

# The Science of Sled Dogs: Denali National Park and Preserve Teacher Guide



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## National Science Education Standards/Framework

### LS3.A Inheritance of Traits

*How are the characteristics of one generation related to the previous generation?*

### LS3.B: Variation of Traits

*How do individuals of the same species vary in how they look, function, and behave?*

### LS4.C: Adaptations

*How does the environment influence populations of organisms over multiple generations?*

#### Lesson Overview

Denali sled dogs are specially adapted to survive and thrive in the subarctic. They are not wild animals, but they are not house pets either. Sled dogs and rangers are a team that works together. Students explore adaptations that make Denali's sled dogs well-suited to living and working in subarctic winter conditions. Students learn about specific traits that make a sled dog suited to Denali and to particular jobs on a team, and then they choose their own team from the park's kennel.

**Lesson Objectives:** Students will be able to:

1. Identify four positions on a sled dog team and list traits and tasks important to each and apply this knowledge to choose a dog team.
2. Define adaptation.
3. Identify and describe the function of at least four different adaptations that make sled dogs suited to winter work in Denali

## BACKGROUND INFORMATION FOR THE TEACHER

### The History of Sled Dogs in Denali National Park and Preserve

#### Stewards of a Special Place

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 select park rangers are very lucky because they 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 these rangers are so reliant on the dogs and work so closely with them on a daily basis, sled dogs are a great study topic to understand life in the subarctic.

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.

#### The Job of a Sled Dog

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.

In the summer, sled dogs help visitors learn about the wilderness of Denali, and what it is like to live and work in 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.

#### Adaptations of Sled Dogs

Sled dogs are not wild animals, but they are not house pets either. Adaptations are physical characteristics or behaviors that help an organism, or living thing, survive in its environment. There are five major ways that sled dogs have adapted to live and work in the bitterly cold winters of Denali. During the live lesson with the park ranger, she will discuss these adaptations in depth. We will look at the dog's tongue, feet, fur, circulation, and tail.

- **Tongue:** Dogs get rid of excess heat by panting. Cold air is inhaled through the mouth and nose, and 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.
- **Feet:** Sled dogs have a special kind of fats in their toe pads. Saturated fats, like butter, stay solid in cold temperatures. Unsaturated fats, like olive oil, are liquid at cool temperatures. The special blends of fats in a sled dog's paws stay liquid at colder temperatures than the

rest of the fats in their body. Combined with the tough skin covering their toe pads, this special fat prevents freezing and frostbite.

- **Fur:** Sled dogs have two coats of fur that make them adapt to Denali weather better than other pack animals. The guard hair is the outer layer that we mostly see. It repels water to help keep the dog dry. The underfur provides insulation and prevents heat loss.
- **Circulation:** Sled dogs have countercurrent circulation that helps dogs conserve heat carried by blood. Heat travels from warm blood inside the arteries to the cooler 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 saves the sled dog a lot of energy.
- **Tails:** Sled dogs have big, bushy tails. On winter patrol, the dogs sleep outside on the snow. They curl up, tucking their noses and feet under their bushy tails. When the dogs breathe out, the warm air is trapped by their furry tails warming the air they breathe in.

## BEFORE DISTANCE-LEARNING PROGRAM

**Time:** 50-60 minutes (depending on what parts are assigned as homework)

### Materials

#### For each student

- 1 Copy of *Denali's Sled Dogs* reading
- 1 Copy of *Build a Denali Dog Team* sheet

#### For the class

- 1 10 foot string/rope (optional)
- Pre-lesson Powerpoint (online)
- *Winter Patrol* (DVD) or online video (5 minutes)
- Colored pencils, pencils
- Computer setup for viewing DVD/online clip and for Skype conference session
- Internet access for students to “meet” the sled dogs on this web page
- [www.nps.gov/dena/planyourvisit/meet-the-sled-dogs.htm](http://www.nps.gov/dena/planyourvisit/meet-the-sled-dogs.htm)

### Getting Ready

1. **Check your computer setup.** This is a good time to make sure your computer setup is functioning optimally for showing the online clip from the *Winter Patrol* video or using the DVD to show the video. You also want to make sure that the Skype application is functional. Check with the Murie Science and Learning Center videoconference liaison if you have any questions and to perform a pre-conference connection.
2. **Consider student reading.** Students are asked to read a short background about Denali National Park and Preserve. Decide whether you want them to read this as homework, in class individually, or together as a class.
3. **Plan to submit class questions.** The last step in the pre-conference activities is to have students collectively identify three questions they want to ask the park rangers at the end of the Skype session. You should submit these questions to the Murie staff at the [contact e-mail](#) provided, at least 24 hours in advance of the Skype session.

### Procedure

1. **Introduce the lesson.** Tell students that they are going to have the opportunity to meet some park rangers from Denali National Park and Preserve in an online video conference in a few days. Tell students that Denali National Park is located in Alaska. Much of the park is designated wilderness, and during the winter months, no motorized vehicles are permitted in these wilderness areas.
2. **Describe preparation for the video conference.** Explain that the rangers will help them learn more about Denali, but they need to prepare for the conference beforehand by finding out a bit more about Denali, about how sled dogs are used in the park, and by learning what it's like to live and work in a subarctic climate.
3. **Introduce and show the video.** Tell students sled dogs teams have been used in Alaska for many, many years. Denali National Park and Preserve is a designated wilderness, where no motorized vehicles are permitted. Sled dogs are the best means of transportation in the winter months to transport materials and researchers into the wilderness. Explain that you have a short

video that describes Denali and the use of sled dogs. Before starting the video, ask students to identify three new and interesting things they learned about sled dogs while watching the video. Show the video.

4. **Discuss the video.** Ask students to take a few moments in groups of three or four to discuss the three things they learned about Denali from the video. Then have a group leader report what their group came up with. You might want to keep a list of their notes on some chart paper.
5. **Positions on a Sled Dog team.** Explain to students that today they are going to learn about four different positions on a sled dog team, the jobs performed in each, and the traits that make a dog work well in each position. Let them know they will be using this knowledge to make their own sled dog teams by choosing dogs from Denali's kennel. Use the "*DL Pre-Lesson Powerpoint*" OR sketch a diagram of the lines on the board or project the diagram found in the background information. Identify the **gang line**, **tug line**, **neck line**, and **harness** and write the names on the board. Have students label the three lines on their worksheets.
6. **Student demonstration.** Identify the four team positions (lead dog, swing dog, team dogs, and wheel dogs). Using a 10-foot rope or piece of string to simulate a gang line, call on students to come up to stand in the position along the gang line. Ask students to say the name of their position and you write them on the board or in the circles on the powerpoint. Send students back to their seats, and have them label the four team positions on their worksheets. Discuss how each position on a dog team has certain responsibilities (just like on a football or basketball team). Use the "Dog team positions" section of the background information and the "Teachers' edition" of the worksheet to discuss the particular traits and tasks important for each position on the dog team. List the specific traits and tasks for each position on the board and have students record the information on their worksheets.
7. **Review the student reading.** If you have assigned the reading as homework, spend a few minutes reviewing what students have learned. Or, you can read the assignment in class, individually or as a class, concluding with a discussion of the information in the reading.
8. **Consider questions to ask rangers.** Tell students that they will have a chance to ask the rangers questions at the end of the Skype session. Tell them that the rangers have asked their class to come up with three questions that the class finds particularly interesting. They would like to see the class questions before beginning the Skype session so they have time to come up with the best answers. Explain that, if there is time at the end of the Skype session, they will be able to ask more questions. If they run out of time, the rangers will provide an e-mail address where students can submit further questions about Denali. Their questions need not be just about the geology and landforms of Denali, but should be serious and appropriate questions.
9. **Identify the three questions.** You may want to have each small group come up with a question to share with the class, have individuals come up with questions, or have a brainstorming session with the entire class. Hopefully you will come to agreement on three questions to ask the park rangers. Remind the students that they will have further opportunities to get their questions answered after the Skype session. They may even come up with further questions after participating in the Skype session.

## DURING THE DISTANCE LEARNING PROGRAM

**Time: 45-50 minutes**

### **Materials needed during the program with the rangers:**

#### **For the class**

- Adaptations matching card game (one card for each student)
- TWO Fleece jackets
- Two Rain Jackets
- Paper Towels (one per every 3-4 students)
- Cups/containers of water (one per every 3-4 students)

#### **Getting Ready**

1. **Consider student volunteers.** For one activity during the Skype session, three students will be needed to put on the jackets in front of the class. Keep this mind as the Skype session proceeds and be ready to identify the selected students.
2. **Establish Skype connection.** Make sure your Skype connection is up and running before beginning the session with the Denali park rangers.

#### **Procedure**

1. **Orient your students.** Before signing on to Skype with the Denali rangers, show students the set-up and go over any standards of behavior students should follow during the session. Remind them that the rangers may not be able to see everyone in the classroom, so they should look to you as an intermediary, if necessary, when they want to make a comment or ask a question.
2. **Connect with Denali.** At the designated time, use Skype to connect with the rangers. The program may last between 45-60 minutes, depending on student input and questions.
3. **Let the communication begin!** Please be available to the rangers during the entire length of the program.
4. **At the end of the program.** Take some time at the end of the program for students to discuss and provide feedback about their experience. Tell them that if they have further questions for the Denali rangers, they can contact them at [DENA\\_education@nps.gov](mailto:DENA_education@nps.gov).

**Vocabulary:**

- Adaptation: a way an animal's body changes over time to allow it to live in its environment.
- Countercurrent circulation: blood flow that allows the arteries to heat the blood in the veins returning to the heart keeping the inner core warm.
- Evaporation: to convert or change into vapor.
- Gang line: completed line consisting of the tug line and neck line.
- Guard hair: long, outer layer of hair that sheds water.
- Harness: device around the dog that connects it to the neck line and tug line.
- Metabolism: processes in an organism by which its material substance is produced, maintained, and destroyed, and by which energy is made available.
- Neck line: holds the dog close to the gang line to prevent falling out and turning around.
- Saturated fats: type of fat that is a solid at freezing temperatures.
- Snowballing: the build up of ice and snow that gets between a dog's toe pads.
- Subarctic climate: characterized by long, unusually cold winters, and short, mild summers.
- Tug line: attached to the harness and transfers the pulling power straight back onto the main line.
- Underfur: layer of fur under the guard hair, serves as the insulation.
- Unsaturated fats: type of fat that is in a liquid state at freezing temperatures.
- Wilderness: an area where the earth and community of life are untrammelled by man, where man himself is a visitor who does not remain.

## Extensions

The following are a few extension activities you may want to use with your students after the Skype session.

- **Help another Animal Adapt:** Think about the adaptations students learned about in the distance learning lesson and how these adaptations helped the sled dogs thrive in their environment. The students will choose (or be assigned) an animal and make it adapt to a given environment (i.e. desert, forest, jungle, coastline, ocean, etc). The animal must have at least three adaptations.
- **Writing/Reflection:** Students will watch the “Cabin Life Tour” video. After the video, the students will write a summary of what they thought, and how life in the cabin is both similar and different from where they live.
- **Behavior, Form, or Function:** During the distance learning lesson with the ranger, the students learned about several types of adaptations. Have students decide if each adaptation (fur, tail, paws, circulation, tongue, desire to pull, metabolism, curling into a ball, ability to avoid danger) was a Behavior (the way something acts), Form (the way something is built), or Function (the way something works).
- **Do more Denali research:** Provide the following resource list for your students and encourage them to find a topic of interest to prepare a report, poster, PowerPoint, or some other type of presentation to share with the rest of the class.
- **Iditarod:** Denali’s sled dogs are bred especially for hauling freight and patrolling, thus they are larger and may not be as fast as a typical racing sled dog. Have students read about the Iditarod (link below) and decide what the difference is between these two type of dogs.

## Resources

### Web:

#### Denali Puppies Webcam

<http://www.nps.gov/dena/photosmultimedia/webcams-pups.htm>

#### Meet the Sled Dogs

<http://www.nps.gov/dena/planyourvisit/meet-the-sled-dogs.htm>

#### Kennels Photo Gallery

<http://www.nps.gov/dena/planyourvisit/kennels-gallery.htm>

#### NPS Web Rangers

<http://www.webrangers.us/>

#### Life of a Sled Dog

<http://www.nps.gov/dena/planyourvisit/life-of-a-sled-dog.htm>

#### Alaska Dog Musher's Association

<http://www.sleddog.org/>

#### Iditarod Race

<http://iditarod.com/>

### Print Resources:

***D is for Dog Team: Alaska Acrostics from A-Z***, by Ken Waldman. 2009. Nomadic Press, Anchorage, AK. ISBN-10: 978-0-9816758-1-7.

***Dog Sled Wisdom***, by Tricia Brown, illustrations by Tom Nixon. 2006. Epicenter Press, Kenmore, WA. ISBN: 0-9745014-5-X.

***Running with the Big Dogs: A Sled Dog Puppy Grows Up in Denali National Park***, by Lori Yanuchi, illustrated by Wendy Brown. 1998. Ridge Rock Press, Healy, AK. ISBN: 0-9670177-0-X.

***Sled Dogs of Denali National Park***, by Karen Fortier. 2002. Alaska natural History Association, Anchorage, AK. ISBN: 0-930931-37-8.

