Minnesota Conservation Volunteer

Young Naturalists

Teachers Guide

Prepared by Cindy VanBrunt, Professional Education Department, Bemidji State University

"Color On, Color Off" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "Color On, Color Off," by Susan Kaneko Binkley. Published in the November–December 2001 *Minnesota Conservation Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/coloroncoloroff.


Young Naturalists

By SUSAN KANEKO BINKLEY

COLOR ON, COLOR OFF

THERE'S MORE TO ALBINISM THAN MEETS THE EYE.

Without thinking about it, we use color to recognize things in nature. A male cardinal is red. A deer turns a bright rust color in summer. A gray squirrel is, well, gray. That is, unless they have a rare condition called *albinism*. Albino animals are astonishingly all white, sometimes partly white. And their eyes are deep pink or icy blue.

Maybe you've seen a white squirrel in the wild or a white rabbit or mouse in a pet store. They stand out among other animals with normal color, especially the ones that blend into their surroundings. Though they are very different on the outside, they differ only in small ways on the inside.

Their striking appearance has always made people wonder about albino animals. Some people believed albinos had special powers and worshiped them; others believed they were spooky and feared them.

Today we know that the real wonder and mystery of albinism lies in the complex function of pigment, the coloring matter found in certain cells of living organisms. Pigment is controlled by genes, inherited from an animal's mother and father.

ALBINO SQUIRREL BY DOMINIQUE BRAUD, SUBMITTED PHOTO (CONTACT).

28 Minnesota Conservation Volunteer November–December 2001 29

Young Naturalists teachers guides are provided free of charge to teachers, parents, and students. Each guide contains a brief summary of the article, suggested independent reading levels, word count, materials list, estimates of preparation and instructional time, academic standards application, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources, vocabulary knowledge rating chart, reaction chart 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. ***Note: This guide is intended for use with the PDF version of this article.***

Summary

"Color On, Color Off" introduces students to the concept, nature, and causes of albinism. It includes an explanation of why some animals are albino and others are not. It also explores the survival challenges albino animals face in their natural environments.

Suggested reading levels: Upper-elementary through high school

Total words: 1,230

Materials: Copy of vocabulary knowledge rating chart for each student; copy of reaction guide for each student; additional materials for extension activities.

Preparation time: About one hour, not including extension activities

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

Minnesota Academic Standards applications: "Color On, Color Off" 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

III. Speaking, Listening and Viewing
- A. Speaking and Listening
- B. Media Literacy

Math

III. Patterns, Functions and Algebra
- A. Patterns and Functions

IV. Data Analysis, Statistics and Probability
- B. Probability

Science

I. History and Nature of Science
- A. Scientific World View

III. Life Science
- B. Diversity of Organisms

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

Begin your preview with a survey of the article. Ask your students to skim the article. Have them note how it is organized. Alert them to the essential ideas and information they are about to read by discussing questions about albinism. Some suggestions:

- What do you think "Color On, Color Off" means?
- What experiences can you share about albino animals?
- Are albinos exactly the same as other animals except for their color?
- Do albino animals behave the same as normal animals?
- Do all animal species have albino members?
- What do you think causes albinism?
- Why do only a small percentage of animals display characteristics of albinism?
- How do you think other animals react to an albino?

- What challenges do albino animals encounter when living in their natural environments?

A copy-ready vocabulary knowledge rating chart is provided. You may want to use this to prepare students to read by reminding them of what they already know, getting them ready to link their knowledge to new information, helping them acquire a firm understanding of most of the vocabulary used in the article, and building student interest in the article before they read it.

Vocabulary exercise

Give each student a copy of the vocabulary knowledge rating chart. For each word, have students check whether they "Know it well," have "Heard of it," or are "Clueless" about its meaning. For words they know well or have heard of, have them jot down what they think the word means in the "Definition" column. Then work as a class to fill in as many blanks as possible by tapping each other's knowledge.

Now have students read the article and predict from the context the meaning of the words that still lack definitions. Have them jot down their predictions in the definition column. Finally, review all definitions as a class and correct them as needed. (Definitions are provided at the end of this guide.)

Reaction guide

A copy-ready reaction guide is provided. The reaction guide poses questions that are textually explicit (the answers are found in the text) and questions that are textually implicit (the answers are suggested or implied by the text). You can use it to generate discussion about the article and focus on the important issues and concepts learned.

After they've read the article, give each student a copy of the guide. Provide about 15 minutes for students to complete their reaction guides individually, emphasizing that they must be able to support their responses in small-group discussions. Then form small groups. Have each group discuss participants' answers and attempt to arrive at a consensus (If they can't, they should summarize the positions and arguments presented.) One member from each group should present the group findings while group members offer supporting statements.

Adaptations

Read aloud to special needs students. Abbreviate the Reaction guide or highlight priority items to be completed first. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the knowledge-rating chart, reaction guide, and discussion activities. With close teacher supervision, cooperative groups can also offer effective support to special needs students.

Assessment

You may use all or some of the reaction guide questions, combined with vocabulary, as a quiz. Other assessment ideas: (1) Ask students to choose one species of animal and develop a portfolio of researched facts,

artwork, and writing related to albinism in that species. Would albinism be an advantage or a disadvantage or have no effect on the animal's ability to find a mate or protect itself from predators? (2) Have groups complete a Punnett square for a set of two parents. The capital letter "A" represents the dominant form of the albino gene, and the lowercase letter "a" represents the recessive form of the albino gene. AA and AA would be homozygous set of parents (pure dominant). AA and Aa would be one homozygous parent and one heterozygous parent. Aa and Aa would be two heterozygous parents. aa and aa would be two homozygous (pure recessive) parents. What are the chances that the next offspring of each set of parents would be albino? Which offspring would be likely to have albino offspring of their own? (3) Ask students to compare and contrast leucistic and albino traits.

Extension activities

1. Go to www.eduref.org, click the Lesson Plan tab, and search the word *albino* to find a wonderful activity called "Survival of the Mutant Toad." The activity uses white and brown beans to illustrate the importance of camouflage.
2. Go to www.eduref.org, click the Lesson Plan tab, and search the word *taster* to find the activity "Taster or Non-Taster," which shows students patterns of inheritance.
3. For students who want to learn more about heredity, The Biology Project on Mendelian genetics has an interactive Punnett square activity at www.biology.arizona.edu/mendelian_genetics/problem_sets/monohybrid_cross/01t.html.

Web resources

The Gene Scene:
www.ology.amnh.org/genetics
ThinkQuest, Gene School 99:
library.thinkquest.org/28599
Albino animal photographs:
www.geocities.com/issabekov
Albino koala:
cnn.com/US/9806/05/albino.koala

Here's a sample of some of the related *Conservation Volunteer* articles available online at www.dnr.state.mn.us/volunteer/articles:

September–October 2000
"Changing Color"
www.dnr.state.mn.us/young_naturalists/color
March–April 2004
"Special Delivery: Eggs"
www.dnr.state.mn.us/young_naturalists/eggs

Vocabulary Knowledge Rating Chart

"Color On, Color Off," by Susan Kaneko Binkley
Minnesota Conservation Volunteer, November–December 2001
www.dnr.state.mn.us/young_naturalists/coloroncoloroff

Rate your knowledge of albinism.

	Know it well	Heard of it	Clueless	Definition
aberrant				
agouti				
albinism				
camouflage				
enzyme				
eumelanin				
gene				
genetics				
hormone				
leucistic				
melanin				
melanocyte				
melanosomes				
organic				
pheomelanin				
pigment				
protein				
recessive				
trait				
tyrosinase				
variant				
xanthin				

Reaction Guide

"Color On, Color Off," by Susan Kaneko Binkley
Minnesota Conservation Volunteer, November–December 2001
www.dnr.state.mn.us/young_naturalists/coloroncoloroff

Name _____ Period _____ Date _____

1. Read the statements below. If you agree with a statement, check the "Agree" column. If you disagree with a statement, check the "Disagree" column. Be ready to explain your position.

Agree	Disagree	
		1. All albinos are pure white.
		2. The color of an animal's fur is the key albino clue.
		3. Some pure-white animals are not albinos.
		4. Albinism only occurs in mammals.
		5. Albino animals have better protection from the sun's UV rays.
		6. Albino animals have better eyesight than nonalbino animals.
		7. Albino animals have a special enzyme not found in nonalbino animals.
		8. More than 100 genes are known to affect albinism.
		9. An albino animal inherits one recessive gene for albinism from either of its parents.
		10. Hunting albino animals in Minnesota is illegal.

2. Reflect on what you read in the article and your own experiences. Put an X by the statements you agree with. Be able to give examples to support your choices.

_____ A. Nonalbino animals with white coats are not noticed and captured by predators more easily, so albino animals wouldn't be either.

_____ B. Nonalbino animals probably regard albino animals as unique and special by going out of their way to make them feel accepted and valued.

_____ C. Other states should follow the example set by the residents of Olney, Il., and protect and encourage the reproduction of albino animals.

Reaction Guide Answer Key

"Color On, Color Off," by Susan Kaneko Binkley
Minnesota Conservation Volunteer, November–December 2001
www.dnr.state.mn.us/young_naturalists/coloroncoloroff

1. Read the statements below. If you agree with a statement, check the "Agree" column. If you disagree with a statement, check the "Disagree" column. Be ready to explain your position.

1. All albinos are pure white. **False. Not all albinos are pure white, because some traits that control melanin allow forms of the pigment to appear in the fur of the animal.**
2. The color of an animal's fur is the key albino clue. **False. Aberrant eye color is the key albino clue. If an animal's eyes are any color other than pinkish-red or pale blue, it is not albino.**
3. Some pure-white animals are not albinos. **True. White animals, whose eyes are normal in color and function are called leucistic.**
4. Albinism only occurs in mammals. **False. It has been observed in mammals, birds, reptiles, amphibians, fish, mollusks, and insects—just about every species from whales to snails.**
5. Albino animals have better protection from the sun's UV rays. **False. Melanin blocks harmful rays of the sun, while allowing beneficial ones to enter. Albinos are deficient in melanin.**
6. Albino animals have better eyesight than nonalbino animals. **False. Melanin helps develop various parts of the eyes, including the irises, retinas, eye muscles, and optic nerves. The absence of melanin results in disorganized development of eyes and leads to problems with focusing, depth perception, and tracking.**
7. Albino animals have a special enzyme not found in nonalbino animals. **False. Albino animals lack the enzyme tyrosinase. Without it, melanin cannot be made.**
8. More than 100 genes are known to affect albinism. **True. Other hormones and proteins also are key to complete melanin production, and their presence is determined by their own special genes.**
9. An albino animal inherits one recessive gene for albinism from either of his parents. **False. For the recessive albino trait to appear in an animal, the baby animal must inherit a recessive gene from both parents.**
10. Hunting albino animals in Minnesota is illegal. **False. In Minnesota it is *legal* to hunt albino animals except white bears, albino or leucistic.**

2. Reflect on what you read in the article and your own experiences. Put an X by the statements you agree with. Be able to give examples to support your choices.

_____A. Nonalbino animals with white coats are not noticed and captured by predators more easily, so albino animals wouldn't be either.

_____ B. Nonalbino animals probably regard albino animals as unique and special by going out of their way to make them feel accepted and valued.

_____ C. Other states should follow the example set by the residents of Olney, Illinois, and protect and encourage the reproduction of albino animals

Vocabulary

"Color On, Color Off," by Susan Kaneko Binkley
Minnesota Conservation Volunteer, November–December 2001
www.dnr.state.mn.us/young_naturalists/coloroncoloroff

aberrant Different from an accepted norm.

agouti Having multicolored individual hairs.

albinism The condition of lacking natural coloring in the skin, hair, or eyes.

camouflage Coloring or covering that makes something blend into its surroundings.

enzyme An agent that starts and speeds up reactions.

eumelanin Dark brown and black pigment.

gene A part of a cell that is passed from parents to offspring and determines the offspring's physical characteristics.

genetics The study of the ways characteristics are passed from one generation to another through genes.

hormone Chemicals made by the body that affect growth and development.

leucistic White animals whose eyes are normal in color and function.

melanin	The primary pigment that determines the color of a mammal's skin, fur, and eyes.
melanocyte	A specialized cell where melanin is produced.
melanosomes	Clusters of melanin.
organic	To do with or coming from living things.
pheomelanin	Light reddish tan and blond pigments.
pigment	Coloring matter.
protein	A type of molecule found in all living things.
recessive	A trait whose power remains hidden when paired with a stronger trait.
trait	A quality or characteristic that makes one thing different from another.
tyrosinase	An agent that must be present in a melanocyte for melanin to be produced.
variant	Something different from others of the same type.
xanthin	A yellow pigment.