

# What is Hibernation?

## Experiment

In this lesson, students will explore how ground squirrels, bats, grizzly bears, snakes, and amphibians survive Alberta's harsh winters by entering a state of torpor. A 19-minute video featuring local researchers provides insight into the unique adaptations of these animals. Afterward, students will conduct a hands-on experiment investigating cryoprotectants, natural antifreezes, that help amphibians survive freezing temperatures. By comparing the freezing rates of sugar and non-sugar solutions, students will apply scientific observation and analysis to understand this crucial survival strategy.

## Instructions

### 1. Watch the Video

Begin by watching the 19-minute video [Hibernation – Alberta Examples](#) (or specific segments of interest) to learn from experts on how different animals in Alberta use hibernation to survive winter. Animals featured include:

- **Ground Squirrels** – Jeffery Lane, Associate Professor, Department of Biology, University of Saskatchewan (cue: 0 - 3:15 min.)
- **Bats** – Lisa Wilkinson, Species At Risk Biologist, Alberta Environment (cue: 3:16 - 5:54 min.)
- **Grizzly Bears** – John Paczkowski, Wildlife Ecologist, Alberta Parks (cue: 5:55 - 9:55 min.)
- **Snakes** – Roland Kirzinger, Education Coordinator, Fish Creek Provincial Park (cue: 9:50 - 14:04 min)
- **Amphibians** – Vicki Perkins, Education Coordinator, Kananaskis Country (cue: 14:05 - 19:06 min.)

### 2. Inquiry Question

After watching the video, introduce the question: ***How do amphibians that hibernate in the frost zone (where the ground freezes) survive?***

### 3. Hands-On Experiment: Investigating Cryoprotectants

Students will explore this question by comparing the freezing rates of sugar and non-sugar solutions while documenting their observations.

#### Procedure

- A. Mix one part sugar to one part water in one of the containers (e.g. 250 ml sugar: 250 ml water). Stir until sugar is completely dissolved.
- B. Fill the second container with an equal amount of water to the first container.
- C. Place both containers in the freezer.

#### Materials:

- 2 containers (equal size)
- Water  Sugar
- Measuring cups  Spoon
- Freezer
- Science Journal  Pencil

#### Vocabulary:

**Cryoprotectant** - a substance that can prevent tissues from freezing at low temperatures.

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- D. Check the containers after 1 hour, 2 hours and 3 hours. Notice how the two containers freeze and reflect on the following in your science journal:
- Is there a difference in the rate of freezing between the two containers?
  - Which solution freezes faster? Slower?
  - Do the solutions feel different when touched by the stirring spoon?
- E. Leave your containers in the freezer overnight or for at least 8 hours.
- F. Remove them and let them thaw at room temperature. Observe and document in your science journal:
- How long does it take each container to thaw?
  - Which solution thaws faster? Slower?

### Questions

The following questions offer students the opportunity to analyze their observations and to encourage them to reflect on the broader implications of these adaptations:

- How did the sugar solution and the plain water differ in their freezing rates?
- Why is sugar a useful adaptation for frogs that hibernate in the frost zone?
- What strategies do these animals share to adapt to winter? How do their adaptations differ?
- Pick one animal and draw a food web illustrating its ecological relationships with other animals and plants.
- Identify a natural region and one Provincial Park where this animal can be found?
- Why is your animal important to its ecosystem?
- How might human activity (e.g. climate change, habitat destruction) affect the survival of hibernating animals?
- What actions can people take to help protect these species and their habitats?

## Discussion

Amphibian species of Alberta survive the cold freezing temperatures of winter by hibernating. Most species burrow into the ground below the frost line (where the ground is not frozen) or into the mud at the bottom of a wetland where the water does not freeze to the bottom. There are a few species including the **Wood Frog** and the **Boreal Chorus Frog** that are freeze-tolerant and hibernate near the ground surface within the frost zone. They possess superpowers to avoid becoming a frogsicle! This experiment provides insight into one way they can do this, through the adaptation of having a cryoprotectant – a substance that protects their tissues from freezing at low temperatures. What is their secret? **Sugar!** While not as simple as this experiment, the concept is the same. Sugars act as antifreeze in their cells, preventing ice crystal formation and allowing them to survive sub-zero temperatures.