creature part that they envision. (As you help students, you might suggest that they also consider the number of each part they desire. A scientist with six arms/hands might function much better than a scientist with only one.) Alternatively, students could find useful creature features to cut out of magazines and paste together to create their mashup. (*National Geographic* and *Ranger Rick* are particularly useful for this, but any magazines with pictures of animals will do) Students should use the remaining time to either draw a picture in the space on page 15, or produce a physical model (using craft supplies and/or pictures cut from magazines), of their scientist mashup to share with the class. In the lower right hand corner of page 15, students may even give their mashup scientist a name. Be creative, have fun, and get ready to share your creation with the class!

Creature Features

Questions	**Driving Question** • How do the adaptations of living organisms help them to survive, grow, and meet their needs in extreme environments? **Probing Questions** • What adaptations of living organisms might be useful to a scientist working a mile underground? • How does the structure of a living organism make it suited to its particular habitat? • How is the structure of something related to its function? • Are there any organism adaptations that would allow scientists to avoid the use of personal protective equipment (PPE)?
Summarize (10 minutes)	
Communicate	Ask students to share their scientist mashups with a partner and explain how each part helps their scientist work safely, comfortably, and/or efficiently in the underground laboratory. Encourage students to ask questions of each other and discuss the strengths and limitations of each scientist mashup part. **Note:** Remind students to be respectful of others while discussing strengths and limitations from the plant and animal world.
Terminology and Concepts to Solidify	**PPE-** abbreviation for personal protective equipment such as hardhat, steel toe shoes and safety glasses. **Model-** a representation, generally in miniature, to show the construction or appearance of something. **Sanford Underground Research Facility (SURF)-** a deep underground laboratory located in a former gold mine near Lead, South Dakota. **Laboratory-** a space equipped to conduct scientific experiments, tests, investigations, etc. **Mashup-** a mixture of different elements, or something created by combining elements from two or more sources.
Connection to Big Ideas (Phenomena)	The way in which an object or living thing is shaped determines many of its properties and functions. Every organism possesses certain adaptations, which help it survive in a particular habitat.

Creature Features

Follow Up/Practice	**Optional Extensions** **A-** Students could build a diorama of the underground laboratory to display their mashup scientist in its "natural habitat". **B-** Students could write a story (or even produce an illustrated book) about the work of their mashup scientist at the Sanford Underground Research Facility.
Assessment 	Student presentations communicating how each part of their mashup makes their scientist well adapted to working nearly a mile underground at SURF. (Structure and function) The performance rubric (in print masters) may be useful for tracking progress.

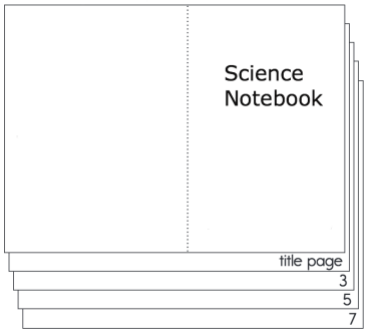
Print Masters

Creature Features

Printing Science Notebooks

Use the pdf file ‘CreatureNotebook’ located on the USB drive

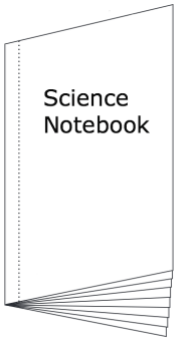
Paper size 8.5-by-11-inches



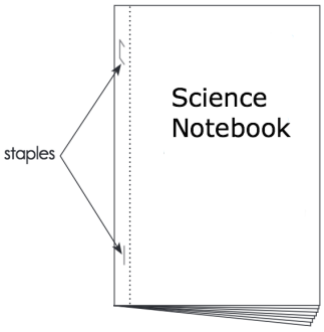
Layout is landscape

Print 2-sided

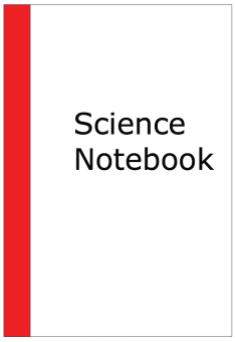
Flip pages on short side. (short-edged binding)



Fold stack of pages in half, taking care to line up the corners



Staple two times along left edge of front cover



(Optional) Place a strip of 1-inch tape along the left side, covering the staples on the front and wrapping to the back of the notebook

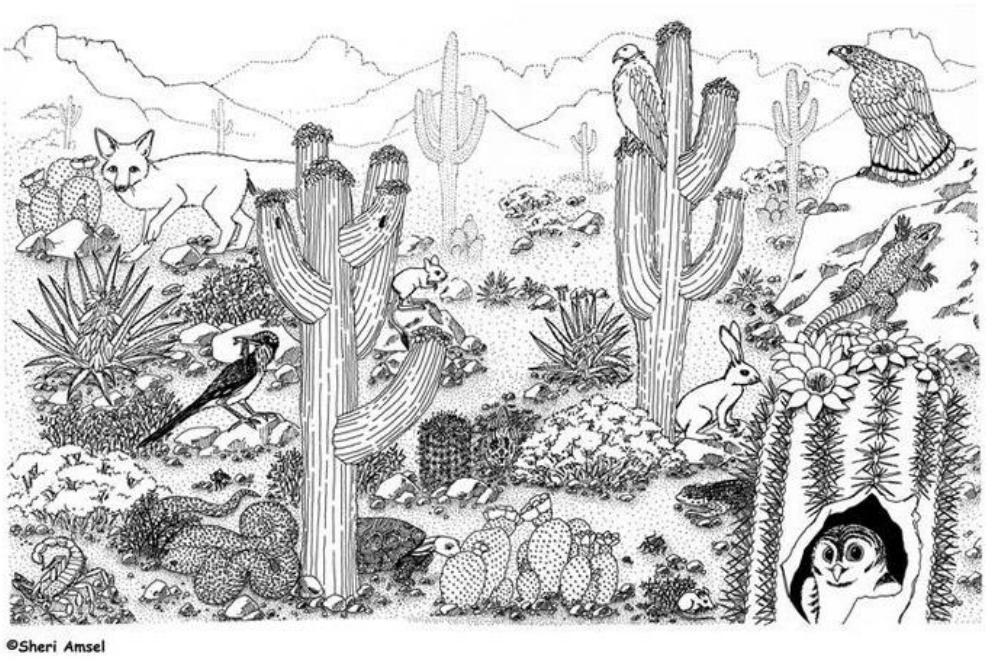
Creature Features

Water 	Water 	Water 
Food/Nutrients 	Food/Nutrients 	Food/Nutrients 
Sunlight 	Sunlight 	Sunlight 
Air 	Air 	Air 
Shelter 	Shelter 	Shelter 
Water 	Water 	Water 
Food/Nutrients 	Food/Nutrients 	Food/Nutrients 
Sunlight 	Sunlight 	Sunlight 
Air 	Air 	Air 
Shelter 	Shelter 	Shelter 

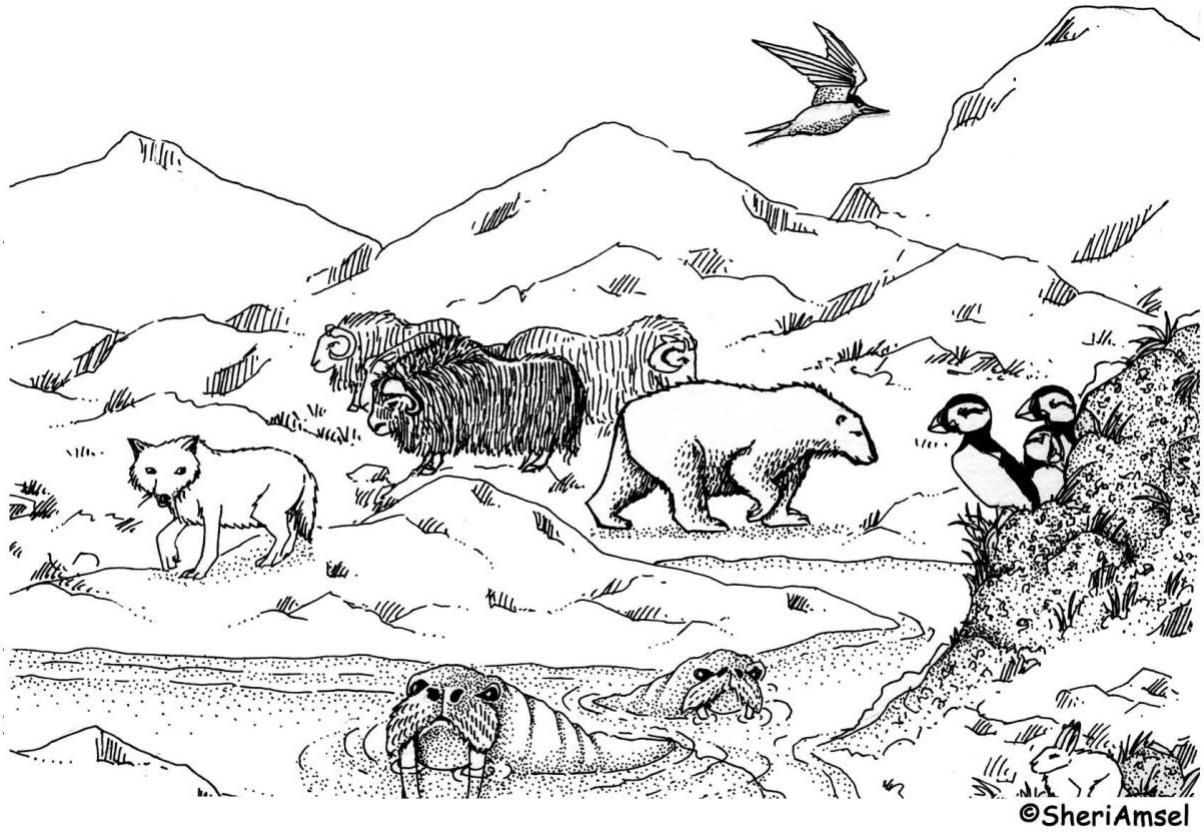
Creature Features

Lesson 2 Assessment

1. Circle the organisms (plants and animals).
2. Draw lines to show relationships between organisms/resources in the habitat.
3. Label these relationships. For example, food, water, shelter, reliance on other organism to survive.



Lesson 2 Assessment (alternative)



1. Circle the organisms (plants and animals).
2. Draw lines to show relationships between organisms/resources in the habitat.
3. Label/describe these relationships.

For example, food, water, shelter, reliance on other organism to survive.

Creature Features

The Habitat Game

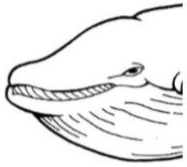
Character Creation Chart

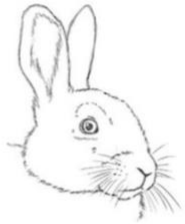
Name: _____

Circle one feature in each row:

Head:





Body:





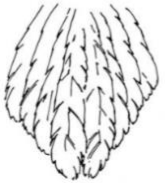

Hands/Feet:






Tail:



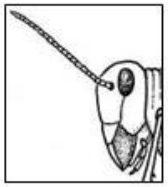



The Habitat Game

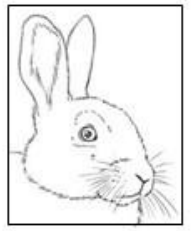
Character Creation Chart

Cut out one feature in each row, then glue them onto your character sheet:

Head:





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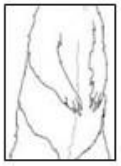
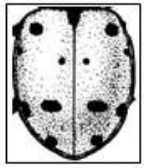
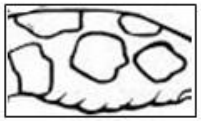
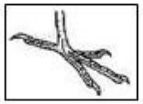


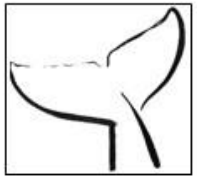




Hands/Feet:





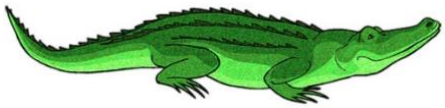

Tail:

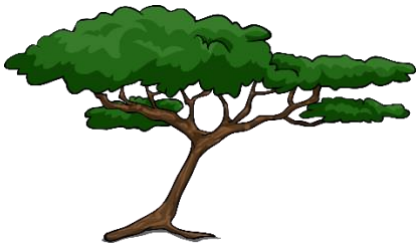



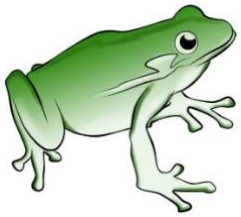


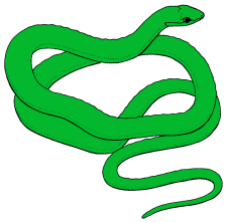
Creature Features

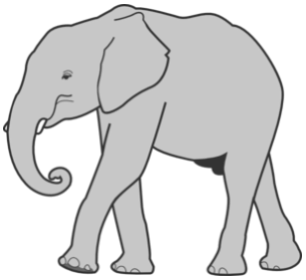
Lesson 3 Assessment











Creature Features

Performance Rubric

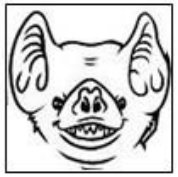
What do living things need to survive?

	Evidence for Exceeding Expectations	Meets Expectations	Areas for Improvement
		Can explain that all living things have basic needs that must be met to stay alive.	
		Can explain that living things survive only in habitats that meet their specific needs.	
		Can describe how living things depend on each other to survive.	
		Can explain how certain structures and behaviors (adaptations) of a living organism help it to survive in its specific habitat.	

Mash-Up Scientist Creation Chart

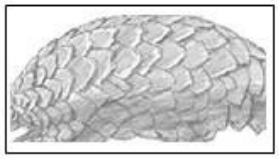
Cut out one feature in each row, then glue them onto your mash-up Sanford Lab scientist sheet:

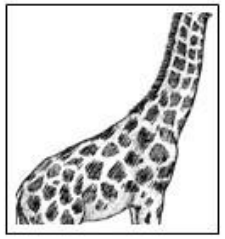
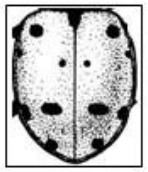
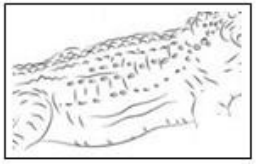
Head:

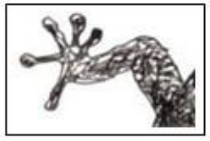


Body:

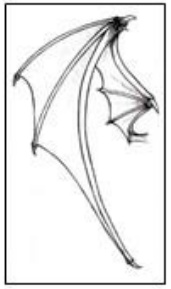


Hands/Feet:








Tail: