Arctic Adaptations
(from the National Park Service, http://www.nps.gov/akso/ParkWise/Students/ReferenceLibrary/BELA/ArcticAdaptations.htm)

Biologists call the physical, physiological and behavioral traits that help an organism survive in a particular environment "adaptations". Organisms that live in the arctic and subarctic must have adaptations to help them survive and raise young despite the periodic extreme cold, persistent winds, short growing seasons and other difficulties posed by their severe environment.

Tundra bumble bees provide a fascinating example of arctic adaptation. Many insects cease functioning during winter. Since they are poikilothermic or "cold-blooded", insect body temperatures are closely related to the temperature of their surroundings. The chemical reactions necessary for insect movement do not occur at cold temperatures. Tundra bumble bees have developed a dense hair on their bodies which slows heat loss to the air. They also "shiver" their flight muscles to generate heat. This heat is temporarily trapped within their velvet coat. Some bumblebees can keep, their body temperatures 20-30, degrees C (68-86 degrees F) above air temperatures and are easily active while other insects are too cold to move.

The furry and wax-like coatings of certain tundra plants are adaptations that enable them to resist cold and wind. The fine dense hair around the flowers of the woolly lousewort not only reduces wind chill, but also traps heat from sunlight like the glass of a greenhouse. The flowers are thus surrounded by relatively warm air, sometimes 20 degrees C (34 degrees F) warmer than the environment. This is quite important because the process of cell division necessary for the formation of seeds cannot occur at cold temperatures. In addition, many tundra plants retain rather than shed their dead leaves each year. The dead leaves serve no apparent purpose except to insulate fragile new buds from the wind and cold.

Most living things are made up of 70% water. When water freezes, it expands and forms ice crystals. Repeated freezing and thawing can destroy living tissue. The Alaska blackfish overcomes this problem by producing chemicals within its body that lowers the freezing temperature of cell fluids. Much like the antifreeze we add to the water in our vehicles, the "antifreeze" of the Alaska blackfish prevents the formation of large ice crystals within its cells, even at low temperatures. The Alaska blackfish can survive temperatures of -20 degrees C (4 F) and the complete freezing of some body parts, including their heads, for up to several days.
One of the most obvious adaptations for life in a cold environment is insulating feathers or fur. Most tundra birds and mammals actually have two coats. Ptarmigan, whose feathery coats and thick down even cover their feet and provide a "snowshoe" effect, have the best insulation of any Alaska bird. They can keep their body temperatures at 40 degrees C (104 degrees F) without increasing their respiration rate, even at air temperatures of -34 C (-29 F). The ptarmigan's white winter feathers (brown during summer) not only help camouflage it in the snow from predators, but radiate less heat back to the frigid air than would dark feathers.

In addition to the insulation provided by feathers and fur, large size and short appendages are adaptations that reduce heat loss and resist cold. Since small animals have more surface area relative to their weight than large animals, they lose heat more quickly. Musk oxen are one of the largest mammals found in the arctic. An average-sized adult bull may weigh 340 kilograms (750 pounds). Their relatively short legs and inconspicuous tails minimize heat loss. Only a small patch between the musk oxen's nostrils and lips is hairless. The rest of the body, including the head and ears, are all densely haired. In addition to the animal's long, course, guard hairs is an exceptionally effective insulating layer of the finest wool grown by any mammal. Below -40 c (-40 F), musk oxen lie with their backs or sides to the wind and choose sheltered valleys or slopes during storms. Slow movements conserve energy in winter and reduce the likelihood of overheating during the brief but warm temperatures of summer.

Here are some other interesting animal adaptations in the arctic:

**Caribou**
Caribou are generally associated with arctic tundra, mountain tundra and northern forests. The species has been a distinctive part of Alaska for thousands of years. Approximately 500,000 wild caribou exist in Alaska in about 25 more or less distinct herds. They are large, stout members of the deer family. Caribou have developed large, concave hoofs that spread widely to support the animals in deep snow and soft tundra and function well as paddles when they swim.

**Brown Bear**
Brown bears occur throughout much of Alaska. "Brown" and "grizzly" bears are now classified as the same species. In winter when food is unavailable or scarce, most Alaska brown bears enter dens and sleep through winter. In northern Alaska where the winters are long and harsh, brown bears may spend as much as 6 to 7 months asleep in their dens.

**Polar Bear**
Polar bears and brown bears evolved from a common ancestor and are closely related.
However, polar bears spend much of their life on the sea ice. Their white coats are made up of water repellent guard hairs combined with a dense underfur that covers to the bottom of their feet. Polar bears have short, thickly furred snouts and ears that minimize heat loss to the environment. They also have extremely sensitive noses. Polar bears can smell a seal up to 20 miles away or under three feet of ice.

**Moose**
Moose are the largest member of the deer family in the world, and the Alaska race is the largest of all the moose. Moose are long-legged and thick-bodied, adaptations that enable them to move about through deep snow and wet lands and to carry sufficient fat stores. Their thick, hollow hair is fatter at the tip than at the base. The shape helps trap an efficient insulating layer of air next to their bodies.

**Wolf**
Wolves inhabit approximately 85 percent of Alaska's 586,000 square-miles. They are extremely adaptable animals and exist in a wide variety of habitats extending from the rain forests of the southeastern Panhandle to the arctic tundra along the Beaufort Sea. In northern Alaska, the wolf is dependent on migratory caribou. Though wolf packs tend to remain within a home range of 200 to 600 square miles, they will abandon their range and travel longer distances if necessary to follow the migrating herds.

**Wolverine**
Wolverines, relatives of the mink and weasel, are common residents of mainland Alaska. Wolverines have tremendous physical endurance. They may travel up to 40 miles each day in search of food, a necessity for an animal that does not hibernate. Despite their size (an adult male averages about 14.5 kg or 32 pounds), wolverines are capable of bringing down some of Alaska's largest hoofed mammals. Reports of wolverine predation on caribou and reindeer are fairly common.

**Red Fox**
Red foxes, members of the dog family, are the subject of many stories, songs and fables. The red foxes' reputation for cunning and intelligence is probably due to their well-developed senses of sight, smell and hearing. When the red foxes' home range overlaps with that of the arctic fox in northern Alaska, the red fox is dominant. Red foxes have been observed digging white (arctic) foxes from their dens and killing them. Red foxes cache excess food when hunting is good and can be seen digging up and reburying their stores, apparently seeking reassurance that the food is still there.

**Arctic Fox**
Arctic foxes are found in the treeless coastal areas of Alaska from the Aleutian Islands north to Point Barrow. Arctic foxes molt twice each year with the changing of the
seasons. The white foxes begin to shed their long winter fur in early April and by late June, the face, legs and upper parts of the body are covered with short, brown summer fur. The change to winter’s camouflage begins in September and by October or November, the luxurious white winter coat is complete.

Lynx
Lynx, shy and unobtrusive animals, are the only cats native to Alaska. Lynx inhabit much of Alaska’s forested terrain and use a variety of habitats including spruce and hardwood forests and both subalpine and successional shrub communities. Lynx reproduction is highly influenced by small game populations. When prey are abundant, a high percentage of female lynx produce kittens. When prey is scarce, the number of adults that breed declines and few offspring are produced.

Snowshoe Hare
Snowshoe hares are the most common and widespread of the two hare species found in Alaska. Unlike rabbits, hares are born fully furred with eyes open and can walk by the time their fur is dry. Populations of snowshoe hares are subject to cycles of high abundance and scarcity. In times of great numbers, they may compete with larger animals such as moose for forage. The hare’s summer coat of yellowish to grayish brown is replaced by white pelage in winter.
Arctic Adaptations

1. What is the physical, physiological, and behavioral traits that help an organism to survive called?

2. How do tundra bumble bees prevent heat loss?
   a. 
   b. 

3. What allows certain tundra plants to resist cold and wind?

4. What purpose do the dead leaves of some tundra plants serve?

5. How does the Alaska blackfish overcome freezing problems?

6. True/False The Alaska blackfish can survive complete freezing of some body parts, including their head, for several days.

7. How does the ptarmigan keep its feet warm?

8. What color are the ptarmigan’s feathers in winter? In summer?
   a. 
   b. 
9. List two ways the musk ox minimizes heat loss.
   a. 
   b. 

10. What is the musk ox’s insulating layer made of?

11. How does the musk ox’s slow movement help?
   a. 
   b. 

12. How do the caribou’s large, concave hoofs help them survive?
   a. 
   b. 

13. How long do brown bears hibernate?

14. What is the polar bear’s white coat made of?

15. How far away can a polar bear smell a seal?
   a. 
   b. 

16. How does the shape of the moose’s hair help insulate it?
17. How often do Arctic foxes molt during the year?

18. When do white foxes shed their fur and what color is their fur?
   a. 
   b. 

19. What does the snowshoe hare replace its summer coat with in the winter?
Arctic Adaptations Key

1. What is the physical, physiological, and behavioral traits that help an organism to survive called?

Adaptations

2. How do tundra bumble bees prevent heat loss?

   a. Developed a dense hair on their bodies

   b. Shiver their flight muscles

3. What allows certain tundra plants to resist cold and wind?

Furry and waxlike coatings

4. What purpose do the dead leaves of some tundra plants serve?

Insulate fragile new buds from wind and cold

5. How does the Alaska blackfish overcome freezing problems?

Produces chemicals that lowers the freezing temperature of cell fluids.

6. True/False The Alaska blackfish can survive complete freezing of some body parts, including their head, for several days.

7. How does the ptarmigan keep its feet warm?

Cover them with a feathery coat and thick down, a “snowshoe” effect.

8. What color is the ptarmigan’s feathers in winter? In summer?

   a. white

   b. brown

9. List two ways the musk ox minimizes heat loss.
a. Relatively short legs

b. Inconspicuous tail

10. What the musk ox’s insulating layer made of?

A layer of the finest wool grown by any mammal.

11. How does the musk ox’s slow movement help?

a. Conserves energy in winter

b. reduces the likelihood of overheating during the summer

12. How do the caribou’s large, concave hoofs help them survive?

a. Supports them in the deep snow and soft tundra

b. Function as paddles when they swim.

13. How long do brown bears hibernate?

6 to 7 months

14. What is the polar bear’s white coat made of?

Water repellent guard hairs

15. How far away can a polar bear smell a seal?

a. 20 miles

b. Under three feet of ice

16. How does the shape of the moose’s hair help insulate it?

It traps a layer of air next to their bodies.

17. How often do Arctic foxes molt during the year?
18. When do white foxes shed their fur and what color is their fur?
   a. Early April
   b. Brown

19. What does the snowshoe hare replace its summer coat with in the winter?

White pelage