

# TEACHERS GUIDE

## TO “FANTASTIC FUR”

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in *Minnesota Conservation Volunteer*, January-February 2022, [www.mndnr.gov/mcvmagazine](http://www.mndnr.gov/mcvmagazine).

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*Minnesota Conservation Volunteer* magazine tells stories that connect readers to wild things and wild places. Subjects include earth science, wildlife biology, botany, forestry, ecology, natural and cultural history, state parks, and outdoor life.

**Education has been a priority** for this magazine since its beginning in 1940. “One word—Education—sums up our objective,” wrote the editors in the first issue. Thanks to the MCV Charbonneau Education Fund, every public library and school in Minnesota receives a subscription. Please tell other educators about this resource.

**Every issue now features** a Young Naturalists story and an online Teachers Guide. As an educator, you may download Young Naturalists stories and reproduce or modify the Teachers Guide. The [student portion of the guide](#) includes vocabulary cards, study questions, and other materials.

**Readers’ contributions** keep *Minnesota Conservation Volunteer* alive. The magazine is entirely financially supported by its readers.

**Find every issue online.** Each story and issue is available in a searchable PDF format. Visit [www.mndnr.gov/mcvmagazine](http://www.mndnr.gov/mcvmagazine) and click on *past issues*.

**Thank you** for bringing Young Naturalists into your classroom!

## “FANTASTIC FUR”

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in *Minnesota Conservation Volunteer*, March–April 2020, [www.mndnr.gov/mcvmagazine](http://www.mndnr.gov/mcvmagazine).

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**SUMMARY.** Fur provides mammals with a variety of benefits. It protects their skin, provides insulation, offers protective coloration, and lots more. This Young Naturalists feature story describes what hair is and the various benefits it offers. It also looks at the ancient hair and ways in which people use hair to inspire innovation.

**SUGGESTED READING LEVELS.** Third through middle school grades

**MATERIALS.** KWL organizer; optional resources include dictionaries, video viewing equipment, Internet access and other print and online resources your media specialist may provide.

**PREPARATION TIME.** 15–30 minutes, not including time for extension activities.

**ESTIMATED INSTRUCTION TIME.** 30–60 minutes, not including extension activities.

**MINNESOTA ACADEMIC STANDARDS APPLICATIONS.** “Fantastic Fur” activities described below may be used to support some or all of the following Minnesota Department of Education standards for students in grades 3–8:

**SCIENCE (\*CODING IS BASED ON THE 2019 COMMISSIONER APPROVED DRAFT OF MN ACADEMIC STANDARDS IN SCIENCE)**

**SCIENCE AND ENGINEERING PRACTICES**

1. Asking questions and defining problems
2. Developing and using models.

- 3.Planning and carrying out investigations.
  - 4. Analyzing and interpreting data
  - 7. Engaging in argument from evidence
  - 8. Obtaining, evaluating, and communicating information
- Crosscutting Concepts
- 5. Energy and matter
  - 6. Structure and function)

### **DISCIPLINARY CORE IDEAS**

Physical Sciences 1: Matter and its interactions; 3: Energy

Life Sciences 1: From molecules to organisms: Structures and processes; 2: Ecosystems:

Interactions, energy, and dynamics; 3: Heredity: Inheritance and variation of traits; 4:

Biological Evolution: Unity and diversity

Earth and Space Sciences 3: Earth and human activity

### **SOCIAL STUDIES**

Citizenship and Government (Benchmark 6.1.5.10.1)

History (Benchmark 6.4.4.16.1)

Geography (Benchmark 6.3.4.10.1)

### **MATH (GRADES 2-4)**

Data Analysis (3.4.1.1, 4.4.1.1, 5.4.1.2, 6.3.3.1)

### **ENGLISH LANGUAGE ARTS (GRADES 3-8)**

Reading Benchmarks: Informational Text

Key Ideas and Details (Benchmarks 3.2.1.1, 3.2.2.2, 4.2.1.1, 4.2.2.2, 5.2.1.1, 5.2.2.2, 6.5.1.1, 7.5.1.1, 8.5.1.1)

Craft and Structure (Benchmarks 3.2.4.4, 4.2.4.4., 5.2.4.4; 6.5.4.4, 7.5.4.4, 8.5.4.4)

Integration of Knowledge and Ideas (Benchmarks 3.2.7.7, 4.2.7.7, 4.2.8.8, 5.2.7.7, 5.2.9.9, 6.5.7.7)

### **WRITING BENCHMARKS (GRADES 3-8)**

(Grades 3-8)

Research to Build and Present Knowledge (Benchmarks 3.6.7.7, 4.6.7.7, 5.6.7.7, 6.7.7.7, 7.7.7.7, 8.7.7.7)

### **SPEAKING, VIEWING, LISTENING AND MEDIA LITERACY (Grades 3-8)**

Comprehension and Collaboration Benchmarks 3.8.1.1, 4.8.1.1, 5.8.1.1, 6.9.1.1, 7.9.1.1, 8.9.1.1)

### **LANGUAGE BENCHMARKS GRADES 3-8)**

Vocabulary Acquisition and Use (3.10.4.4, 4.10.4.4, 5.10.4.4, 6.11.4.4, 7.11.4.4, 8.11.4.4, 6.11.6.6, 7.11.6.6, 8.11.6.6)

**READING BENCHMARKS** Literacy in Science and Tecchnical Subjects (Grades 6-8)

Key Ideas and Details (Benchmarks 6.13.1.1, 6.13.2.2)

Integration of Knowledge and Ideas (6.13.8.8)

## WRITING BENCHMARKS: LITERACY IN SCIENCE AND TECHNICAL SUBJECTS (GRADES 6-8)

Research to Build and Present Knowledge (Benchmark 6.14.7.7)

For current, complete Minnesota Academic Standards, see [www.education.state.mn.us](http://www.education.state.mn.us). Teachers who find other connections to standards may contact *Minnesota Conservation Volunteer*.

**PREVIEW.** Ask your students what they know about fur. Give them a chance to share their ideas about animals that have fur and words that describe fur. Then divide them into small groups to do a [KWL activity](#). Within the groups, have students describe what they know (K) about fur and what they wonder (W) about fur. Give each student a copy of the organizer (see [www.teach-nology.com/web\\_tools/graphic\\_org/kwl](http://www.teach-nology.com/web_tools/graphic_org/kwl)) and encourage each to make notes during the group discussion. As you read and discuss the article you can compile a list of what they learn (L) while reading the article and related materials and participating in extension activities.

**VOCABULARY PREVIEW.** You can find a copy-ready vocabulary list at the end of this guide. Feel free to modify it to fit your needs. Share the words with you students and invite them to guess what they think they mean. Tell them you will be reading a story that will help them understand these words so they can use them in the future! As your students encounter these vocabulary words in the story, you may want to encourage them to infer meaning using context clues, such as other words in the sentence or the story's illustrations. Students also could be encouraged to compare their inferences as to what the words mean with their earlier guesses and with the definitions from the vocabulary list.

**STUDY QUESTIONS OVERVIEW.** Preview the study questions with your class before you read the article. Then read the story aloud. Complete the study questions in class, in small groups, or as an independent activity, or use them as a quiz.

**ADAPTATIONS.** Read aloud to special needs students. Abbreviate the study questions or focus on items appropriate for the students. Adapt or provide assistance with extension activities as circumstances allow.

**ASSESSMENT.** You may use all or part of the study guide, combined with vocabulary, as a quiz. Other assessment ideas include: (1) Ask students to describe what they learned about red-winged blackbirds. See the “learned” list from your KWL activity. (2) Have students write multiple-choice, true-false, or short-answer questions based on the article. Select the best items for a class quiz. (3) Have students create posters, podcasts, or videos to share their new knowledge with others.

**EXTENSION ACTIVITIES.** Extensions are intended for individual students, small groups,

or your entire class. Young Naturalists articles provide teachers many opportunities to make connections to related topics, to allow students to follow particular interests, or to focus on specific academic standards.

1. Fur helps keep mammals warm in winter or in water by trapping their body heat close to their body. Investigate the concept of insulation. What characteristics of fur make it good for insulation? What role does the air trapped in between hairs play? What does this tell us about how we might design clothing, buildings, etc., to better trap heat? Younger students could be asked to construct an explanation using evidence from multiple sources for how fur helps mammals survive. Older students could design and conduct an investigation stemming from questions that have arisen from the article and their discussion (for example: Do some types of fur trap heat better than others? Which is a better insulator, feathers or fur? Does layering (and order of layers) affect insulation? Does size of mammal affect insulation? Is snow a good insulator?). The lesson “How Warm is My Fur?” from [“Furs of Alaska Mammals: A Teacher’s Guide”](#) provides ideas for simple experiments investigating the insulating properties of different furs and other materials by wrapping them around warm potatoes and measuring and graphing temperature changes over time.

2. Explore the role fur played in the history of Minnesota. How did furbearing animals affect when, how, and where Europeans and their descendants explored and settled Minnesota? How did they affect Europeans’ interactions with Indigenous people? How was the use of fur by European settlers different from the use by Indigenous peoples? Older students could be asked to use multiple information sources to explore how European and Indigenous people have made, and currently make, decisions about how to use and manage natural resources.

3. Should animals be killed for their fur? Does it matter if they are wild or domestic animals? This topic could be used toward supporting students in learning to respectfully and productively discuss and disagree, using the following [approach by author and educator Brittany Collins](#). Initially, use a “story circle” for sharing opinions. This is a space for differing opinions to coexist in a nonjudgmental way, where students take turns sharing perspectives that might be grounded in anecdotes, experiences, beliefs, etc. During the sharing, students are reminded to listen and ask clarifying questions, but not yet debate. Students then are asked to retell or restate another student’s point of view (either as a group or in pairs as “story partners”) as if it were their own, which can build careful listening and empathy. Next, hold a mock debate, where students argue in support of a viewpoint with which they disagree. The debate could include conducting research, preparing an argument and rebuttal, and debriefing. Finally, ask students to think about where there were similarities across the arguments and what themes united them. Prompt students to think about how differences strengthen communities—

whether classrooms or communities more broadly.

4. The article tells us that both hair and porcupine quills are made from a molecule called keratin. Take a deep dive into this ubiquitous substance. What exactly is it? What kinds of animals make it? What kinds of animal parts are made of keratin? What traits does keratin have that make it perform its functions well? Do any plants make keratin? Students could be asked to develop a model to represent their understanding of keratin within the context they investigated.

5. The story mentions humans have about 100,000 hairs on their heads. The diagram on page 48 shows the three layers of a piece of hair that collectively create a very strong hair fiber. Invite students to design and conduct an investigation into how strong a strand of their hair is (by, for example, how much weight it holds before breaking). Does hair texture and/or color influence the strength of hair? Ask students to make a hypothesis and then carry out an experiment to test their hypothesis. Students could also be asked to investigate if human hair is stronger than the hair of an animal such as a dog. After conducting their experiments, have students speculate about and then obtain information regarding how different traits of hair affect their ability to help an animal survive.

6. Does the fur of snowshoe hares and weasels literally turn from brown to white as winter approaches, and back again in springtime? Or do they shed the old fur and grow new twice a year? Put on your detective hats and find out! This exploration offers a great opportunity to learn about how animals use daylength and hormones to prepare for the change of seasons, rather than waiting for weather to change.

7. Did you know that no two species of mammals have the exact same hair structure? Each has its own characteristic microscopic hair structure patterns. This comes in useful for biologists as they identify prey species from hair remnants in scat, owl pellets, and other feeding caches. This also comes in handy when museums are trying to verify things that might be in their collections to ensure authenticity of artifacts. Wildlife forensic specialists also use unique hair structure patterns to identify species in their work to solve wildlife-related crimes involving the exotic pet trade, poaching, and even oil spills. Encourage students to learn more about what a wildlife forensic specialist does. If possible, invite one to your classroom or to talk with students virtually to share more about what they do and how they became one.

## WEB RESOURCES

MINNESOTA DNR

[Trapping and Furbearers](#)

## GENERAL TEACHER AND STUDENT RESOURCES

[Minnesota DNR Teachers' Resources](#)

[DNR Kids Page](#)

## RELATED MCV ARTICLES

[The Nature of Feathers](#)

[Color by Nature](#)

## STUDY QUESTIONS ANSWER KEY

1. Name three benefits fur provides. **Answers may vary, but might include warmth, protection from bites, camouflage, and ability to sense surroundings.**
2. Match the hair parts with the function:  
**Guard hairs – give the animal color, protect from injury due to rubbing, shed water**  
**Underhairs – insulate, keep skin dry**  
**Cortex – holds pigments and moisture**  
**Sebaceous glands – secrete oil**  
**Nerves – send signals from the hairs to the brain**
3. What part of a hair gives it color?
  - a. medulla
  - b. cortex**
  - c. cuticle
4. Name three ways a deer's winter hair is different from its summer hair. **It is longer, it is hollow, it is filled with air.**
5. What kinds of hair helps a mammal sense objects around them? **whiskers**
6. The ability to trap air in fur is called **entrapment**.
7. How does a beaver benefit by trapping air in its fur? **The air helps insulate the animal because it doesn't conduct heat as well as water does.**
8. True or false: Mammals use hair to sense food in the ocean. **True**
9. **Spots** and **barring** help cats sneak up on their prey by providing camouflage in habitats with lots of different colors and textures.
10. True or false: Sea otters are native to Minnesota. **False – they live in oceans.**
11. Which has longer whiskers: wild dogs or wild cats? **Wild cats**

12. How do mammals use piloerection?

- a. To signal aggression
- b. To trap air near their skin
- c. To sense objects around them
- d. All of the above
- e. **a & b**

CHALLENGE: On the time line below, mark the approximate time for each of these events:

A. The age of the oldest known mammal fossils (**200**)

B. The period during which small, furry mammals became abundant (**141–65**)

C. When *Spinolestes xenarthrosus* was alive (**125**)

\_\_\_\_\_ x \_\_\_\_\_ x \_\_\_\_\_ x \_\_\_\_\_  
200 million years ago      100 million years ago      Today

### **MINNESOTA COMPREHENSIVE ASSESSMENTS ANSWER KEY.**

1 What is the difference between hair and fur? **Fur is a subcategory of hair. It is hair that is densely packed together.**

2. Name one thing besides hair that makes mammals different from other animals. **They produce milk for their young.**

3. Name three ways the story tells us that the color of fur helps an animal survive. **1. It provides camouflage. 2. It distracts a predator. 3. It warns predators of trouble.**

4. Why did MIT scientists make fake fur?

- a. They were trying to design more waterproof clothing
- b. They wanted to understand how air entrainment works
- c. They were trying to design warmer clothing
- d. **b and c**
- e. All of the above

5. The article tells us that Native Americans valued bison for their dense underfur. Why do you think did they consider this valuable? **The article implies but does not state that it helped people stay warm, too. Answers may vary; accept any that include the concept of retaining heat.**

Place the following in order of shortest to longest:

- 1. American pygmy shrew hair**
- 2. Sea otter undercoat fur**



3. Sea otter guard hairs
4. American bison underfur
5. American pygmy shrew fur
6. American bison fur

### VOCABULARY LIST

**abrasions** – wear caused by rubbing densities – closeness

**follicle** – a tiny depression in the skin frigid – extremely cold

**groom** – care for a body

**pigments** – molecules that give an object color

**keratin** – a protein that gives body parts structure and strength

**meticulously** – very carefully

**plunged** – moved rapidly into

**tissue** – a group of cells in or on a body

**velvet** – a soft fabric made of short, densely packed fibers sticking out from a backing.

**vital** – very important

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