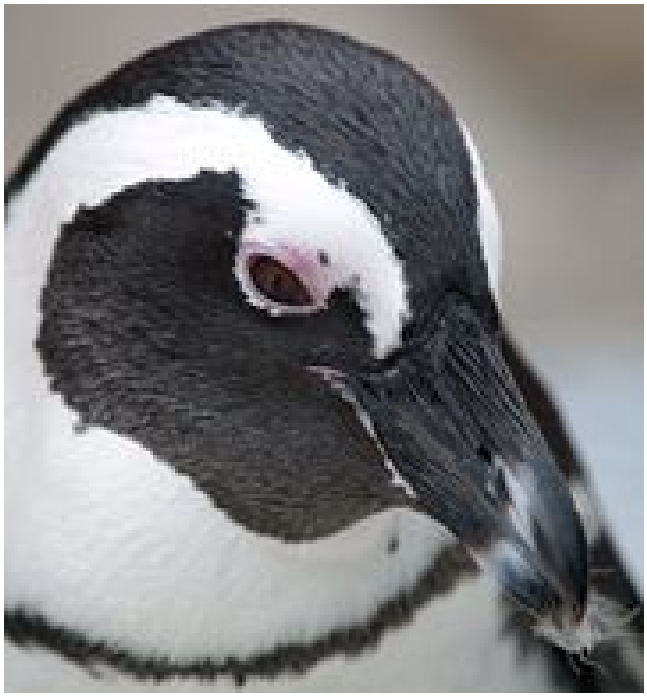
Always Adapting

An Educator's Guide to Lesson Plans about the Adaptation of Life at the Poles



Always Adapting

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Related Exhibitions

Evolving Planet
Take an awe-inspiring journey through 4 billion years of life on Earth in their new permanent exhibition**.**

What Is an Animal?
Explore what makes an animal an animal. See what animals look like, where they live, how they survive and more.

Always Adapting Stories

Lesson Title: *Poles Apart: Why Penguins and Polar Bears Will Never Be Neighbors*

Illinois Learning Standards:

Language Arts:

Goal 1 – Reading: 1.B.1a, 1.B.2a, 1.B.3a, 1.B.4a, 1.B.5a, 1.C.1a, 1.C.2a, 1.C.3a, 1.C.4a, 1.C.1d, 1.C.2d, 1.C.3d, 1.C.4d

Goal 3 – Writing: 3.A.1, 3.A.2, 3.A.3, 3.B.1b, 3.C.1a

Goal 4 – Listening and Speaking: 4.A.1a, 4.A.2a, 4.A.3a, 4.A.4a, 4.A.1b, 4.A.2b, 4.A.3b, 4.A.4b, 4.A.1c

Science:

Goal 12 – Concepts and Principles: 12.A.1a, 12.A.2a, 12.A.1b, 12.A.3a, 12.B.1a, 12.B.2a, 12.B.3a, 12.B.2b, 12.B.3b, 12.E.1a, 12.E.1b, 12.F.1b

Social Studies:

Goal 17 – Geography: 17.B.1a, 17.B.1b, 17.B.2b

Objectives:

Students will be able to:

- Build on existing vocabulary.
- Separate Arctic life from Antarctic life.
- List differences from the North Pole and South Pole.

Materials:

- Book: *Poles Apart: Why Penguins and Polar Bears Will Never Be Neighbors*
- Student Activity Sheet
- Pencil

Instructional Procedures:

1) Show the slide show *Life at the Poles*. Ask students to look for the blue arrows on each slide and indicate how that structure is an adaptation to the animal's environment.
2) Read *Poles Apart: Why Penguins and Polar Bears Will Never Be Neighbors* to students.
3) Ask students to answer the questions about the book on the student activity sheet.

Poles Apart: Why Penguins and Polar Bears Will Never Be Neighbors
Student Activity Sheet

Name _____

Activity Questions:

1. Have the North and South Poles always been the frozen places they are today? Why or why not? _____

_____

_____

2. Which is colder, the Arctic or Antarctic? _____

3. Which has a higher elevation? Mount Everest Vinson Massif

4. What is the Prime Meridian? _____

5. When does summer officially come to the Northern Hemisphere? _____ Hours of sunlight and darkness are evenly divided at the equator. As you move north from the equator, what happens to the length of sunlight of each day?

_____

6. In the Southern Hemisphere, things are just the opposite. Beginning at the equator and moving south, what happens to the length of daylight? _____

7. Of the 17 species of penguins, how many have ever lived at the North Pole? _____

8. Which colony of penguins is the northernmost? _____ Why are they able to live so far north?

_____

9. When Gondwanaland began to break up, and the piece of land that became Antarctica started to drift to the south, it carried some penguins and other tropical creatures along with it. Millions of years passed and the land moved farther and farther south and the climate turned colder and colder. Other animals like dinosaurs became extinct. Why were penguins able to survive?

_____

_____

_____

_____

10. List three ways in which penguins stay warm in Antarctic temperatures:

1) _____

2) _____

3) _____

11. What animal was the ancestor of today's white polar bear? _____

12. During the Ice Age (100,000 years ago), glaciers in the northern parts of Russia isolated a large pack of brown bears. What happened to those brown bears over time? _____

_____

13. What benefit does a coat of white fur give a polar bear? _____

_____

14. List three ways in which polar bears stay warm in Arctic temperatures:

1) _____

2) _____

3) _____

15. Polar bears have long necks and sleek bodies. What benefit does this offer the bear? _____

_____

16. If polar bears were moved to Antarctica (which man will never do!), give two reasons why polar bears would probably not survive life in Antarctica:

1) _____

2) _____

17. The Amundsen-Scott South Polar Station sits at the South Pole, where people work and do research. At the North Pole however, there is no permanent research station. Why not? _____

_____

18. What kinds of research are going on in the Arctic and Antarctic? _____

_____

Can You See the Polar Bear?

Lesson Title: Can You See the Polar Bear?

Illinois Learning Standards:

Language Arts:

Goal 3 – Writing: 3.A.1, 3.A.2, 3.A.3, 3.A.4, 3.B.1a, 3.B.2a, 3.B.3a

Goal 4 – Listening and Speaking: 4.A.1a, 4.A.2a, 4.A.3a, 4.A.4a, 4.A.1b, 4.A.2b, 4.A.3b, 4.A.4b, 4.A.1c

Science:

Goal 12 – Concepts and Principles: 12.A.1a, 12.A.2a, 12.A.1b, 12.A.3c, 12.B.1a, 12.B.2a, 12.B.2b, 12.B.3b

Social Studies:

Goal 17 – Geography: 17.A.1a, 17.A.2a

Fine Arts:

Goal 26 – Creating and Performing: 26.B.1d, 26.B.2d

Objectives:

Students will be able to:

- Mimic the effectiveness of camouflage.
- Explain why camouflage is important for polar bear survival.
- Create a piece of art that is useful in the learning of adaptation of life.
- List other arctic adaptations that help polar bears to survive.

Materials:

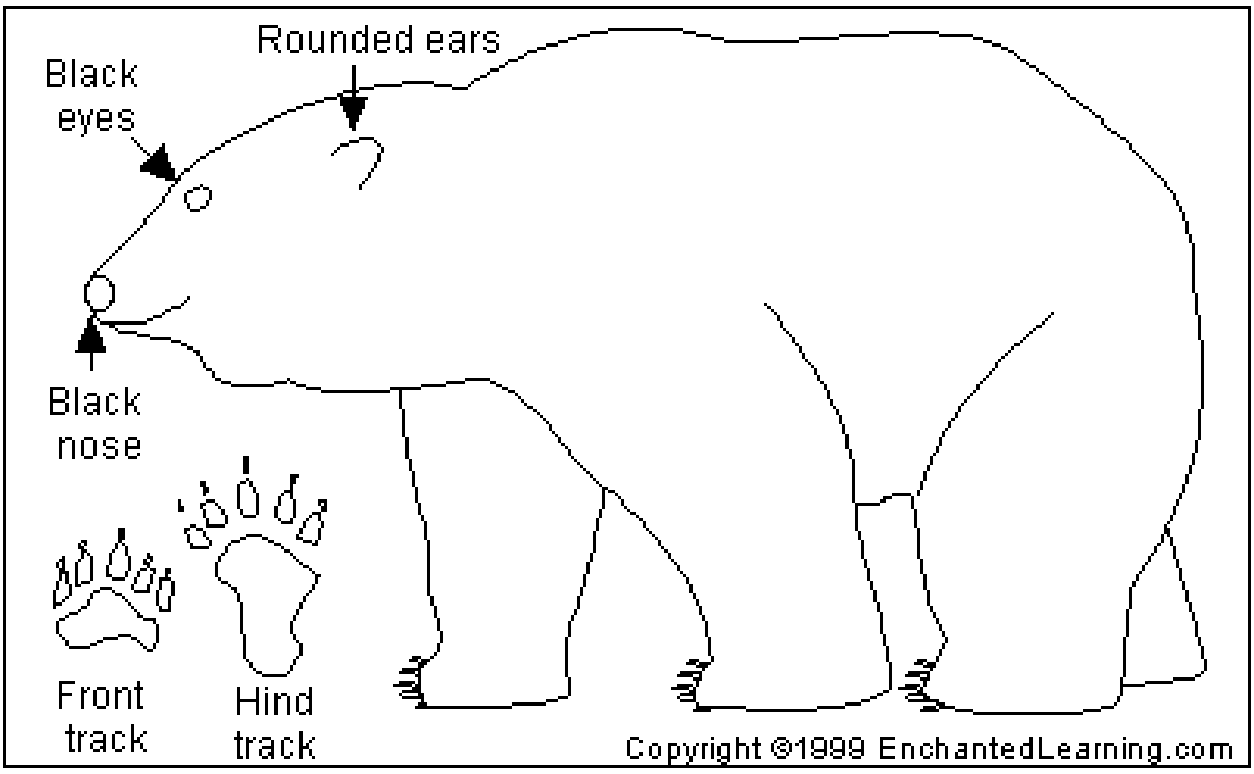
- Polar Bear Die Cut
- Student Activity Sheet
- Pencil
- Scissors
- Crayons
- White Paper
- Glue

Background:

Polar bears live in a very cold part of the earth. But like all other animals, they have adapted to their environment in order to survive. What characteristics does a polar bear have to help it survive?

Instructional Procedures:

1) Begin by introducing camouflage and how polar bears rely on it for survival.
2) Using the die cut image of the polar bear, instruct students to cut two polar bears out of white paper.
3) Instruct students to glue one of the polar bears to a sheet of totally white paper.
4) Instruct students to use the second piece of white paper to draw a habitat that would be different from the arctic. For instance, they could draw a jungle, forest, city or farm.
5) Once the students have drawn their new habitat, instruct them to glue the second polar bear to it.
6) Ask the students to explain how this activity relates to camouflage and adaptation.
7) Have students complete the questions on the student activity sheet.



Can You See the Polar Bear?

Student Activity Sheet

Name _____

1. What is camouflage? _____

2. Why is camouflage important to animals? _____

_____

3. Why is camouflage important to polar bears? _____

4. Besides polar bears, give three other examples of animals that use camouflage:

1) _____ 2) _____ 3) _____

5. Polar bears have other adaptations that help them to survive in the arctic, especially when it comes to keeping warm. For the list below, explain how each helps to keep polar bears warm.

Fat: _____

Fur: _____

Snout: _____

Black Skin: _____

Small Ears: _____

Hollow Hairs: _____

Thick Padded Soles: _____

Everyone Needs To Adapt

Lesson Title: Everyone Needs to Adapt

Illinois Learning Standards:

Language Arts:

Goal 3 – Writing: 3.A.1, 3.A.2, 3.A.3, 3.A.4, 3.B.1a, 3.B.2a, 3.B.3a, 3.B.1b, 3.B.2b, 3.C.1a, 3.C.2a, 3.C.3a

Goal 4 – Listening and Speaking: 4.A.1b, 4.A.2b, 4.A.1c, 4.A.2c, 4.A.1d, 4.B.1a, 4.B.2a, 4.B.1b, 4.B.2b

Goal 5 - Research: 5.A.1a, 5.A.2a, 5.A.3a, 5.A.1b, 5.A.2b, 5.B.1a, 5.B.1b, 5.B.2b, 5.C.1a

Science:

Goal 12 – Concepts and Principles: 12.A.1a, 12.A.2a, 12.A.1b, 12.A.3c, 12.A.4c, 12.B.1a, 12.B.2a, 12.B.2b, 12.B.3b

Objectives:

Students will be able to:

- Isolate and identify the role that change and adaptation play in extreme environments.
- Identify structural modifications in plant and animal life that help flora and fauna exist in extreme environments.
- Examine change and adaptation as a theme in nature.
- Utilize internet resources for research.

Materials:

Students work in small groups.

- 3x5 Index Cards
- Internet Access
- List of Items for Laboratory Practical (See Below)
- Student Activity Sheet
- Pencil

Laboratory Practical Materials and Set-Up:

Station #	Items at Each Station	Change OR Adaptation?
1	Bunch of Grapes & Bowl of Raisins	CHANGE
2	Wig	ADAPTATION
3	Cucumber & Pickle	CHANGE
4	Ice & Water	CHANGE
5	Piece of Leather & A Shoe	CHANGE
6	Fake Fingernails	ADAPTATION
7	Photo of a Baby & Photo of an Adult	CHANGE
8	Any Book & Movie of the Same Title	ADAPTATION
9	Photo of a Sheep and a Piece of Wool	ADAPTATION
10	A Photo of a Football Player in Pads & Helmet	ADAPTATION
11	Any Plant Seed & Live Plant	CHANGE
12	Piece of Wood & Sheet of Paper	CHANGE
13	Piece of Rubber & Pair of Sneakers	CHANGE
14	A Block of Wood & A Pencil	CHANGE

Background:

Students will learn about the role adaptation plays in life by observing its nature in botany and ornithology. In each of these areas, students will understand that life forms must adapt to survive. Once this theme has been isolated and analyzed, students will be able to recognize and identify adaptive features in plants and birds.

Instructional Procedures:

1) Show the slide show *Cacti & Penguin Adaptations*.

2) On a set of 3x5 index cards, print the word "change" on half and the word "adaptation" on the other half.

3) Using the attached list, prepare all materials and set up the 14 station laboratory practical.

4) Give each student an index card with either "change" or "adaptation" printed on it. Ask students to separate themselves into two groups based on the card they received (the "changers" and the "adapters").

5) Assign each student to write a definition of what "change" or "adaptation" means to them on the student activity sheet. After they develop a definition, instruct each of them to share their definitions of "change" and "adaptation" with the class. After each group has presented their definition, provide students will the following working definitions of the terms:

Change is the act of altering, transforming, or substituting one action or behavior for another.

Adaptation is the act of adjusting to environmental conditions over a period of time.

6) Assign students to pairs.

7) Instruct students to move through the 14 stations. At each station, students will determine if the items provided represent an adaptation or a change and should record their answer on the activity sheet.

8) After all students have visited the 14 stations and have recorded their answers, lead a class discussion of each station, providing the correct answer and rationale. For example, "Station #1 has a bunch of grapes and a bowl of raisins. What does this represent?" (Change.) Why is it change?" (The grape and the raisin are basically still the same, the form has just changed.) Continue in this manner through each of the stations. Extend the discussion of adaptations and changes by asking students to come up with examples of change and adaptation in their own lives. How do people change and adapt? What are the possible consequences when people DO NOT change or adapt to new circumstances?

9) Assign each student one of the following types of cactus: barrel, cholla, or saguaro. Using internet resources, have students research the answers to the questions on the student activity sheet.

10) Using internet resources, have students research the answers to the questions on the student activity sheet about penguins.

Everyone Needs To Adapt

Student Activity Sheet

Name _____

Define Change: _____

Define Adaptation: _____

Station #	CHANGE	ADAPTATION	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

Activity Questions:

1. How do people change and adapt? _____

_____

2. What are the possible consequences when people DO NOT change or adapt to new circumstances? _____

_____

Your Assigned Cactus: _____

Use the internet to research your assigned cactus.

Scientific Name of Your Cactus: _____

Where does your cactus live? _____

Describe the environmental conditions in that location: _____

Average Life Span: _____ Adult Size: _____

How many inches does your cactus grow in a year? _____

Shape of your cactus? _____ Color of your cactus? _____

Does your cactus produce flowers or fruit? *Yes* *No*

What animals eat your cactus? _____

How does your cactus defend itself from being eaten? _____

Give three ways in which your cactus has adapted to its environment:

1) _____

2) _____

3) _____

Using the internet to research penguin adaptations, complete the chart below:

Question to Research	Your Answer	Website Used
How does a penguin's bone structure help it to swim better?		
How are a penguin's wings different from other birds?		
How do Antarctic penguins stay warm?		
What is the father's role in the reproduction of emperor penguins?		
What are the predators of Antarctic penguins?		
How do penguins protect themselves from these predators?		
What other adaptations do penguins have that allow them to survive in Antarctica?		

Large or Small…What Keeps You Warmer?

Lesson Title: Large or Small…What Keeps You Warmer?

Illinois Learning Standards:

Language Arts:

Goal 3 – Writing: 3.A.1, 3.A.2, 3.A.3, 3.A.4, 3.B.1a, 3.B.2a, 3.B.3a, 3.B.1b, 3.B.2b, 3.C.1a, 3.C.2a, 3.C.3a

Goal 4 – Listening and Speaking: 4.A.1b, 4.A.2b, 4.A.1c, 4.A.2c

Mathematics:

Goal 6 – Number Sense: 6.B.1, 6.B.2, 6.C.1a, 6.C.2a, 6.D.1, 6.D.2

Goal 7 – Estimation and Measurement: 7.A.1a, 7.A.1b, 7.A.1d

Goal 10 – Data Analysis and Probability: 10.A.1b, 10.A.2c, 10.A.3c, 10.B.1a, 10.B.2a, 10.B.2d

Science:

Goal 12 – Concepts and Principles: 12.A.1a, 12.A.1b, 12.A.3c, 12.A.4c, 12.B.1a, 12.B.2a, 12.B.2b, 12.B.3b

Goal 13 – Science, Technology, and Society: 13.B.1a, 13.B.1b

Objectives:

Students will be able to:

- Utilize the scientific method.
- Relate an experimental design to animal adaptations.
- Examine how size adaptations aid in the survival of animal life.

Part 1

Materials:

Students Work In Groups:

- 2 Thermometers
- Access to Cold Temperatures (Outdoors or Refrigerator)
- Large & Small Container (2 tin cans or 2 plastic jugs)
- Hot Tap Water
- Pencil
- Student Activity Sheet

For Both Part 1 & Part 2, Begin By Showing the Slide Show *Large or Small?*

Part 1

Instructional Procedures:

1) Instruct students to fill the large and small containers with hot water. Measure the water temperature in each container and record it on the student activity sheet.
2) Place both containers in the refrigerator or in a cold place for 15 minutes.
3) At the end of 15 minutes, have the students measure and record the water temperatures again.
4) Instruct the students to calculate the difference between the starting and ending readings for both containers and record this information on the student activity sheet.

Part 2

Materials:

Students Work In Groups:

- 2 Thermometers
- Access to Cold Temperatures (Outdoors or Refrigerator)
- 2 Latex Gloves
- Several Rubber Bands
- Warm Tap Water
- Pencil
- Student Activity Sheet

Part 2

Instructional Procedures:

1) Instruct students to close off each of the five finger compartments in one of the latex gloves using rubber bands. This will be the "mitten." The other glove will be the "normal" glove.
2) Have students measure the temperature of the warm water and record it on the student activity sheet.
3) Have the students pour 250 mL of water into both gloves and then seal them both with rubber bands.
4) Place both containers in the refrigerator or in a cold place for 15 minutes.
5) At the end of 15 minutes, have the students measure and record the water temperatures in both gloves.
6) Instruct the students to calculate the difference between the starting and ending readings for both gloves and record this information on the student activity sheet.

Background:

Many tundra birds and mammals are larger and have smaller appendages than do similar species living in warmer environments. Tundra hares, for example, are among the largest hares and have shorter ears and legs than do desert hares (called jackrabbits). Similarly, arctic foxes have shorter ears than do desert kit foxes. Even lemmings are larger and have smaller ears and tails than do most other mouse-like animals. Large size and short appendages are adaptations that reduce heat loss and resist the cold.

The amount of heat loss increases as the proportion of exposed surface area to body mass increases. Since that proportion is greater in small animals, they lose heat more quickly. An animal with long legs, ears, or a tail has more surface area than an animal of the same size that has shorter appendages.

However, in some cases, small size can be an adaptation for survival on the tundra. A small organism can survive on less food than can a large organism of the same species. Shrews, the smallest of all mammals, thrive in the tundra of arctic Alaska.

Large or Small…What Keeps You Warmer?

Student Activity Sheet

Name _____

Data Table
Part 1

Container	Starting Temperature	Ending Temperature	Temperature Difference
LARGE			
SMALL			

Activity Questions:

1. Which container's contents cooled down more? *Large* *Small*

2. Explain your results above: _____

_____

_____

3. Based on your results, do you think animals living in tundra environments would be larger or smaller than animals living in warm environments? Why?

_____

_____

_____

_____

Data Table
Part 2

Glove	Starting Temperature	Ending Temperature	Temperature Difference
MITTEN			
NORMAL			

Activity Questions:

4. In which glove did the temperature decrease more? *Mitten* *Normal*

5. Explain your results above: _____

_____

_____

6. In the winter, do you think you will wear mittens or gloves to keep your hands warm? *Mittens* *Gloves*

Why? _____

_____

7. Think about animals living on the tundra. The blood in their bodies is like water in the gloves. Their toes, ears, and tails are like the fingers in the glove. Considering what you learned from this experiment, which animal do you think would stay warmer in the tundra, one with long ears, toes, and tail, or one with short ears, toes, and tail? Why?

_____

_____

_____

_____

_____

Always Adapting Movies

Lesson Title: Always Adapting Movies: *Planet Earth – Ice Worlds*

Illinois Learning Standards:

Language Arts:

Goal 3 – Writing: 3.A.1, 3.A.2, 3.A.3, 3.A.4, 3.B.1a, 3.B.2a, 3.B.3a, 3.C.1a, 3.C.2a, 3.C.3a

Science:

Goal 12 – Concepts and Principles: 12.A.1a, 12.A.2a, 12.A.3c, 12.A.4c, 12.B.1a, 12.B.2a, 12.B.3a, 12.B.1b, 12.B.2b, 12.B.3b, 12.E.1b

Social Studies:

Goal 17 – Geography: 17.A.1a, 17.A.2a, 17.B.1a, 17.B.1b, 17.B.2b

Objectives:

Students will be able to:

• Form a connection between extreme environments at the poles and the adaptations that life forms posses to survive in those environments.
• Recognize that global climate change is affecting the adaptability of life at the poles.
• Gain a responsibility for the health of the planet.

Materials:

• *Planet Earth – Ice Worlds* DVD
• Student Activity Sheet
• Pencil

Background:

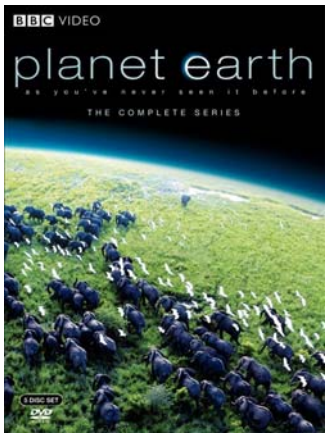
From the creators of *Blue Planet: Seas of Life* comes this epic series celebrating the Earth as never before. This series captures rare action, impossible locations and intimate moments with our planet's best-loved, wildest and most elusive creatures.

Disk two contains the segment on *Ice Worlds*. The advances and retreat of polar ice is the real challenge to life. As the sea freezes in Antarctica all animals flee, except for the Emperor

Penguin. Meanwhile, in the Arctic, the polar bear is forced to swim vast distances and take on one of the deadliest adversaries on the planet.

Instructional Procedures:

1) Watch the film *Planet Earth – Ice Worlds*.
2) Instruct students to complete the questions on the student activity sheet.



Always Adapting Movies: *Planet Earth – Ice Worlds*

Student Activity Sheet

Name _____

Activity Questions:

1. List three different types of animals found at each location:

Arctic	Antarctic
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____

2. What is the major problem facing polar bears today? _____

_____

_____

3. How do emperor penguins work together to help ensure the survival of their young?_____

_____

_____

4. What did you notice about the colors of the arctic fox? _____

5. Why do you think this is important? _____

_____

6. How are walruses adapted to possible predation from polar bears? _____

_____

7. Penguins have lost the ability to fly. But why have arctic birds maintained their ability? _____

_____

Suggested Books for Children

Bramwell, Martyn. 1998. *Polar Exploration: Journeys to the Arctic and Antarctic*. DK Publishing, Inc. New York, NY.

Crow, Sandra L. 1996. *Penguins and Polar Bears: Animals of the Ice and Snow*. National Geographic, Des Moines, IA.

Lennson, Nancy, S. 2002. *North Pole South Pole*. Holiday House Publishing, New York, NY.

Scott, Elaine. 2004. *Poles Apart: Why Penguins and Polar Bears Will Never Be Neighbors*. Penguin Group Publishing, New York, NY.

Taylor, Barbara. 1995. *Arctic and Antarctic*. Alfred A. Knopf, Inc. Publishing, New York, NY.

Suggested Books for Educators

Goodman, Susan E. 2001. *Claws, Coats, and Camouflage*. Milbrook Press, Minneapolis, MN.

Kalman, Bobbie and Walker, Niki. 2000. *How Do Animals Adapt?* Crabtree Publishing Company, New York, NY.

Kriesberg, Daniel A. 1999. *A Sense of Place: Teaching Children about the Environment with Picture Books*. Teacher Ideas Press, Engelwood, CO.

Schmidt-Nielsen, Knut. 1997. *Animal Physiology: Adaptation and Environment*. Cambridge University Press, New York, NY.

Suggested Websites

Polar Bears
Site gives information about polar bear adaptations.
http://www.mnh.si.edu/arctic/html/polar_bear.html

What Is a Cactus?
Site provides information about the defining characteristics of cacti.
Error! Hyperlink reference not valid.

Desert Plants and Wildflowers
Links to pages of information on various cactus plants indigenous to the United States, including the barrel cactus, cholla cactus, and saguaro cactus.
www.desertusa.com/flora.html

Davis Station Webcam, Antarctica
Students can see Antarctica via a live Webcam and also gather data about weather, climate, and atmospheric conditions in Antarctica.
www.aad.gov.au/stations/davis/video.asp

Penguin Adaptation Facts
Site gives information about biological adaptations that allow penguins to thrive in the Antarctic climate.
http://octopus.gma.org/surfing/antarctica/penguin.html