



The Science of Sled Dogs

Adaptations to the Subarctic

Teacher Guide



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Science of Sled Dogs

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 work together as a team to preserve and protect Denali's vast wilderness. In this program, students explore adaptations that make Denali's sled dogs well-suited to living and working in subarctic winter conditions. Students learn about the traits that make a sled dog suited to Denali and to particular jobs on a team, and then they build their own team from the park's kennel.

Lesson Objectives

Students will be able to:

1. Define adaptation.
2. Name and describe at least four different adaptations that make sled dogs suited to work in a subarctic environment.
3. List four positions on a sled dog team.

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?

Suggested Lesson Progression:

Before Distance Learning Program

- 60-75 minutes: student reading, online video, pre-activity, and questions.

During Distance Learning Program

- 50-60 minutes: Skype session

After Distance Learning Program

- 30-45 minutes: post-activity

Background Information

Please read the Denali Sled Dogs - Student Reading for background information on the history and purpose of sled dogs in Denali. The following adaptations will be described to your students during the session. This information is not included in the student packet so that the education staff can teach about them while following canine ranger Chinook on a trip through Denali. Information on sled dog traits can be found in Appendix A.

Adaptations of Sled Dogs

Adaptations are physical characteristics or behaviors that help an organism, or living thing, survive in its environment. Sled dogs have many adaptations that allow them to live and work in the bitterly cold winters of Denali, four of which are described below. During the Skype session the education staff will discuss these and other adaptations.

- **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, water on the tongue evaporates, cooling down the tongue and mouth. The more heat a dog needs to lose, the faster it will pant.
- **Fur:** Sled dogs have two coats of fur that help them stay warm in Denali's winter weather. 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. All dogs have both types of fur, but sled dogs develop extra thick and dense underfur and long, coarse guard hair.
- **Circulation:** Dogs have a special adaptation in their paws that helps them retain heat even when they're walking on snow and ice. They don't have fur on the bottoms of their toe pads, so how do their feet stay warm? Scientists investigated this by studying the arteries and veins in dog paws. They discovered that veins closely surround the arteries that deliver warm blood from a dog's heart to its toes. The veins are so close to the arteries in dog paws that heat is exchanged between the warm arteries and cold veins. 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 system, called countercurrent circulation, saves sled dogs a lot of energy.
- **Tails:** Sled dogs have extra 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: 60-75 minutes (depending on what parts are assigned as homework)

Materials

For each student

- [Copy of Denali Sled Dogs - Student Reading](#)

For the class

- 10 foot string/rope (optional)
- Copy of Positions on a Sled Dog Team – Teacher Key (Appendix A)
- Copy of Sled Dog Position Name Tags – (Appendix B)
- *Winter Patrol* (DVD) or [online video \(5 minutes\)](#)
- Computer setup for viewing DVD/online clip and for Skype conference session

Getting Ready

1. **Check 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 a Denali Education Specialist if you have any questions and to perform a pre-conference connection.
2. **Student reading.** Students are asked to read a short background about Denali National Park and Preserve's sled dogs, if you would like to assign this as homework. Decide whether you want them to read this as homework, in class individually, or together as a class.
3. **Submit class questions.** Have students collectively identify three questions they want to ask the education staff at the end of the Skype session. Please submit these questions after completing the learning activities below, to the Education Team at DNA_education@NPS.gov at least 24 hours in advance of the Skype session.

Procedure

1. **Introduce Denali.** Tell students that they are going to have the opportunity to meet the education staff in an online Skype session. 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. Tell students sled dogs teams have been used for winter transportation in Alaska for many years. Explain that the rangers will help them learn more about Denali, but they need to prepare for the conference by finding out a bit more about Denali, how sled dogs are used in the park, and what it's like to live and work in a subarctic climate.
2. **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.

3. **On-line video/DVD.** 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 on-line video/DVD.** 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 or dry board.
5. **Pre-Activity: Positions on a Sled Dog Team.** During the pre-activity students learn about the positions on a sled dog team, the jobs performed in each, and the traits that make a dog work well in each position (just like on a football or basketball team). Use the Positions on a Sled Dog Team – Teacher Key for background information on each position. Identify the four team positions: lead dog, swing dogs, team dogs, and wheel dogs. Using a 10-foot rope or string, call on students to come up and stand in the dog team positions. Place the correct Sled Dog Position Name Tags around student necks as they come up to join the team. After you discuss the positions and traits of each position, let the team take a spin around the room!
6. **Identify three questions to ask the rangers.** Tell the students that the rangers have asked their class to come up with three questions that the class finds particularly interesting. You may want to brainstorm these questions in small groups, individually, or as a class. Tell students that they will have a chance to ask the education staff these questions at the end of the Skype session. Explain that the students can submit further questions about Denali to the Education Team at DENA_education@nps.gov.

During the Distance Learning Program

Time: 50 - 60 minutes

Materials

For the class

- Adaptations Matching Game Activity Cards (Appendix C; one cut-out card per student)
- Two sweatshirts, sweaters or fleeces (not waterproof)
- Two waterproof jackets
- Paper towels (one per every 3-4 students)
- Cups/containers of water (one per every 3-4 students)

Getting Ready

1. **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 in 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 education staff.

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 education staff 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 education staff. The program may last 50-60 minutes, depending on student input and questions.
3. **Let the communication begin!** Please be available to the education staff during the entire length of the program. At the end of the program be ready to help facilitate questions.
4. **After the program.** Take some time after the program for students to discuss and provide feedback about their experience. Tell them that if they have further questions for the education staff, they can contact them at DNA_education@nps.gov.

After the Distance Learning Program

Post-activity

Time: 30-45 minutes

Materials

For each student

- [Copy of Denali Sled Dogs Post-activity: Build a Denali Sled Dog Team – Student Worksheet](#)

For the class

- [Internet access for students to “meet” the Denali sled dogs on the web page](#)
- Scissors
- Glue

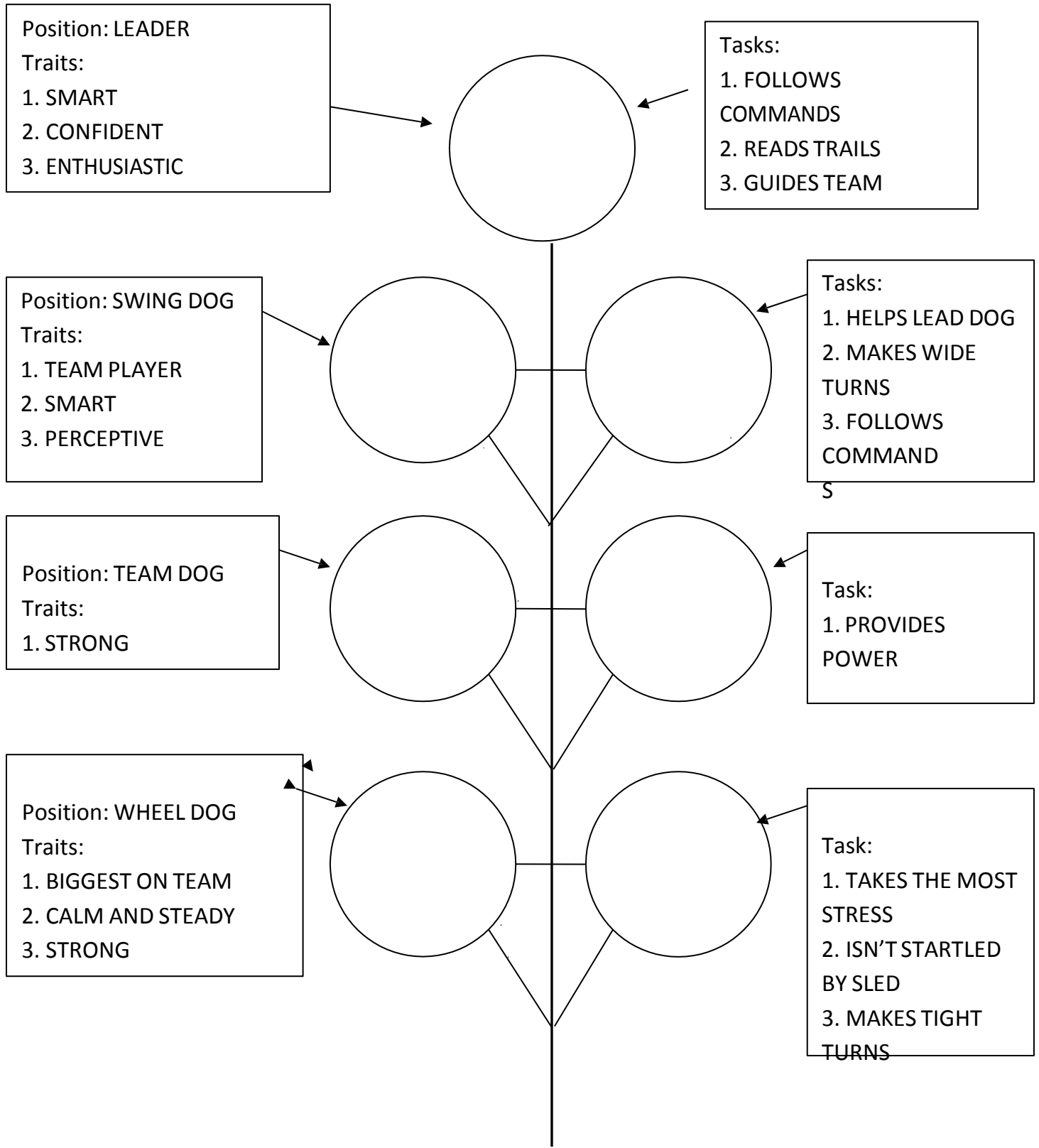
Build a Denali Dog Team: Have students create their very own Denali sled dog team. Pass out the Post-activity: Build a Denali Sled Dog Team – Student Worksheets. Have students choose dogs for their teams based on the trait descriptions. After choosing, they need to cut the dogs’ pictures out and glue them into the correct circle on their Post-activity: Positions on a Sled Dog Team – Student Worksheet.

Extensions

- **Help another animal adapt:** Discuss the adaptations students learned about in the distance learning lesson and how these adaptations helped the sled dogs thrive in their environment. Have your students choose (or assign them) 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.
- **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 on next page) and decide what the difference is between these two types of dogs.

Science of Sled Dogs – Appendix A

Pre/Post activity: Positions on a Sled Dog Team – Teacher Key



Science of Sled Dogs – Appendix B

Pre-activity: Sled Dog Position Name Tags

Lead Dog

Swing Dog

Team Dog

Wheel Dog

Science of Sled Dogs – Appendix C

During Skype Session: Adaptations Matching Game Activity Cards

Cut sheet along the black lines. Each student receives one cut-out card. There are 18 total cards, so you may need to print two copies if you have additional students. It's okay for two students to have the same card.

GUARD HAIR	REPELS WATER TO KEEP THE DOG DRY
UNDERFUR	PROVIDES INSULATION TO KEEP THE DOG WARM
TOUGH PAWS	PROTECT AGAINST CUTS AND SCRAPES
SPECIAL FAT IN THE TOE PADS	PREVENTS PAWS FROM FREEZING AND FROSTBITE
BRISTLY FUR BETWEEN TOE PADS	PREVENTS SNOWBALLING ON PAWS
COUNTERCURRENT CIRCULATION	CONSERVES HEAT CARRIED IN THE BLOOD
BUSHY TAIL	WARMS THE NOSE AND THE AIR A DOG BREATHES IN
CURLING UP INTO A BALL	PREVENTS HEAT LOSS BY EXPOSING LESS OF THE BODY TO COLD TEMPERATURES
PANTING	COOLS DOWN A HARD-WORKING DOG