Young Naturalists

Teachers Guide

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"The Nature of Feathers" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "The Nature of Feathers," by Val Cunningham. Published in the January–February 2004 *Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/feathers.

Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. Each teachers guide contains a brief summary of the article, suggested independent reading levels, word count, materials list, estimates of preparation and instructional time, academic standards applications, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources, including related Young Naturalists articles available on the Conservation Volunteer *Web site, copy-ready study questions with answer key, and a copy-ready vocabulary sheet. Users are encouraged to provide feedback through an online survey at www.dnr.state.mn.us/education/teachers/activities/ynstudyguides/survey.html.*

Summary

Through text and illustrations, "The Nature of Feathers" offers a detailed description of the structure of birds' feathers, how feathers are formed, types and functions of six different feathers, how feathers are colored, and how birds replace and care for their feathers. Captions that accompany the illustrations add interesting facts about unique features of specific species. A self-quiz helps students test their newfound knowledge.

Suggested reading levels: Upper elementary through middle school

Total words: 2,200

Materials: Paper, pencils, pens, resources from your media center, feathers from domesticated birds or game birds (it is illegal to possess feathers from birds protected by the International Migratory Bird Treaty, which includes virtually all nongame wild birds in Minnesota)

Preparation time: About one hour

Estimated instructional time: Two 50-minute class periods (not including extensions)

Minnesota Academic Standards applications: "The Nature of Feathers" may be applied to the following Minnesota Department of Education Academic Standards:

Language Arts
- I. Reading and Literature
  - A. Word Recognition, Analysis and Fluency
  - B. Vocabulary Expansion
  - C. Comprehension
- II. Writing
  - A. Types of Writing
  - B. Elements of Composition
  - C. Spelling, Grammar and Usage
  - D. Research
  - E. Handwriting and Word Processing
- III. Speaking, Listening and Viewing
  - A. Speaking and Listening
  - C. Media Literacy

Mathematics
- I. Mathematical Reasoning
- II. Number Sense, Computation and Operations
  - B. Computation and Operation

Social Studies: Some connections may be made to economics standards. For example, a study could be made of the effects on bird populations of the use of feathers for fashions, or of the collection of tropical species for the pet market. (See Extension activity 4.)

Science

Grade 4
- IV. Life Science
  - B. Diversity of Organisms

Grade 5
- IV. Life Science
  - E. Biological Populations Change Over Time

Grade 7
- IV. Life Science
  - B. Diversity of Organisms
  - E. Biological Populations Change Over Time

Arts
- Artistic Creativity and Performance
- Visual Arts

Complete Academic Standards are available at www.education.state.mn.us. Teachers who find other connections to academic standards are encouraged to contact *Minnesota Conservation Volunteer.*

Preview

You may wish to begin with a **KWL** (Ogle, 1986) activity about birds or feathers. In **KWL** the **K** stands for students' prior **knowledge.** Take a few minutes to brainstorm facts about birds and/or feathers. Write the facts on the board, a transparency, or poster board. The **W** represents **what** the students would like to learn about the subject. Repeat the brainstorming and recording steps as for **K.** The **L** list is built as you read and study. It stands for what the class **learns** about birds' feathers. Try to record answers to **W** questions as they are discovered. You may also add questions to the **W** list as you read the article.

This article contains a large number of biology terms. Terms that are not defined in the article are listed on a transparency-ready vocabulary sheet at the end of this guide. You may decide to preview that list as well as other terms your students might struggle with. However, spending too much time previewing or giving a long list of vocabulary words will intimidate many readers and dampen their interest in the article (Allen, 1995).

Study questions overview

Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). This is an important organizational tool for students and should be emphasized *before* you begin working on the questions. *Preview the questions with your class before you read the article.* You might wish to read the story aloud and complete the questions in class or in small groups. The questions may be assigned as homework, depending on the reading ability of your students. Inclusion teachers may provide more direct support to special needs students (see Adaptations section, below). The study questions may also be used as a quiz. (Note: Items 2, 5, 6, 12, and 14 require analytical thinking.)

Adaptations

Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first. If time allows, remaining items may be attempted. For example, items 1–6 and 13–16 will give students the basic concepts. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. With close teacher supervision, cooperative groups can also offer effective support to special needs students, especially for extension activities.

Assessment

You may use all or part of the study questions, combined with vocabulary, as a quiz. Other assessment ideas: (1) Ask students to sketch and label the parts of a feather. (2) Students may, while displaying a feather, explain how barbs can be separated and reattached through the mechanism of the barbules (barbicels). (3) Students may summarize the salient points of the article in a three- to five-paragraph paper.

Extension activities

1. See the first "Fun Feather Fact" on page 52. A ruby-throated hummingbird weighs 3 to 3.3 grams and a trumpeter swan weighs 9.5 to 13.6 kilograms. Can your students determine the ratio of unit of body weight to number of feathers? Which bird has more feathers per gram of body weight? What do the numbers tell you about each bird's feathers?
2. With help from your media specialist and the Internet, students can research specific bird species and make drawings of the birds in adult and juvenile stages, of males and females, of seasonal plumage changes, and of different feather types for that species. This activity will make an excellent poster project with or without an oral presentation. Details pertaining to what makes the species unique can be a focal point for the project.
3. Plumage color offers another interesting research direction. Why are some species so brilliantly colored and others not? Is plumage color related to behavior?
4. Feathers have long occupied a prominent place in commerce. Students will be amazed at the variety of products made from feathers (see Web resources below). Some species of birds have been threatened because their feathers have been highly prized. A historical research project on "Feathers in Fashion" might catch the interest of some students.
5. Feathers also offer an opportunity for cross-cultural studies. Students can access several Web sites on feathers in Native American culture using "eagle feathers" as a search phrase.

Web resources

Hummingbirds
www.hummingbirdworld.com
www.hummingbirdsociety.org
Trumpeter swans
www.nps.gov/yell/nature/animals/birds/trumpeter.htm.
DNR Nongame Wildlife Program
www.dnr.state.mn.us/ecological_services/nongame
About feathers (with links)
www.geocities.com/SoHo/Bistro/6741/Birds.htm

See also online resources listed at the end of the article.

Many related *Conservation Volunteer* articles are available online at www.dnr.state.mn.us/volunteer/articles. Some more recent articles about birds include:

September–October 2004
"Flights of Fall"
www.dnr.state.mn.us/volunteer/septoct04/flights.html

March–April 2004

"Magnificent Journey" Two stories follow the trail of the whooping crane's return to Minnesota: "Solo Sojourn" and "Whooping Revival"
www.dnr.state.mn.us/volunteer/marapr04/cranes.html

"Rookery Blues"
www.dnr.state.mn.us/volunteer/marapr04/rookery.html

November–December 2003

"Land Use: A Bird's-Eye View"
www.dnr.state.mn.us/volunteer/novdec03/birdseyeview.html

March–April 2003

"Till the Birds Come Home"
www.dnr.state.mn.us/volunteer/marapr03/birds.html

"Let's Go Birding"
www.dnr.state.mn.us/young_naturalists/birding

"Return of the Osprey"
www.dnr.state.mn.us/volunteer/marapr03/osprey.html

January–February 2003

"Flying to Freedom"
www.dnr.state.mn.us/volunteer/janfeb03/falconry.html

References

Allen, Janet. 1995. "It's Never Too Late: Leading Adolescents to Lifelong Literacy." Portsmouth, N.H.: Heinemann.

Ogle, D.S. K-W-L Group Instructional Strategy. In A.S. Palincsar, D.S. Ogle, B.F. Jones, and E.G. Carr (Eds.), Teaching Reading as Thinking (Teleconference Resource Guide, pp.11–17). Alexandria, Va.: Association for Supervision and Curriculum Development, 1986.

Study Questions

"The Nature of Feathers," by Val Cunningham
Minnesota Conservation Volunteer, January–February 2004
www.dnr.state.mn.us/young_naturalists/feathers

Name_____Period_____Date_____

1. What are two ways feathers help make birds some of the most successful animals on Earth?

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_____

_____

2. Which other families of animals have feathers? Why are feathers important? _____

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3. Describe the three basic parts of feathers. _____

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4. What parts of a feather are like a zipper? How? _____

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5. Why is it important for feathers to overlap? _____

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6. Each feather is controlled by a tiny muscle. Why? _____

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7. There are six types of feathers. Pick three, describe them, and explain their function.

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8. What is special about the flight feathers of geese? _____

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9. What is the difference between pigment and structural colors? _____

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10. Why are cardinals red, and blue jays blue? _____

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11. Explain how hummingbirds change color. _____

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12. Why do birds appear different to each other than they do to us? _____

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13. Describe the process of molting. _____

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14. Why is important that young birds are not as colorful as their parents? _____

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15. Why are male birds often more colorful than females? _____

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16. Birds spend a lot time preening (grooming). Why? _____

_____

_____

Study Questions Answer Key

"The Nature of Feathers," by Val Cunningham
Minnesota Conservation Volunteer, January–February 2004
www.dnr.state.mn.us/young_naturalists/feathers

1. What are two ways feathers help make birds some of the most successful animals on Earth? **1. They help birds stand extreme heat or cold better. 2. If the weather gets too bad, birds can use their feathers to fly away.**
2. Which other families of animals have feathers? Why are feathers important? **None. Birds are the only animals with feathers. Feathers allow birds to fly and to keep warm.**
3. Describe the three basic parts of feathers. **1. The central shaft is a strong tube that runs up the middle of the feather. 2. The quill is the bottom of the central shaft, the part that is attached to the skin. 3. The barbs are the soft branches attached to both sides of the central shaft.**
4. What parts of a feather are like a zipper? How? **Barbicels. They can hook and unhook the way a zipper works when it is zipped and unzipped.**
5. Why is it important for feathers to overlap? **So no skin is exposed. (Exposed skin loses heat.)**
6. Each feather is controlled by a tiny muscle. Why? **Birds must adjust wing feathers to control flight. (Students may add that birds fluff their feathers to trap air for warmth.)**
7. There are six types of feathers. Pick three, describe them, and explain their function. **The six are: contour (body, wing, and tail feathers that give the bird its shape and allow it to fly); down (soft feathers under contour feathers with no barbules), semiplume (similar to down; help to insulate); filoplume (scattered over the bird's body; small, delicate feathers that help the bird adjust contour feathers); bristle (stiff feathers near eyes and nose to keep dust or insects out); and powder down (fragile feathers that break apart to form a fine dust that helps keep the bird clean).**
8. What is special about the flight feathers of geese? **They are much stronger than other birds' feathers, with special barbs that do not separate in strong winds.**
9. What is the difference between pigment and structural colors? **Pigments are substances in feathers that absorb and reflect light, resulting in colors from yellow to black. When different parts of feathers reflect light the blues or greens we see are not true colors. That's why some birds appear to change color from shade to sunlight.**
10. Why are cardinals red, and blue jays blue? **Cardinals get their red color from the seeds they eat, which contain the pigment carotenoid. Blue jays' blue color comes from sunlight reflected off bubblelike cells in their feathers.**
11. Explain how hummingbirds change color. **Hummingbirds have bubblelike cells in their feathers that reflect iridescent colors.**
12. Why do some birds appear different to each other than they do to us? **Because they have ultraviolet markings and can see ultraviolet light. (We can't.)**
13. Describe the process of molting. **Old feathers fall out and new ones grow. Most species lose a few feathers at a time, so they can still fly, but others, such as ducks and geese, lose all their flight feathers at once, so for a time they can't fly.**
14. Why is important that young birds are not as colorful as their parents? **Their color blends in with their surroundings, protecting them from predators.**
15. Why are male birds often more colorful than females? **To attract mates and to warn other males away.**
16. Birds spend a lot time preening (grooming). Why? **To keep their feathers in good condition.**

Minnesota Comprehensive Assessments Practice Items

"The Nature of Feathers," by Val Cunningham
Minnesota Conservation Volunteer, January–February 2004
www.dnr.state.mn.us/young_naturalists/feathers

Name _____Period _____Date_____

1. What characteristic sets birds apart from all other organisms?
   A. They can fly.
   B. They have feathers.
   C. They walk on two feet.
   D. They do not have teeth.

2. It is important that birds have the ability to move each feather independently so that
   A. no skin will be exposed.
   B. wing feathers can be positioned for turns or to slow down.
   C. dirt or dust can be removed.
   D. water will be repelled.

3. _____, _____, and _____ are examples of different types of feathers.
   A. Barb, follicle, bristle
   B. Follicle, contour, filoplume
   C. Down, powder down, contour
   D. Sheath, powder down, filoplume

4. A blue jay's blue feathers are an example of
   A. structural coloration.
   B. pigmentation.
   C. albinism.
   D. water coloration.

5. Preening is behavior birds engage in to
   A. find food.
   B. build nests.
   C. find a mate and care for young.
   D. care for their feathers.

Minnesota Comprehensive Assessments Practice Items Answer Key

"The Nature of Feathers," by Val Cunningham
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www.dnr.state.mn.us/young_naturalists/feathers

1. What characteristic sets birds apart from all other organisms? **B. They have feathers.**
2. It is important that birds have the ability to move each feather independently so that **B. wing feathers can be positioned for turns or to slow down.**
3. **C. Down, powder down**, and **contour** are examples of different types of feathers.
4. A blue jay's blue feathers are an example of **A. structural coloration.**
5. Preening is behavior birds engage in to **D. care for their feathers.**

Vocabulary

"The Nature of Feathers," by Val Cunningham.
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www.dnr.state.mn.us/young_naturalists/feathers

bacteria	tiny organisms that may cause disease in other organisms
camouflage	concealment by blending in with the surroundings
contour	outline of a figure
fragile	easily broken
fungi	a group of organisms that includes mushrooms, yeasts, and molds
iridescent	appearing to change color or have multiple colors
parasite	an animal that grows and feeds on another animal without contributing to the host animal's survival
pigment	a substance that produces color
predator	an animal that eats (preys on) other animals
primary	first in importance
secondary	not primary
ultraviolet light	light waves that are invisible to humans but visible to some other animals