

# Animals and Adaptations

Integration: Science; Health (Personal Health)

Grade Levels: 4-6

Time: 2-4 class periods

Materials:

- Sandwich bags that seal
- Tape
- Vegetable shortening or lard
- Ice water
- Rubber bands
- Large spoons or ice cream scoopers
- Paper cups (approximately 5 oz)
- Swatches of different types of materials (cotton, wool, polyester, rubber, nylon, synthetic fur, polypropylene, lace, rayon, silk, etc.)
- Salt
- Tablespoons
- Water
- *Insulation* worksheet
- *Anti-Freeze* worksheet
- *Explorer's Clothing* handout

Objectives:

Students will:

1. Identify the types of animals and plants that live in and around Antarctica.
2. Investigate the importance of adaptations for animals living in Antarctica.
3. Compare the insulation of animals with the equipment that is used by Antarctic explorers such as Liv Arnesen and Ann Bancroft.

Lesson:

1. Review Antarctica's weather conditions with students.
  - a. Ask students what they know about the weather conditions in Antarctica.
    - Antarctica is very cold. The mean temperature of the interior of Antarctica ranges between -40 to -90° F (-40 to -68°C) during the coldest months and -5 to -31°F (-15 to -35°C) during the warmer months.
    - Antarctica is very windy. The katabatic (gravity-driven) winds that blow from the interior can reach 185 miles per hour (300 km per hour).
2. Ask students what they know about the animals that live on and around Antarctica.
  - a. Antarctica is home to tiny *invertebrates* (animals without backbones) like mites, midges, lice, and springtails.
  - b. The water around Antarctica is home to krill (shrimp-like animals), seals, fish, whales, sea birds (albatrosses, petrels, terns) and seven species of penguins.

- Some of these animals such as the birds and seals may come onto the shores of Antarctica but they do not live there permanently.
- c. The water is also home to tiny organisms called plankton. Phytoplankton are microscopic plants; zooplankton are microscopic animals.

EXTENSION: Have students, individually or in groups, research a particular animal and create a poster that includes a picture of the animal and short facts about the animal. Individual species of animals (e.g. Adelie and emperor penguins) can be chosen or assigned.

3. Tell students that although Antarctica is a frozen continent, a few types of plants are found there.
  - a. Algae: simple one-celled plant that grows on rocks or glaciers; looks like red or green powder.
  - b. Moss: tiny plant that grows in clumps near bird colonies.
  - c. Lichen: flat plant that grows on rocks especially where there is sunlight.
  - d. Two flowering plants are found on the Antarctic Peninsula where it is warmer: hairgrass, a type of grass and a moss-like plant called pearlwort.
  - e. Seaweed and algae are abundant in the water.
  
4. Explain to students that plants are not abundant and that animals, except for some small invertebrates, are only found along the coast of Antarctica. It is too cold and windy in the interior for them to survive there.
  
5. Explain that the animals that live around Antarctica have had to *adapt* to this environment over thousands of years.
  - a. Ask students to define the word “adapt” (adjust to the conditions; modify itself to survive).
  
6. Introduce the ways that Antarctic animals are able to survive the harsh temperatures and Antarctic winds.
  - a. Ask, “What would happen to the animals’ bodies in the extremely cold and windy environment.” Explain to students that animals in Antarctica are in danger of freezing from the low temperatures and wind. Some of the Antarctic animals are able to survive because they use one or both of two methods: anti-freeze and insulation.
    - Some animals, like the arthropods and fish, have chemicals in their bodies that act as anti-freeze, preventing their bodies from freezing. Once such chemical is called *glycerol*. These animals can live in temperatures well below 0° F.
    - Some animals, like seals and penguins, have some type of *insulation* (material that keeps heat in and cold out) that helps to keep their bodies warm.
  - b. Ask students to give examples of types of insulation these animals may use to survive the cold (feathers, fat).

- Penguins have a dense layer of waterproof feathers that helps to keep them warm and dry. The feathers trap a layer of air next to their skin and this keeps the cold away from their bodies.
- Penguins and seals both have thick layers of fat between their skin and their muscles. This fat serves like a blanket and helps to keep them warm and their bodies from freezing.

### Small group

7. Tell students they will work in small groups to investigate the adaptations they are learning about.
8. Activity #1: Insulation
  - a. Students work in cooperative groups to investigate the insulating effect of fat.
  - b. Preview the following activity with the class.
    - Place a scoop of shortening or lard inside one sandwich bag.
    - Turn a second bag inside out, place it inside the first bag and seal them together. This will trap the fat between the bags
    - Seal the edges and corners with tape.
    - Put a hand inside the bag and spread the fat between the bags.
    - Repeat the previous steps with two bags without fat.
    - Answer the questions on your *Insulation* worksheet labeled “Before the Experiment.”
    - Place a hand in the glove without fat (you can secure it around your wrist with a rubber band if you wish) and place it in the ice water. **DO NOT ALLOW WATER TO ENTER THE GLOVE.**
    - Record your observations. (How does your hand feel?)
    - Place a hand in the glove with fat and repeat the experiment.
    - Record your observations.
    - Answer the questions on the *Insulation* worksheet labeled “After the Experiment.”
9. Activity #2: Anti-Freeze
  - a. Preview the experiment with the class. Tell students that they will investigate the effect of anti-freeze chemicals in animals. They will not use the actual chemicals but will see the effect with an everyday substance.
    - Label two paper cups: label one “Water only” and the other “anti-freeze”.
    - Fill each paper cup half-way with water.
    - Add 1 tablespoon of salt to the cup labeled “anti-freeze” and stir until it dissolves.
    - Answer the questions on the *Anti-Freeze* worksheet labeled “Before the Experiment.”
    - Place both cups in the freezer and allow them to remain there overnight. If possible check on them every 30 minutes to one hour on the first day.

- After 24 hours, take out the cups, record your observations and answer the remaining questions on the *Anti-Freeze* worksheet.

### Full group

10. Tell students that although humans do not have chemicals that act like anti-freeze in their bodies, we do have insulation.
  - a. Ask the students how humans are insulated against cold weather conditions.
    - Layer of fat between the skin and muscles
    - Clothing
11. Ask students how they keep themselves warm during cold weather. What types of clothing do they wear?
12. Tell students that the type of material that their cold-weather clothes are made from is very important. This is especially important to Antarctic explorers like Ann Bancroft and Liv Arnesen. Remind the students that the explorers face extremely cold temperatures and that they must be very careful to protect themselves from the cold.
  - a. Ask students to name characteristics that should be considered when choosing cold-weather clothes.
    - Weight: clothes should be lightweight.
    - Insulation: the material should keep you warm.
    - Feel: you want to feel comfortable in the clothing.
    - Wicking: the removal of moisture from the body by the material is called wicking. Wicking is important because a wet body will be colder.
13. Give each student an *Explorer's Clothing* handout. Tell them that they are going to investigate the best material for the explorers' clothing

### Small Group

14. Divide class into small groups and give each group a sample of swatches (each group should receive a swatch of each material).
15. Instruct students to write the name of each material on a piece of paper and to discuss and record the properties of each.
  - a. Students should observe how the material feels, its weight, and its insulating behavior.
  - b. Students may test its waterproof or absorbent properties by pouring water on the material and observing it.
    - Was the water absorbed? Does the material feel wet to the touch?
  - c. Students will assess their observations, judge each of the materials and decide on a material that would be appropriate for clothing for an Antarctic expedition. Remind students that they will want to keep their bodies dry (wicking layer close to the skin; waterproof layer on the outside).

- d. Each group will report their findings to the rest of the class.
- e. Ann and Liv try to wear synthetic materials such as fleece and polypropylene because they are lightweight, warm, and wick away moisture. They also wear wool for the same reasons, although wool remains wet longer. Ann and Liv never wear cotton because it gets wet and stays wet. It is dangerous to wear for winter activities.

16. Allow time for students to write an entry in their learning logs describing what they have learned about animal adaptations and human insulation.

### Assessment:

Teachers will assess:

1. Student's understanding of the mechanisms animals use to survive in Antarctica.
2. Student's application of animal mechanisms to humans.
3. Student's evaluation of the materials and their properties.
4. Student's ability to work cooperatively.
5. Student's ability to form and test a hypothesis.