

Grade 1 Life Science

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Life Science Grade 1

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Glossary Museum Connections **Unit Overview** 

#### **Unit Description**

In this unit, students are challenged to design a shoe that will be appropriate for the icy, wet, and cold conditions of Antarctica. Students will evaluate a shoe design to determine how well its features serve the functions necessary for surviving the Antarctic environment. They will then sort examples of human-made designs that have been inspired by animal features, in order to explore how animals' features can provide inspiration to solve human problems. Students will also closely observe images of animal feet to specifically analyze how animal foot features might inspire human shoes. Finally, students will create their own shoe design, inspired by the features of real animals, which serves the functions necessary for harsh Antarctic conditions.

### **Driving Questions**

How do animals' foot structures help them survive and live comfortably in their environments? How can these structures be used to inform the design of a shoe for humans?

### **Driving Phenomena**

Animal feet look different. Feet have specific structures that help animals live comfortably and survive in their environments.

### **NGSS Performance Expectation**

This unit was aligned to the following Next Generation Science Standards (NGSS) Performance Expectation:

**1-LS1-1**. Use materials to 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.\* [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]

#### **NGSS Unit Alignment**

**1-LS1-1:** Use materials to 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. Document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.  Use materials to design a device that solves a specific problem or a solution to a specific problem. (1-LS1-1) Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in K- 2 builds on prior experiences and uses observations and texts to communicate new information.  Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. (1-LS1-2)  Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Scientists look for patterns and order when making	<ul> <li>LS1.A: Structure and Function</li> <li>All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)</li> <li>LS1.B: Growth and Development of Organisms</li> <li>Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)</li> <li>LS1.D: Information Processing</li> <li>Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)</li> </ul>	Patterns         • Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-LS1-2)         Structure and Function         • The shape and stability of structures of natural and designed objects are related to their function(s). (1-LS1-1)

Connections to the three dimensions in this unit:

#### SEP:

#### **Constructing Explanations and Designing Solutions.**

Students will design a shoe inspired by animal feet structures to assist a scientist in Antarctica in staying warm & dry and keeping her balanced. In addition to creating a shoe design, students will use evidence of animal feet structure-function to justify an explanation for their design solution.

#### DCI:

#### **Structure and Function**

By creating scientific drawings of animal feet, students will observe and analyze feet structure to determine the ways the structure enables the animal to function well in its specific environment. Students will observe animal feet primarily through photos, but there is an option to bring in museum resources or enhance student learning during an optional Focused Field Trip to the Field Museum. Students will use the evidence collected throughout the unit to design and justify a shoe inspired by various animals from cold, icy, and wet environment.

### CCC:

#### Patterns

- Students will compare and contrast different animal feet structures in order to draw conclusions about how the structures are related to how well the animal functions in its environment.
- After being introduced to the concept of biomimicry through a matching activity, students will be challenged to develop a design for a shoe that is inspired by animal feet structures from snowy environments. This challenge will serve as the performance task for the unit.

Investigation 1: Nature-based Design Lesson 1.1: An Antarctic Adventure

### **Lesson Description**

Students will be introduced to an Antarctic scientist whose research is being stifled by an unlikely problem: her shoes. The shoes do not provide enough dryness, warmth, or traction for the harsh Antarctic conditions. Pairs of students will look closely at the shoes and assess how well they believe that the current shoe design meets the scientist's needs.

# Objective

Students will begin to think critically about how the structure of a human-made object does – or doesn't – serve particular function.

# Materials

#### Per Class

• Teacher Resource 1.1.A

#### Per Pair

• Student Resource 1.1.A

# **Guiding Questions**

How can we tell if a human-made object is successfully fulfilling its intended function?

# **Materials Preparation**

- Prepare to project and read aloud Teacher Resource 1.1.A
- Print out a copy of Student Resource 1.1.A for each pair of students.

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#### Investigation 1: Nature-based Design Lesson 1.1: An Antarctic Adventure

# Engage

1. Tell students that the class has received an exciting letter from a scientist. The scientist is looking for some help from the students.

Teacher tip: Alternatively, enlist someone to record a video reading the script of the letter.

- 2. Project Teacher Resource 1.1.A and read it aloud to students.
- **3.** Tell students that they will be working to help the scientist by looking at the shoe and deciding how to design one better suited to the Antarctic environment.

### Investigate

- Write "Antarctica" on the board. Have students share out things they know about Antarctica and write down their ideas around the word to form a concept map (see Teacher Resource 1.1.B for an example of what that might look like).
- 2. Based on students' ideas from the concept map, brainstorm key functions that a shoe would need to be able to help a scientist work and live in Antarctica. Acknowledge all student ideas, but make sure they address the following functions: keeps foot warm, keeps foot dry, prevents foot from slipping on ice. Write those three ideas on the board.
- **3.** Tell students that they will look at a picture of the current shoe the scientist is wearing, in order to determine how well that shoe meets the three main important functions.
- 4. Pair students and pass out Student Resource 1.1.A.
- 5. Have students work together in pairs to complete **Student Resource 1.1.A** and give a thumbsup when they have finished.

# **Reflect and Share**

- Have a few student pairs share out their grades for each shoe function and their justifications for the grades. Draw students' attention to the way that the shoe's features and structures do NOT meet the functions that the scientist in Antarctica needs (for example, the fabric is too thin to keep the foot warm, the fabric is not waterproof, the soles are too flat to prevent slipping, etc.)
- 2. Tell students that in the next classes, they will try to help the scientist by coming up with a better shoe design, and that to get inspired, they will look at some of the ways real life inventors have found inspiration for their creations, namely by observing nature.

5 minutes

25 minutes

5 minutes

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Teacher Resource 1.1.A Letter #1 from Scientist

Dear First Grade Students,

Greetings from Antarctica! I am here on this icy, cold continent doing scientific research.

It's been great exploring Antarctica, but I have a big problem: my feet hurt! They feel cold and wet. Also, I keep slipping and falling whenever I walk around to do research.

I need to fix my problem so that I can concentrate more on my important research. Can you help me come up with a solution?

Sincerely,

-Cindy Scientist





### **Student Resource 1.1.A**

### **Shoe Evaluation**

Name(s): \_\_\_\_\_\_

Directions: Observe the shoes closely. Notice how the features help meet important functions (or DON'T meet those functions!). Write down your observations. Then give the shoe scores to show how well it meets each function.



\* Features that help keep the foot warm:

Write "none" if there aren't any!

\* Features that help keep the foot dry:

Write "none" if there aren't any!

\* Features that help keep the foot from slipping:



Write "none" if there aren't any!

Investigation 1: Designing to Meet Human Needs (needs better name!) Lesson 1.2: Biomimicry

# **Lesson Description**

Students will discuss the idea that humans often solve problems by developing solutions inspired by something found in nature. In small groups, students will match pictures of human-made objects to the natural specimen that inspired their design. The students will then analyze one of the pairs to determine what specific animal structure is represented in the human-made object and how this design choice helped effectively solve a design problem.

# Objective

Students will be able to explain the connection between a human-made object and the natural object that inspired it, in terms of how the structure serves a similar function.

**Biomimicry** – copying nature to make a design **Design** – to make something for a specific purpose

Structure – a part of a plant, animal, or object

Human-Made – produced or created by humans; not natural

# Materials

### Per Class

• Teacher Resource 1.2.A

Per Small Group

**New Vocabulary** 

• Student Resource 1.2.A

# **Guiding Questions**

How are things that humans design inspired by nature?

# **Materials Preparation**

Make color copies and cut out Student Resource 1.2.A (one set per group)

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Engage

Investigation 1: Designing to Meet Human Needs (needs better name!) Lesson 1.2: Biomimicry

1.	Remind students that in the last class, they learned about a scientist with a problem: her shoes
	are not appropriate for her job doing research in Antarctica! Tell students that they will try and
	come up with a solution to the scientist's problem by designing a better shoe for her.
2.	Tell students that engineers, inventors, and designers often use nature to come up with designs,
	because animals' bodies have amazing ways to survive all sorts of situations!

- **3.** Have students think about their favorite animal. Tell them to turn to a partner and share their favorite animal and explain why it's their favorite. Encourage a few pairs to share with the whole class.
- 4. Tell students that, as they probably realized when talking about their favorite animal, animals are special and can do some amazing things. For example, an elephant's trunk is strong enough to lift over 700 pounds, and is also used to hold onto things, smell, and even breathe underwater. One part of the elephant does so many things!
- 5. Tell students they will look at examples of some amazing animal features and try to see how those features inspired designs meant to be used for humans. These examples should help give them some ideas of how to help the scientist in Antarctica.

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- Place students into groups of 3-4. Hand out a set of human-made object cards (Student Resource 1.2.A) to each group. Ask students: *Have you ever heard "human-made" before?* Elicit student responses and guide students to the idea that human-made means created by people.
- 2. Have the students look at all the human-made designs. Tell students to think about what each object might do, based on its features. If the students have any questions about the designs, use the information from **Teacher Resource 1.2.A** to clarify the function of the design.
- **3.** As they finish looking at each design, have the students place the pictures face-up in one area of the table.
- 4. Tell students that they will receive a set of animal cards. Their goal is to match up a humanmade design with the feature of the animal that inspires it. Explain that it is important to think about the feature and what it does for that animal, and then to think about how that feature could be used to help humans solve a problem.
- **5.** Pass out the set of animal cards (**Student Resource 1.2.A**) to each group. Give groups five minutes to match the cards. When groups have finished matching, as a class, go through each pair to check for accuracy. (See **Teacher Resource 1.2.A** for correct pairings and additional information). Ask students to share their thoughts and if they were surprised by any of the matches.
- **6.** Next, have groups select one pair to look at more closely. Write the following questions on the board and tell students to discuss in their small groups.
  - 1. What do you notice about the animal feature?
  - 2. Why do you think the person who created the object wanted to copy this feature of the animal?
- 7. Have groups share their thoughts.

# **Reflect and Share**

- 1. Remind students that many objects we use everyday are often designed using what we know about animals and their features.
- 2. Tell students that in the next class, they will focus specifically on studying animal feet and their features. Hopefully, observing animal feet closely will give them some ideas for designing a better shoe for the scientist in Antarctica.

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Student Resource 1.2.A Biomimicry Cards



Humpback Whale: Fin Photo Credit: R. and S. Levy, Wikimedia Commons, 2009



Shark: Skin Photo Credit: E. Levy, Wikimedia Commons, 2014



Kingfisher: Beak Photo Credit: K. Rayker, Wikimedia Commons 2010



Blade for Wind Turbine Photo Credit:Popular Mechanics,2009



Swimsuits Photo Credit: K. Barnstorff, Wikimedia Commons, 2008



Train Photo Credit: Nanashinodensyaku, Wikimedia Commons, 2001





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## **Teacher Resource 1.2.A**

**Biomimicry Matching Key** 

<b>Correctly Matched Pairs</b>	Additional Information
Humpback Whale Fin Blade for Wind Turbine	The humpback whale has lots of bumps on its fins, which seems like it would make it less efficient at cutting through the water but actually the bumps reduce turbulence. Inspired by this design, the company
blade for which further	"WhalePower" developed bumpy blades for a wind turbine (machine that uses the power of the wind to produce electricity).
Shark Skin Swimsuits	Sharks are very efficient swimmers because their skin has lots of tiny overlapping scales that allow water to pass over the shark faster. Swimsuits developed for Michael Phelps for the 2008 Summer Olympics were made up of similar tiny scales to help him swim more efficiently
Kingfisher Beak Train	The kingfisher beak is very pointy at the end, which allows it to dive quickly through the air and into the water only creating a small splash. Trains in Japan were making a very loud "Boom!" every time they left a tunnel, and engineers changed the design of the trains to have a pointy beak like the kingfisher so the train could cut through the air without making so much noise.
Gecko Foot Hand Grips	Gecko toes are covered in tiny hairs that actually form atomic bonds with whatever surface they are climbing. Scientists have developed a very strong adhesive material based on the gecko, which can have many purposes, like handgrips used for climbing skyscrapers.
Firefly Light Brighter LED Lights	Fireflies have overlapping scales surrounding their light-emitting organ (like shingles on a roof), which scatters the light and makes it brighter. Scientists are trying to copy this idea on LED lights to make them shine brighter.
Elephant Trunk Robotic Arm	An elephant's trunk can move in any direction to reach out and grab something, and it's incredibly strong and gentle at the same time. An engineering company, Festo developed a robotic arm with a trunk-like feature designed to be flexible, strong, and gentle at the same time.
Woodpecker Ice Axe	The woodpecker chisels into the wood to get at insects using its beak. Franco Lodato designed an ice ax that is produced by CAMP (an outdoor company) that can chisel away into the ice in a similar way as a woodpecker.
Cat Paws & Claws Safety Thumbtacks	Cats have claws that are retractable, or kept safely withdrawn until the cat needs them. Engineer, Toshi Fukaya, developed a safety thumbtack using a cat's claw as inspiration. The pin sits inside a soft capsule until it is pushed against a hard surface when the capsule collapses and the pin is exposed.
Turtle Shell Car Design	A turtle's shell provides incredible cushioning and protection from the elements and predators. A German car company is working on a car design based on a turtle's shell structure to provide similar cushioning and protection to the driver.

Investigation 2: How do animals' feet help them to survive in an Antarctic environment? Lesson 2.1: Sorting Animal Feet for Structure and Function

### **Lesson Description**

Students will sort and analyze various images of animal feet and their structures, identifying which ones would work in an Antarctic environment and why. Students will also practice creating scientific drawings of a specific animal foot structure which they think would be a great example for the Antarctica shoe proposal by recording their observations using words and pictures.

# Objective

Students will be able to observe, identify, and sort physical traits of animals and practice recording their observations in words and drawings by creating a scientific illustration.

# Materials

### Per Class

• Teacher Resource 2.1.A

### Per Group

• Construction paper and glue

### Per Student

- Student Resource 2.1.A (sort)
- Student Resource 2.1.B (scientific drawing sheet)
- Pencil

**New Vocabulary** 

# **Guiding Questions**

What can we notice about animals' feet by looking closely? How does the structure of an animal's foot function to help it survive in its environment?

# **Materials Preparation**

- Prepare the Student Resource
   2.1.A cards for each group or pair
- Prepare Teacher Resource 2.1.A to display to students, either by projecting digitally, or printing a large copy of each image.
- Copy Student Resource 2.1.B for each student

**Characteristic** – a quality that typically belongs to a person, place, or thing **Environment** – the surroundings in which a person, animal, or plant lives **Function** – to work

### 55 minutes

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### Engage

### 15 minutes

1. Remind students that their goal is to ultimately help out the scientist by developing a shoe model that will help her conduct research in the icy, cold, and slippery Antarctica environment. Remind students that an "environment" is all the things (plants, rocks, water, weather conditions, other animals) that make up an area where an animal lives.

Investigation 2: How do animals' feet help them to survive in an Antarctic environment?

- 2. In order to design a shoe that could do this, students will study and sort the feet of animals and how the feet work to help the animals survive in their environments. Explain that they will be designing shoes that copy animal feet features but don't look exactly like animal feet, because we don't wear animal feet!
- 3. To practice noticing important features of animal feet, project **Teacher Resource 2.1.A** on the board. Demonstrate to the students how to zoom in (if possible, zoom in using the camera of the projection) to look at just one part, in this case, the foot, of the animal. Ask students to share with the class the characteristics that they notice about its feet.
- 4. Zoom back out, and tell them to look at the environment. Ask them what about that foot might help the animal survive there. Focus on details that relate to dryness, traction, and warmth. Note: the students may observe that the animal *doesn't* seem to have traits for one or more of these functions.

Optional: Project Teacher Resource 2.1.B if you need more examples of animal feet.

- 5. Tell students that scientists often record their observations with scientific drawings in order to help them notice and record details that can later be analyzed.
- 6. Make a scientific drawing on the board of the animal's foot. Highlight the importance of drawing details and labeling important features of the foot especially those that relate to function.

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### Investigate

- 1. Explain to students that before they make scientific drawings it is important to analyze a variety of animal feet structures and their functions and see which ones are best suited to keep a scientist's feet warm, dry, and from slipping in the Antarctica environment.
- 2. Break students into groups and pass out Student Resource 2.1.A for the animal feet sort.
  - a. Assign each group a different feature that they should look for when sorting:
    - i. Some groups will sort the images by features that will keep a foot warm
    - ii. Another group will sort feet by those that have features to keep a foot dry
    - iii. The final group will sort foot features into groups which will **keep the foot from slipping** in an icy environment
- **3.** As each group sorts the images with their specific purpose in mind (warmth, dryness, and traction), encourage them to make a poster of the images they choose to include in their category and why.
  - a. Encourage students to label images and justify why they choose to sort that image into the certain category and why.
- 4. Once all groups have completed their assigned sort, come back together as a class to share and have each group explain what animal feet features are useful in terms of keeping a foot dry, warm, or from slipping.
- 5. Once all groups have shared, look at all the posters as a class and decide if any other images could fit into each category or if there are some foot features that are not good fits.
- 6. Give a final moment for students to engage in a gallery walk so they can think about what features of a foot are best to keep it warm, dry, or from slipping with their future Antarctica shoe design in mind.

### **Optional Lesson Break**

### Investigate

- 7. After sorting and discussing the foot features, have each group look at their specific sorts again and have them choose a foot image that they think would be very useful in their creation of an Antarctic environment shoe they will design later.
- 8. Explain that students will use **Student Resource 2.1.B** to make a scientific drawing of the animal foot by observing, drawing, and labeling important characteristics, which are the important detailed qualities of the foot. Explain that artistic talent isn't the focus, and emphasize that students should use words and labels to call out important details of the features. Remind students that a scientific drawing should have detail and labels.
- **9.** After students complete their drawing, encourage them to write down how that foot might function to help that animal in its environment.

### **Reflect and Share**

- 1. Gather students together and ask them to share their scientific drawings with a partner. Tell students to explain the characteristics that they observed and drew.
- 2. If time allows, have students do a gallery walk looking at all of the scientific drawings so they can get a feel for what features help a foot stay warm, dry, or from slipping and encourage them to think about what they want to include in their own Antarctica Shoe recommendation.
- **3.** Leave drawings on display for future lessons.

# Student Resource 2.1.A

# **Foot Sorting Cards**

Name(s): \_\_\_\_\_



**Student Resource 2.1.B** 

Scientific Drawing of an Animal Foot

Name(s):\_\_\_\_\_

Choose a foot image to observe. Use words and pictures to make a scientific drawing of the foot below:

How might the parts of the foot help the animal to survive in its environment?

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Teacher Resource 2.1.A Example Animal Reference



Photo Credit: M. Baird, Wikimedia Commons, 2007

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Teacher Resource 2.1.B Additional Foot References







Investigation 3: How can animals inspire us to solve a problem? Lesson 3.1: Designing a Shoe

### **Lesson Description**

Students will work in small groups to design a shoe for a scientist conducting research in Antarctica who wants her shoes to keep her feet warm, dry, and prevent slipping. The shoe will be based on animal feet features they have seen and analyzed from previous lessons. Students will present their designs and be able to explain how and why their shoe design, which was inspired from various animal foot structures, will help the scientist's feet stay warm, dry, and from slipping in Antarctica.

# Objective

Students will be able to design a shoe inspired by feet structures of animals which helps to keep a human foot warm, dry, and from slipping in an Antarctica environment.

# **Guiding Questions**

How can animal feet inspire a shoe that can function in a specific environment?

# Materials

### Per small group

- Student Resource 3.1.A
- Writing Utensils

### Per class

• Teacher Resource 3.1.A

# **Materials Preparation**

- Print and copy Student Resources 3.1.A
- Have Teacher Resource 3.1.A available to project
- Prepare to project and read aloud Teacher Resource 3.1.C after the lesson is completed

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50 minutes

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Engage

Investigation 3: How can animals inspire us to solve a problem? Lesson 3.1: Designing a Shoe

1.	Gather students and remind them that their job is to design a shoe based on animal features
	observed throughout the lessons that will help the scientists working in Antarctica keep their
	feet warm, dry, and from slipping in the extreme environment.
2	Project Tagcher Resource 3.1 A on the heard to remind students of the original shoe and its

- 2. Project **Teacher Resource 3.1.A** on the board to remind students of the original shoe and its features.
- **3.** Have partners think-pair-share whether or not they now think the shoe would do well to keep the scientists feet warm, dry, and from slipping after viewing different animals' feet and why.
- **4.** As a class, share out ideas and re-grade the shoe following the directions on the resource and discuss preliminary improvements they are thinking of making to the shoe.
- 5. Explain that now that they have observed different feet from animals and have found structures that work well to keep a foot warm, dry and from slipping, they will use their observations to design a shoe that can be worn by the scientist in Antarctica.
- **6.** Remind students that they can refer back to the animal sort activity and scientific drawings they completed in lesson 2.1 to guide their designs and explanations.

	Investigate	30 minutes
1.	Place students into small "Design Groups" of three to four members.	

- 2. Pass out **Student Resource 3.1.A** and explain to students that they will create a design for a shoe that:
  - Can be worn in an Antarctica environment
  - Help the foot stay warm, dry, and keep it from slipping
- **3.** Tell students that while drawing their design, they should record how the shoe's features help it meet the important functions. Then give the shoe scores to show how well it meets each function.
- 4. Tell groups that they will also give a one-minute presentation of their design. In their presentation, they should explain their shoe, how it is based on animal feet traits, and why they think it will help the scientist's foot stay warm, dry, and from slipping in the Antarctica environment.
- 5. Provide ample time for students to design and prepare to present their shoe.

10 minutes

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### **Reflect and Share**

- 1. Gather back together as a class and have each group share their shoe designs.
  - a. Remind them to explain how and why they think their shoe will help keep a foot warm, dry, and from slipping and what animal features inspired them.
- 2. Hang designs around the room for a final gallery walk
- **3.** Tell students you will collect all the designs to send to Cindy Scientist. Use **Teacher 3.1.B** to score each group's design.
- 4. In a day or two read the second letter from the scientist (Teacher Resource 3.1.C).

**Student Resource 3.1.A** 

Name(s): \_\_\_\_\_

Directions: Design a shoe that will help the scientist doing research in Antarctica that meets the following requirements:

- □ Keeps foot warm
- $\Box \qquad \text{Keep foot dry}$
- □ Keeps foot from slipping

Draw your shoe design. Write down how your shoe will keep the foot warm, dry, and from slipping. Don't forget to score your shoe!

									* Features that help keep the foot warm:
									* Features that help keep the foot dry:
									* Features that help keep the foot from slipping:
$\subseteq$								$\square$	
Warmth:		Dryness:			Slip Prevention:				
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**Teacher Resource 3.1.A Original Shoe Design** 

**Structure/Function** 



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### Teacher Resource 3.1.B Shoe Design Rubric

Student Name:

Total Score: \_\_\_\_ / 8 pts.

Question	Points	Total Points
Step #1: Shoe Design	Student draws a shoe. 1 point.	/ 1 pt
Step #2: Explain Design	<ul> <li>Student correctly fills in the blanks with the comparison between the design/characteristic and the animal.</li> <li>Warm - 1pt</li> <li>Dry - 1pt</li> <li>Slipping - 1pt</li> <li>Coherence* - 1pt</li> <li>*Example: "It keeps you warm" "It keeps your feet dry." "It's good for snow."</li> </ul>	/ 4 pts
Step #3: Connection Between Shoe and the Characteristics of Animal Feet	Student correctly explains how each characteristic of the shoe (warm, dry, prevents slipping) is based off a characteristic of an animal foot. <b>1 point per</b> <b>characteristic.</b>	/ 3 pts

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Teacher Resource 3.1.C Letter #2 from Scientist

Dear First Grade Students,

Hello again from Antarctica!

Your teacher sent me your shoe designs, and I'm very impressed! In my work, I have to make careful observations of the animals of Antarctica and how they've had to adapt to make this harsh environment their home. I love how you've done the same with your shoe designs!

I've forwarded the drawings you sent me along to the rest of my research team, and I think they'll prove to be a huge inspiration in designing shoes for our next expedition.

Thanks for all your help!

Sincerely,

-Cindy Scientist

#### Glossary

Analyze – carefully study something to determine the relationship between different elements

- Biomimicry using nature to inspire a design
- Characteristic a quality that typically belongs to a person, place, or thing
- **Design** to make something for a specific purpose
- Environment the surroundings in which a person, animal, or plant lives
- Evaluate to determine the strength of a design and how well it solves a problem

**Function** – to work

- Human-Made produced or created by humans; not natural
- **Observe** to notice something closely
- Structure a part of a plant, animal, or object

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**Connections to Museum Resources** 

## **Museum Resource Information**

If you are interested in using museum resources in your classroom to support this unit, review the information below and consider bringing in museum objects and/or specimens based on the suggested recommendations.

*N. W. Harris Learning Collection* at the Field Museum: From a skunk specimen to SUE's tooth to a ceremonial mask from Cameroon, the *N. W. Harris Learning Collection at The Field Museum* gives educators and parents a chance to take the Museum's collection to their classroom or home. Visit: <u>harris.fieldmuseum.org</u>

**Teacher Leadership Center at the Peggy Notebaert Nature Museum:** The Teacher Leadership Center's popular loan program includes the following materials which can be borrowed free of charge for two weeks at a time: Inquiry Kits from the Illinois Department of Natural Resources (IDNR) and the Nature Museum, EnviroScapes, and National Geographic Book Packs. Visit: <u>naturemuseum.org</u>

### **Recommended Resources**

Lesson 2.1: Sorting Animal Feet for Structure and Function The Field Museum's N. W. Harris Learning Collection Items

The Field Museum's N. W. Harris Learning Collection Items:

- Wild in Chicago (Experience Box)
- Beaks and Feet (Experience Box)
- Animal Tracks (Experience Box)
- Shoes (Experience Box)
- Snowshoe Hare (Exhibit Case)

#### The Peggy Notebaert Nature Museum's Inquiry Kits:

- Wild Mammals
- Reptiles and Amphibians

**Use:** Any one of these resources can be used to provide more opportunities for students to explore animal feet in their native habitats. The Snowshoe Hare exhibit case may also be used as an alternate reference for students when they create their scientific drawing of an animal's foot.

Investigation 2: How do animals' feet help them to survive in an Antarctic environment? Optional Field Trip Extension: Further Observation on the Structure of Animal Feet

## **Lesson Description**

Students will continue their observation of animal feet started in lesson 2.1 by getting a closer look at animals through the Field Museum's animal dioramas. They will choose three dioramas of animals living in conditions similar to Antarctica and create labeled scientific drawings of the animal's feet to observe how they are structured to provide warmth, balance, and dryness.

Note: This optional field trip was designed to be taken between lessons 2.1 and 3.1.

## Objective

Students will further hone their ability to observe, identify, and sort physical traits of animals and practice recording their observations in words and drawings by creating a scientific illustration.

### Materials

#### Per Student

- Student Resource 2.2.A (3 Copies)
- A pencil

### **Guiding Questions**

Life Science

What can we notice about animals' feet by looking closely? How does the structure of an animal's foot function to help it survive in its environment?

# **Materials Preparation**

• Print out 3 copies of Student resource 2.2.A for each student

60 minutes

Grade 1

Investigation 2: How do animals' feet help them to survive in an Antarctic environment? Optional Field Trip Extension: Further Observation on the Structure of Animal Feet

### Engage

- 1. Remind students of the observations and scientific drawings they made in the classroom.
- 2. Explain that they will be using these skills at the Field Museum to learn more about the structures of the feet of animals that thrive in environments similar to those found in Antarctica. They will specifically observe how the feet provide **dryness**, **warmth**, and **balance** to inform their shoe design.
- **3.** Pass out pencils and three copies of **Student Resource 2.2.A** to each student. Tell students to write their names at the top of each page.
- 4. Remind students that they will be using these drawings back at school, so they should take good care of them.

### Investigate

45 minutes (10 min. in each exhibit + travel time)

Life Science

#### At The Field Museum:

During this focused field trip, you will make three stops: **Messages of the Wilderness**, **The Hall of Birds**, and **Mammals of Asia**. At each stop, students will complete scientific drawings of animal feet that they see in dioramas depicting snowy or mountainous conditions. These stops can occur in any order, and should last about 10-15 minutes each. At each stop, give students a few minutes of free-exploration time, and then guide them through the process below:

- 1. Direct students to pick an animal in a diorama that depicts animals that live in a snowy or mountainous environment. Encourage students to choose different dioramas to study.
- 2. Tell students that they will closely observe that animal's feet and make a scientific drawing of the feet and its characteristics, paying close attention to traits that help with dryness, balance, and warmth.
- **3.** Remind students that scientific drawings should include pictures and labels to provide detailed information.
- 4. Repeat for two additional dioramas.

Teaching Tip: If any students are unable to attend the field trip, you can have students engage in the activity through resources from The Field Museum's N.W. Harris Learning Collection or from the Peggy Notebaert Nature Museum Inquiry Kits.

### **Reflect and Share**

10 minutes

#### On the bus or back in the classroom

- 1. In pairs, encourage students to trade scientific drawings. Ask each student to look at their partner's drawing and pick out the features that they notice.
- **2.** Collect students' scientific drawings and remind them that they will use their observations and scientific drawings in a future lesson.

Student Resource 2.2.B

Scientific Drawing of a Museum Specimen

Name(s): \_\_\_\_\_

Choose an animal to observe. Write the name of the animal and the name of the exhibit:

Use words and pictures to make a scientific drawing of the animal's feet below:

How might the parts of the foot help the animal to survive in its environment?