

Science of Sled Dogs

National Park Service
U.S. Department of the Interior
Denali National Park and Preserve



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Welcome



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Welcome to the “Science of Sled Dogs” Electronic Field Trip! This slideshow will introduce you to the Denali Sled Dog Kennels and the science behind the dogs. As you go through this slideshow, **write down any questions that you may have.** These may be the beginning of questions that you can ask directly to a park ranger as part of your Electronic Field Trip. Your teacher will provide you with more detailed directions. If you come across any words you are not familiar with, please look them up in a dictionary or online, ask your teacher, or ask us. Let’s go!



Teamwork



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Denali National Park Rangers are stewards of a very special place that belongs to you. They protect and preserve over six million acres of wild lands in Alaska. A few of us park rangers are very lucky because we are also stewards for a very special part of the park – the Denali sled dogs.

Park Rangers take good care of the park's sled dogs so that they can continue to help us take care of the park.

Sled dogs and rangers are a team that works together to preserve and protect this special place. Because we are so reliant on them and because we work so closely with them on a daily basis, sled dogs are a great study topic for us to understand life in the subarctic. Let's start with an introduction to who these sled dogs are and what they do.



Kennels



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The sled dog kennels is located near the work offices of Denali's park rangers. There are 33 dogs currently at the kennels, but the numbers fluctuate as puppies are born and dogs retire. Every day park rangers must be at the kennels to feed and water the dogs as well as give them attention from humans.

The primary purpose of these dogs since 1922 has been to provide transportation in a park where mechanized vehicles are mostly prohibited.



Winter Job



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Denali's kennel began in the 1920s in the first few years of the park's history. Then, dog teams patrolled the boundaries helping the rangers prevent poachers from illegally killing wildlife.

Today, during the winter, the sled dogs continue to work hard providing a variety of services. Their work has focused on transporting construction materials to restore and repair historic ranger patrol cabins throughout the park, removing litter from the Toklat river area after several floods have scattered old bridge and construction debris, and assisting park scientists with delivering scientific monitoring equipment to a remote site.

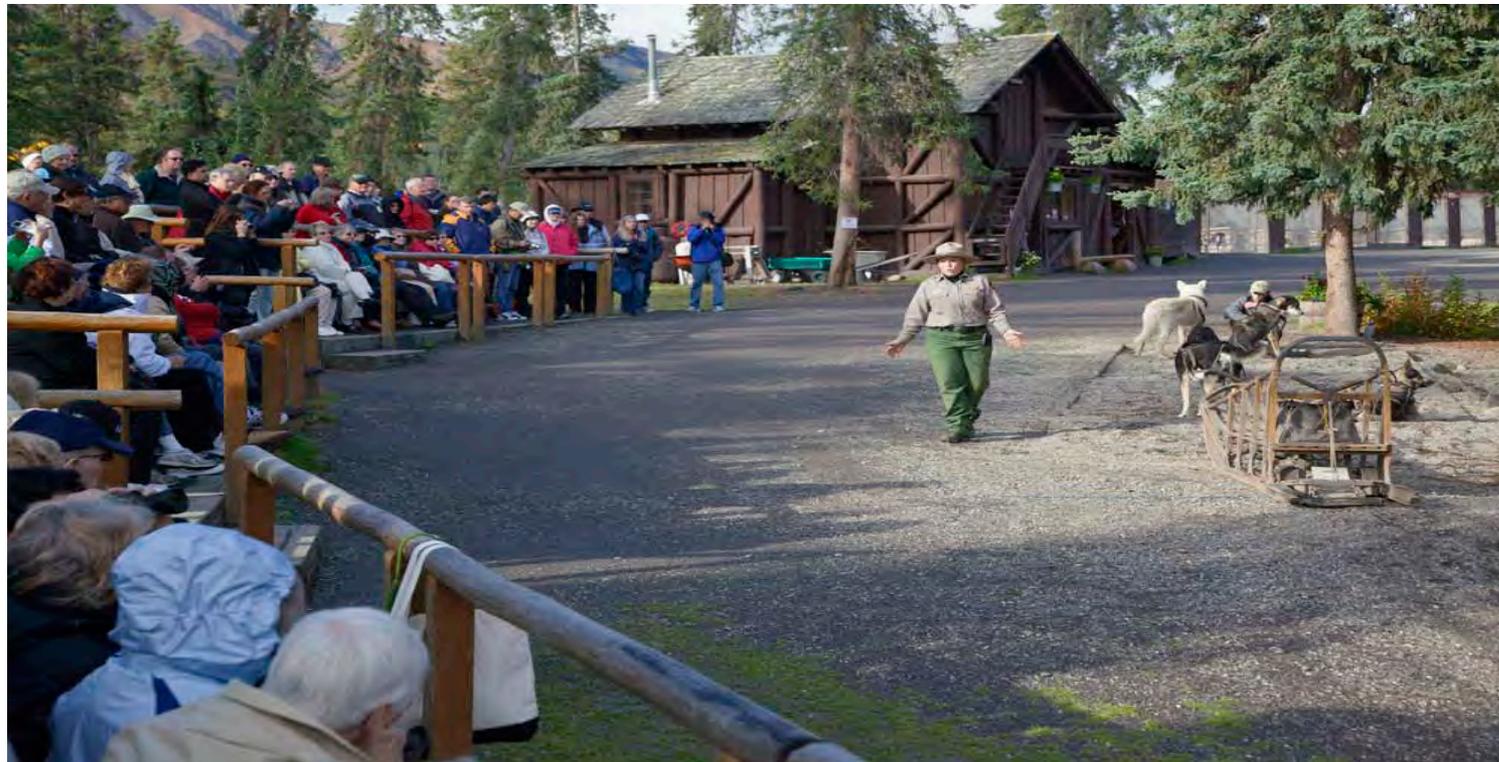


Summer Job



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In the summer, sled dogs help visitors learn about the wilderness of Denali, and what it is like to live and work in the extreme conditions of an Alaskan winter. Park visitors can meet the dogs and attend *dog demonstrations* at the historic kennels, led by Park Rangers and a select team of dogs. Ask your teacher to help you locate more information on the park website about these kennels and meet the dogs who call the kennel home.



Adapt



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Sled dogs are not wild animals, but they are not house pets either. We need to study and understand the biology of sled dogs in order to give them the care they need.

Adaptations are physical characteristics or behaviors that help an organism, or living thing, survive in its environment. Today, let's explore five ways that sled dogs have adapted to live and work in the bitterly cold winters of Denali.

We'll start with:

1. a look at a dog's *tongue*
2. then move to its *feet*,
3. next, its whole body, *fur*
4. and then internally we'll look at the blood flow, *circulation*
5. and end with the back part of its body, the *tail*.



Adaptation 1: Tongues



Respiratory Adaptation: Tongues

When you're working hard even at cold temperatures, it can be difficult to stay cool, especially if you're a dog wearing a fur coat! Humans sweat to cool down when they overheat, but dogs only sweat through their paws. **Dogs get rid of excess heat by panting.**



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Tongues



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Cold air is inhaled through the mouth (and nose), then warmed up in the lungs. The warm air is then exhaled. As the air is exhaled over the dog's wet tongue, the water evaporates cooling down the tongue, losing excess heat in the process. The more heat a dog needs to lose, the faster it will pant.



Adaptation 2: Feet



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Climate Adaptation: Feet

Another adaptation that sled dogs share with wolves is the **special kind of fat in their toe pads.**

There are two different kinds of fats. Saturated fats, like butter, stay solid at cool temperatures. Unsaturated fats, like olive oil, are liquid at cool temperatures.

For example: the unsaturated fat in the bodies of coldwater fish, like salmon, stays liquid allowing them to swim in colder waters without stiffening up.



Feet



Sled dogs have a special **blend** of saturated and unsaturated fats in their paw that stays liquid at lower temperatures than the rest of the fat in their body. Combined with the tough skin covering their toe pads, this special fat prevents freezing and frostbite.

Imagine what it would be like to walk barefoot at temperatures below zero. Do we have this adaptation?

We have fats in our fingers and toes that get solid at cold temperatures. Think about how hard it is to move your fingers when they are cold, they get stiff because the fats are not liquid.



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Adaptation 3: Fur



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Climate Adaptation: Fur

All mammals have hair. Some mammals, like sled dogs, have thick coats made of two different kinds of hair to keep them warm in cold climates.

In the early days of the park horses were kept as working animals. Like sled dogs, horses also have two kinds of hair, but their coats are thinner so they are less suited to working in the extreme cold of winter.

Because of their thick coats, sled dogs are better adapted than other pack animals to work at Denali National Park.



Fur



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There are two kinds of hair that make up a sled dog's coat: *underfur* and *guard hair*.

Guard Hair

Guard hair forms the longer, coarser outer layer of a dog's coat. This is the part of the coat that we mostly see when we look at a dog. It is also the part that contains pigment which gives the fur its color. Guard hairs repel, or shed, water to keep the dog dry.



Guard Hairs perform the same job as the rain jacket that we wear.

Fur



Underfur

Underfur is the dense soft fur underneath the guard fur. While this layer is also water repellent, it also provides insulation to keep the dog warm. This furry insulation prevents heat loss by trapping the dog's inner warmth and keeping it from contact with the cold air outside.

Underfur is like the warm fleece jacket we wear *underneath* a rain jacket.



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Fur



A third type of fur adaptation is the toe pad fur. Most dogs have little or no fur on their paws, so sticky snow builds up on their feet and forms large, icy, uncomfortable clumps. This is called “snowballing.”

Sled dogs share some adaptations from their wolf relatives such as the stiff bristly fur between their toe pads. This fur is a type of guard hair that helps insulate the feet, provides traction, and prevents snowballing because snow and water cannot easily stick to it. When dogs run for a long time, any snow that sticks to their feet will attract more snow. This can become a painful problem for the dog, like having a rock in your shoe!



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Adaptation 4: Blood Flow



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Circulatory adaptation: Blood Flow

Fingers and toes get colder than our stomach because blood stays warm deep inside your body core, but when it gets pumped out to the extremities (arms and legs) it cools quickly. Sled dogs, (like many animals that live in cold regions, such as caribou, arctic fox, wolves, and birds), have a specially-adapted system of blood vessels called countercurrent circulation. This system helps dogs conserve heat carried by blood. Heat travels from the warm blood inside the arteries to the cooler blood in the veins surrounding them.



As a result, the cool blood returning from the feet gets reheated to lukewarm before it gets back to the body core. This heat exchange can save sled dogs a lot of energy!

Blood Flow



In animals with **countercurrent circulation**, (unlike us), the blood going to the toes and back is much colder than the blood in the body core.

A caribou's legs are 30 degrees colder than its body core, and some birds have leg blood that is more than 60 degrees colder than their bodies!

Dogs have cold legs and feet too, but a sled dog's feet are adapted to operate at cold temperatures.

The tough pads and special fats of a sled dog's paw keep the temperature of the pads one or two degrees above freezing during winter.



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Blood Flow



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A sled dog saves energy by keeping warm blood in the head and body core and sending cold blood everywhere else.

Countercurrent circulation lets sled dogs use their energy pulling a sled instead of trying to stay warm.

When a sled dog is working hard and needs to lose excess heat, this system shuts itself off...that's some fancy plumbing!



Adaptation 5: Tails



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Sled dogs have bushy tails. In the summer the tail's main job is to wag, but in the winter it plays a more important role.

On winter patrol, the dogs sleep outside on the snow. They curl up, tucking their noses and feet under their bushy tails.

When dogs breathe out, the warm air is trapped by their furry tails warming the air they breathe in. The scarves we wear around our noses and mouths in winter do the same thing...

...so a dog's tail is like a built-in scarf!



Tails



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Animals also stay warm by limiting the exposure of their body to the cold.

By curling up into a ball in the cold of winter, a sled dog *prevents heat loss* by exposing less of its body surface to the cold temperatures.



Discover



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Denali's sled dogs represent one animal through which we can learn about science at this national park. However, they are not the only animals here that teach science. The wild animals, plants, mountains and glaciers teach us too.

I hope Denali's sled dogs have peaked your curiosity that you discover more about the science and nature of our national parks.



Ask



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If you are participating in the 2011 Electronic Field Trip, we look forward to hearing your questions.



The sled dogs of Denali eagerly await a special visit from you. Stop on by!

Info



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For more information
murislc.org or nps.gov/dena

