

BLUBBER

Winter is the coldest season on Earth. Although there are **temperate** climates (areas without long periods of extremely hot or cold weather) that do not experience cold and icy winter weather, people living in colder climates need to find ways to adapt to weather that can be very harsh. People keep warm by dressing in layers of warm fabric, like wool, cotton, or fleece. They often wear hats, gloves, and scarves when outdoors to help them stay warm.



Have you ever wondered how **warm-blooded** animals living in very cold climates stay warm? Most mammals and birds are warm-blooded. That means they can maintain a fairly stable body temperature regardless of the temperature of their environment. Another name for warm-blooded animals is **endothermic**, from the words *endo* meaning "internal" or "inside" and *therm* meaning "heat". Warm-blooded marine mammals like whales, seals, and polar bears can survive in freezing temperatures, sometimes as low as -40°F at the North Pole and -76°F at the South Pole.



Animals have many **adaptations** (special skills or physical conditions which help an animal to survive) that allow them to live in cold climates. One of these is **blubber**, or adipose tissue. Blubber is a thick layer of fat beneath the skin that has low **thermal conductivity**, which means it does not transfer heat well. **Marine animals**, such as dolphins, seals, walrus, and whales, spend at least part of their time in the ocean and are completely covered by blubber, except for their fins, flukes, and flippers. Blubber **insulates**. It keeps body heat in and cold air or water out. Blubber helps to keep an animal's internal organs warm. Without it, animals wouldn't be able to survive and hunt for food in the cold oceans. Blubber is less dense than the surrounding ocean water, so it also helps animals naturally stay **buoyant**, or float.

Blubber is different than normal body fat. It is very thick and dense. Animals with the thickest blubber are found in the **Arctic** (the extreme northern part of the Earth, beyond the Arctic Circle) and in **Antarctica** (the extreme southern part of the Earth, beyond the Antarctic Circle). Animals that spend the greatest amount of time in the water have the most blubber, and this varies between animals. The body mass of a baby harbor porpoise is 43% blubber! Whales that swim slowly have thicker blubber than faster-swimming whales.

More energy is needed to keep a body warm in cold water compared to warm water. Blubber has more blood vessels than regular body fat. Cold temperatures cause those blood vessels to **constrict**, or become narrower. This decreases blood flow so the animal doesn't need to use as much energy to heat its body. This helps to **conserve** (save) body heat.



Thick, oily layers of blubber store nutrients and energy. This includes protein (mostly **collagen**, a fibrous protein found in bone, connective tissue, and skin) and fats. Marine mammals can use these stored nutrients so they can go for long periods of time without searching for food. The body of a pregnant mammal builds up an even thicker layer of blubber before giving birth. Since they do not regularly hunt while feeding their young, new mothers rely on the energy that has been stored in their blubber.

NOTE: For these activities, you will need **shortening** or **lard**. Shortening is a solid vegetable oil that remains solid at room temperature and is often used to make pastry and to cook other foods. Lard is a soft, white solid or semisolid fat that comes from pork.

ACTIVITY #1: See how blubber can help insulate against cold temperatures

CAUTION! Do not try Activity #1 if you have diabetes or other health conditions that impair your circulation or sensation!

Materials:

- 2 cups or bowls
 - Cold water
 - Ice cubes
 - Thermometer
 - Shortening or lard
 - Paper towels
 - Stopwatch
 - Helper
1. Place the same number of ice cubes in each bowl or cup
 2. Add the same amount of cold water to each bowl or cup.
 3. Use the thermometer to measure the temperature of the water in each bowl or cup. Check to see that they are the same temperature.
 4. Cover the index finger (pointer) of one hand with a thick layer of shortening, ½ to 1" thick.
 5. Leave the same finger on your other hand bare.
 6. Have your helper ready to check the time on a stopwatch, or if you don't have a helper, you can watch the minute hand on a clock.
 7. Place the index finger of each hand in the cold water and have your helper begin to time you with the stopwatch.
 8. When your fingers get too cold to keep them in the water, take them out.
 9. How long were you able to leave each finger in the cold water?



ACTIVITY #2: Another way to explore the insulating properties of blubber

Materials:

- 2 cups or bowls
 - Shortening or lard
 - 2 thermometers
 - Cold water
 - Paper and a pencil to record your results
1. Fill one cup with shortening and the other cup with water, both at room temperature.
 2. Place a thermometer in the middle of each cup, and record the starting temperature.
 3. Remove the thermometers.
 4. Place the cups in a freezer for 30 minutes.
 5. After 30 minutes, remove the cups and check the temperature again.
 6. Place the cups back in the freezer and check the temperature again every 30 minutes until the temperature no longer changes.
 7. How did the temperature in each cup compare?

What happened?

In both activities, you discovered that shortening, much like blubber, provided insulation. In Activity #1, the finger that was coated with shortening did not get as cold as your bare finger. You were probably able to keep it comfortably in the ice water for a longer period of time.

In Activity #2, the temperature of the cup of shortening was not as cold as the temperature in the cup of water. Blubber is an insulator and prevents heat loss. In the shortening-filled cup, the shortening at the center of the cup started at room temperature. The outer layer of shortening kept the heat from escaping so it didn't cool down quickly. Water is not a good insulator. It becomes cold and freezes much faster than shortening or fat.

More blubber facts:

- Blubber does such a good job of keeping whales warm, they can overheat if they are very active. The pilot whale can take in water through its blowhole, which then travels inside its body picking up heat. When it is blown out of the body, the water takes the excess heat with it.
- Walrus blubber can be 4 inches thick. Walruses eat large amounts of food including clams and shrimp to maintain this layer of blubber.
- Marine mammals that suffer from poor health and nutrition may not produce enough blubber. Without it, they can die from exposure to cold temperatures.
- Marine mammals do have nerve cells in their skin, and it is thought that they can sense temperature. Some whales migrate to warmer waters in the winter to give birth.
- **Indigenous** (the first people to live in a land, also known as Native, First Peoples, or First Nation) people living in the Arctic have long relied on blubber as part of their diet. Thick slices of whale blubber and skin are called **muktuk**. Muktuk provides an excellent source of vitamin D, vitamin C, and energy.



- **Biomagnification** has now made eating muktuk and whale meat a possible health risk. It is the process which causes an increase in the amount of a substance as it goes up the food chain. Marine mammals are top predators in the marine food chain. Blubber now contains a high concentration of toxins, such as **PCBs** (polychlorinated biphenyl, a chemical that causes cancer and other harmful health effects). This may be the result of marine pollution. PCBs do not easily break down in the environment. They can be carried long distances and have been found in sea water in areas far from the source of origin. The manufacturing of PCBs was banned in 1979.
- The whaling industry was based on the harvesting of blubber. This industry was very **lucrative**, or profitable, in the 18th and 19th centuries. Millions of whales in the Atlantic, Pacific, and Arctic oceans were hunted and killed. The blubber was cooked slowly over a low temperature and turned into whale oil. Whale oil was used in making soap, cooking oil, and fuel for oil-burning lamps. Today there are laws that limit the hunting of whales. Vegetable oils have replaced whale oil in margarine and soap. Natural gas and petroleum are now used for fuel.



Humpback Whale



Polar Bear



Walruses



Spotted Seal

ADDITIONAL RESOURCES

Books available from the Washoe County Library System:

[*Amazing Arctic Animals*](#) by Jackie Glassman

[*The Antarctic Ocean*](#) by Anne Ylvisaker

[*The Arctic Ocean*](#) by Anne Ylvisaker

[*Beluga Whales*](#) by Elizabeth R. Johnson

[*Beluga Whales: Animals of the Snow and Ice*](#) by Elaine Landau

[*Big and Blubbery*](#) by Felicia Macheske

[*Elephants on the Beach*](#) by Colleen Stanley Bare

[*Exploring the World of Seals and Walruses*](#) by Tracy C. Read

[*Find Out About Arctic Peoples: What Life was Like in the Most Northerly Reaches of the Earth*](#) by Jen Green

[*Harp Seals*](#) by Kathleen Martin-James



[*How to Survive in Antarctica*](#) by Lucy Jane Bledsoe

[*Killer Whales*](#) by Sandra Markle

[*Polar Bears*](#) by Leslie Beckett

[*Polar Bears*](#) by Dorothy Hinshaw Patent

[*Walruses*](#) by Valerie Bodden

[*Whales: Killer Whales, Blue Whales and More*](#) by Deborah Hodge

[*Where is Antarctica?*](#) by Sarah Fabiny

Videos:

National Geographic, "Arctic: Exploring Oceans" <https://youtu.be/umAeFKF2uxA>

SciShow Kids, "How do Whales, Penguins, and Polar Bears Keep Warm?" https://youtu.be/TwfkCX_8fbA

SciShow Kids, Winter at the North Pole <https://youtu.be/WXtAGvcLxC4>

Socratica Kids, "10 Arctic Animals for Kids – Snow Animals for Kids – Polar Animals"
<https://youtu.be/DXxzmCFwTI>

TED-Ed, "The Arctic vs. the Antarctic – Camille Seaman" <https://youtu.be/Z5VRoGTF60s>

Websites:

NASA, Climate Kids, Which Pole is Colder? <https://climatekids.nasa.gov/polar-temperatures/>

National Oceanic and Atmospheric Administration, National Ocean Service, Education – For Kids
<https://oceanservice.noaa.gov/kids/>

National Geographic, Collections: Ocean Education
<https://www.nationalgeographic.org/education/programs/oceans-education/>

