Hide Insulation

Learning Objectives:

- Learn about bison adaptations.
- Learn about the anatomy of bison.

Prep Time: 15 minutes
Duration: 30-60 minutes

Learning content:

Every year when mid-winter arrives, snow can blanket Montana, temperatures can drop well below zero, and the winds can howl unmercifully, and yet bison remain alive and well on the hostile landscape. Indeed, bison have evolved digestive, physiological, and behavioral strategies that allow them to survive some of the harshest weather in North America.

Under cold stress, bison have developed the adaptation to minimize nutritional needs and slow their metabolism to conserve energy. Metabolism is a term used to describe the process by which our bodies convert food into energy. People say bison during the winter are time minimizers rather than energy maximizers. In other words, bison cannot merely eat more food more often to compensate for the low nutritional forage they eat. Instead, they slow down their metabolisms, the amount of time they spend foraging, and the amount of food they consume in order to conserve energy. Bison also have the ability to generate internal body heat through digestion. Forage is retained longer in their gut — due to the increase of indigestible plant material found in the winter — which allows them to eat less but still receive the nutrition they require. Without these adaptations, surviving the freezing temperatures and blizzard storms would not be possible.

During the cold winter season, bison develop thick, woolly coats that help protect them from freezing temperatures and harsh winds. It is said that a bison's winter coat is so thick and provides insulation so effective that when snow accumulates on its coat, it will not melt from the heat of the bison's skin. Their skin also thickens in response to cold temperatures and fatty deposits appear to insulate the animal. Insulation is about separating something hot from something cold so that the heat doesn't transfer. This is important because during winter storms, bison will actually turn toward the storm, hunker down, and wait for it to pass. With thick coats and creating a low profile, bison can survive the same storm that would kill many domestic livestock. Bison also have the ability to use their large head and massive neck and shoulder muscles as snow plows to forage in snow as deep as four feet! Some cultures use bison and other animal hide as coats and blankets to stay warm.

(National Park Service)

Supplies:

- Ice cubes (1 per student)
- Plastic bags (1 per student)
- Fabrics with various thicknesses (enough for

Set Up:

- Put individual ice cubes in plastic bags and set in a freezer or ice box until the activity starts
- Separate types of fabric, cotton, and Polyfill

each student to have different pieces)
- Poly-Fil and/or cotton balls
- Thermometers
- Rulers
- Scratch paper
- Pencils

into sets so that each student has 1 type of material to use
- Set out scratch paper and pencils for students to mark down measurements
- Have thermometers and rulers ready for each student to measure the ice melt
- Prepare images and videos of bison to support discussion.

Activity:

1. **Introduce** the activity: How do you stay warm when it's cold outside? How do you think bison stay warm in the winter?
2. **Show images and videos** of bison and make observations about their adaptations to cold weather. Introduce the concept of insulation.
3. Show students their fabric and cotton insulation materials for the day, and **tell them their mission** is to use their "hide" like a coat to prevent the warm room from melting an ice cube.
4. Give students ice cubes, keeping them in plastic bags to prevent mess, and ask them to **measure** the longest and shortest sides of their ice cube, marking the measurement on a piece of paper.
5. Using their materials, invite students to **experiment with insulating** their ice cube.
6. As a **control**, set one ice cube out with no insulation for students to compare.
7. When everyone is finished insulating their ice cube, **set a timer** at an interval that works best for your group (ideally between 30 and 60 minutes). When the timer goes off, invite students to **measure** their ice cubes again. Whoever's ice cube has shrunk the least has the best insulation technique and material.
8. **Reflect** and discuss comparisons between technique, material, and rate of melt.

Extension:

- Students may measure their ice cubes at shorter intervals before the timer goes out. For example, every 10 minutes students may use a ruler and note how much smaller their ice cube is.
- Use a temperature gun or thermometer to measure changes in the water, fabric, and ambient air.
- Older students may graph the changes occurring as the ice cube melts.
- As students wait for the timer, watch OPI's videos about buffalo jumps, or other Indigenous stories on spectrUM's website.
- As students wait for the timer, invite them to create artwork about bison. Artwork about bison is a traditional Indigenous method of self-expression, cultural expression, and reverence for the animal.

- Weigh the ice cube at the beginning of the experiment, then at the end to compare.

spectrUM Pedagogy:

Inspire Curiosity: Ask open-ended questions and encourage creative thinking.
Encourage Growth Mindset: Measuring can be challenging and a point of frustration for some students. Be available to help students when invited, do not measure for them. Encourage students and praise them on their effort and problem-solving skills.
Make Meaning: Create personal connections between science and students by asking them about their relationship with bison and other animals.
Navigate Your Future: Let students know about resources and opportunities for them to continue to pursue an interest in wildlife, such as classes, clubs, camps, and higher education.
Collaborate With Communities: spectrUM has collaborated with many tribal representatives to connect science with Indigenous traditions. These resources can be found on spectrUM's website, umt.edu/spectrUM.
Try It: Encourage student autonomy by providing them the opportunity to insulate, measure, and problem-solve independently.