

Teachers Guide

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“The Magic of Morphing” Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalist article “The Magic of Morphing” by Mary Hoff. Published in the March–April 2008 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/morph.

Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This 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 Conservation Volunteer articles), copy-ready study questions with answer key, and a copy-ready vocabulary sheet. There is also a practice quiz in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified to suit user needs. Users are encouraged to provide feedback through an online survey at www.mndnr.gov/education/teachers/activities/ynstudyguides/survey.html.



Summary

“The Magic of Morphing” describes, through text and photographs, how a variety of organisms undergo metamorphosis, a change from one form to another, as they mature. Examples from insect, amphibian, fish, and mollusk phyla help the reader learn why animals undergo metamorphosis; what environmental cues signal successive physical changes; and how dragonflies, moths, frogs, eels, and mussels undergo metamorphosis. Please note that if you are downloading articles from the Web site only the Young Naturalists article is available in PDF. Upper elementary through ninth grade

**Suggested
reading levels:**

fifth grade through high school

“The Magic of Morphing”—Teachers Guide

Total words: 1,532

Materials: Paper, poster board, pencils, pens, markers, print resources from your media center, Web sites

Preparation time: One to two hours, not including time for extension activities

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

Minnesota Academic Standards applications: “The Magic of Morphing” 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
- D. Research
- E. Handwriting and Word Processing

III. Speaking, Listening and Viewing

- A. Speaking and Listening
- B. Media Literacy

Arts: Artistic Expression:

- D. Visual Arts

Science

Grade 5

IV. Life Science

- E. Biological Populations
 - F. Flow of Matter and Energy
- Grades 7, 9–12
- B. Diversity of Organisms
 - C. Interdependence of Life
 - E. Biological Populations
 - Change Over Time
 - F. Flow of Energy and Matter

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*.

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Preview Survey the article. Ask your students to examine the photos. Use the KWL strategy (Ogle, 1986) to find out what your students already know (K) about metamorphosis, what (W) they would like to learn, and eventually, what they learned (L) while reading the article and related materials, and through participating in extension activities. Display your K and W ideas on poster board or paper (see Vocabulary preview). Add to your L list as you read and discuss the article. See www.teach-nology.com/web_tools/graphic_org/kwl for a KWL generator that will produce individual organizers for your students. KWL also gives you the opportunity to introduce interdisciplinary connections you will make during extension activities. For example, if you plan to use the article during science or art you may ask students to review their KWL’s for concepts that are specific to those disciplines.

Vocabulary preview This article includes many challenging terms, making a thorough vocabulary preview essential to your students’ understanding and appreciation of the article. Pay particular attention to italicized words, since they are not included in the vocabulary list or study cards.

Connections to vocabulary in the article may also be made during the KWL activity. Ask students to highlight the italicized words. If students are not familiar with some of the terms, include them in the W list. Unfamiliar terms, or terms used in your evaluation, may be added to the W list as they read the article. Eventually these words can be moved to the L list. You may write vocabulary from the article in green ink, while other ideas are written in black. Note: Some of the words in the vocabulary list definitions may require further explanation.

You may wish to use the study cards found at the end of this guide. Cut along the horizontal line; fold in the middle and tape or staple. Study cards, see Strategic Tutoring (Hock, Deshler, and Schumaker, 2000), can be applied to any subject area. On one side of the card, in large letters, write a key word or phrase that students are expected to know. In smaller letters frame the word or phrase in a question or statement. On the other side of the card, in large letters, write the answer to the question. Finally, in smaller letters, frame the answer in a question or statement. Blanks are provided to allow you or your students to add new words or phrases.

Study guide overview Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). Preview the entire guide with your class before you read the article. You may wish to read the story aloud and complete the study questions in class, in small groups, or as an independent activity. 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). The study questions may be also used as a quiz. Note: Items 6, 8, 9, 12, and 13 and the Challenge require varying degrees of analytical thinking.

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Adaptations Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first, for example, items 1–5, 7, 12, and 14. If time allows, remaining items may be attempted. For the sketch in item 9 you may provide an unlabeled drawing to students who are unable to draw, or ask a peer helper to make the sketch. 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 guide, combined with vocabulary, as a quiz. Other assessment ideas: (1) Students may write an essay describing how a specific organism undergoes metamorphosis. (2) Students may sketch and label the stages in an animal’s development. (3) Poster presentations may illustrate how an organism’s development is an adaptation to its environment. (4) Ask each student to write two or three multiple choice or short answer questions as they read the story. Select 15–20 student questions for a quiz.

Extension activities

1. Students may compare and contrast, in a paper or poster presentation, developmental stages of one or more of the organisms in this article with mammal, bird, and reptile development. (See Web Resources for links.)
2. “The Magic of Morphing” may provide connections to the science of taxonomy, or how life forms are classified. Do all organisms in a phylum undergo the same development stages? If so, why? If not, why not?
3. Students may select one or more of the animals in the article and examine that organism’s life cycle, environmental niche, or evolutionary history.
4. Cell differentiation may be used to introduce students to stem cell biology. Students may relate the role stem cells play in human development to cell differentiation in the woolly bear caterpillar and other species that develop in a cocoon.

Web resources

Embryology

chickscope.beckman.uiuc.edu/explore/embryology
embryo.soad.umich.edu

Taxonomy

www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookDivers_class.html

www.arkive.org
www.dmoz.org/Kids_and_Teens/School_Time/Science/Living_Things/Animals

Dragonflies

www.holoweb.com/cannon/dragonfl.htm

www.npwrc.usgs.gov/resource/distr/insects/dfly/index.htm

Caterpillars, moths, butterflies

www.pick4.pick.uga.edu/mp/20q?guide=Caterpillars

www.support.epnet.com/knowledge_base/detail.php?id=2517
(grades 3-6)

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Web resources continued

www.library.thinkquest.org/C0110693/butterfly.htm

Frogs

allaboutfrogs.org

www.exploratorium.edu/frogs/

American eel

www.chesapeakebay.net/info/american_eel.cfm

Mussels

www.bio.umass.edu/biology/conn.river/fwmussel.html

www.fws.gov/news/mussels.html

Stem cells

stemcells.nih.gov/info/basics/

www.kqed.org/quest/television/view/326?gclid=CM7c1_6GupECFQkNIgodlyMmOQ

www.teachersdomain.org/resources/tdc02/sci/life/stru/different/index.html

Related articles

Many related *Minnesota Conservation Volunteer* articles are available online at <http://www.mndnr.gov/volunteer/articles/index.html> including:

July–August 1996

“Damsels and Dragons”

www.mndnr.gov/young_naturalists/dragons/index.html

July–August 2000

“Katydid”

www.mndnr.gov/volunteer/julaug00/katydid.html

July–August 2000

“Mussel Bound in Minnesota”

www.mndnr.gov/young_naturalists/mussels/index.html

November–December 2000

“The Curious World of Galls”

www.mndnr.gov/young_naturalists/galls/index.html

May–June 2002

“Minnesota Night Life”

www.mndnr.gov/volunteer/mayjun02/moths.html

March–April 2004

“Special Delivery”

www.mndnr.gov/young_naturalists/eggs/index.html

July–August 2004

“Buggy Sounds of Summer”

www.mndnr.gov/young_naturalists/buggysounds/index.html

May–June 2005

“Six-Spotted Tiger Beetle”

www.mndnr.gov/volunteer/mayjun05/mpbeetle.html

May–June 2006

“American Eel”

www.mndnr.gov/volunteer/mayjun06/mp.html

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Related articles continued

May–June 2006

“Mystery Mussel”

www.mndnr.gov/volunteer/mayjune06/fnmussel.html

July–August 2006

“Regal Fritillary”

www.mndnr.gov/volunteer/julaug06/mp.html

January–February 2007

“Four-Toed Salamander”

www.mndnr.gov/volunteer/janfeb07/mp.html

References

- Hock, M.F., Deshler, D.D., and Schumaker, J.B. *Strategic Tutoring*. Lawrence, Kan.: Edge Enterprises, 2000.
- Hölldobler, B., and Wilson, E.O. *Journey to the Ants*. Cambridge, Mass.: Belknap Press, 1994.
- Lampman, E.S., and Valintcourt, H. *City Under the Back Steps*. New York, N.Y.: Doubleday, 1960.
- 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.

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Study Questions

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www.mndnr.gov/young_naturalists/morph.

Name _____ Period _____ Date _____

For items 1 through 5 circle True or False

1. Two kinds of animals that undergo metamorphosis are birds and insects. True False

2. Larvae and adult toads eat the same things. True False

3. Mosquito larvae live in water. True False

4. Larvae have powerful wings. True False

5. Some adult insects do not eat. True False

6. Describe the environmental cues that tell animals when to change from one form to the next.

7. When a dragonfly changes from a nymph to an adult, how does it adapt the way it breathes?

8. In the third photograph in the series on pages 54 and 55, what is the green darner dragonfly resting on? _____

9. How does the green darner ready its wings for flight? _____

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10. The following developmental stages for the woolly bear caterpillar are out of order. Put them in their correct sequence.

Order 1 - 5

Caterpillar spins a cocoon _____

Egg hatches _____

Isabella tiger moth _____

Curled up into a ball _____

Eats any plant _____

11. When cells differentiate they _____

12. How are a caterpillar and a tadpole similar? How are they different?

Similarities

Differences

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

13. When (and why) is the American eel called a glass eel? _____

Challenge: There are “Think About It” highlighted boxes on pages 53, 55, 57, and 58. See how many you can answer. Use the back of this page or attach another sheet if you need more space. _____

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Study Questions Answer Key

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1. Two kinds of animals that undergo metamorphosis are birds and insects. **False**
2. Larvae and adult toads eat the same things. **False**
3. Mosquito larvae live in water. **True**
4. Larvae have powerful wings. **False**
5. Some adult insects do not eat. **True**
6. Describe the environmental cues that tell animals when to change from one form to the next. **Answers will vary, but should include daylight, temperature, humidity, and chemicals in an organism’s body as well as its environment.**
7. When a dragonfly changes from a nymph to an adult, how does it adapt the way it breathes? **It changes from gill breathing to lung breathing.**
8. In the third photograph in the series on pages 54 and 55, what is the green darner dragonfly resting on? **Its old exoskeleton (skin)**
9. How does the green darner ready its wings for flight? **It inflates them with blood, waits for them to dry, and then flies away.**
10. The following developmental stages for the woolly bear caterpillar are out of order. Put them in their correct sequence. **Order 1 - 5 Caterpillar spins a cocoon 4; Egg hatches 1; Isabella tiger moth 5; Curls up in a ball 3; Eats any plant 2.**
11. When cells differentiate they grow into various structures and organs, such as legs, eyes, and digestive tract.
12. How are a caterpillar and a tadpole similar? How are they different?
Similarities/Differences: Answers will vary, but should include: both undergo metamorphosis, both come from eggs, and both change what they eat as they develop. Tadpoles are amphibians. Caterpillars are insects. Tadpoles do not make cocoons. Tadpoles are gill-breathers, while caterpillars are lung-breathers.
13. When (and why) is the American eel called a glass eel? **They are translucent as they change from their immature to mature form.**
14. Explain what fish have to do with the plain pocketbook mussel’s development. **Their larvae attach to a fish’s gills, where they grow for several weeks.**

Challenge: There are “Think About It” highlighted boxes on pages 53, 55, 57 and 58. See how many you can answer. Use the back of this page or attach another sheet if you need more space. P. 53: **a niche includes the elements of your physical environment, what you eat, what threatens you, and the resources you use to stay alive.** P. 55: **propulsion.** P. 57: **Speeds up development from gill breathing to lung breathing.** P. 58: **camouflage.**

Minnesota Comprehensive Assessments Practice Items

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www.mndnr.gov/young_naturalists/morph.

Name _____ Period _____ Date _____

1. Cells clusters inside a cocoon are called _____ .
 - A. glochidia
 - B. imaginal buds
 - C. niches
 - D. cues
2. Larvae often have strong _____ .
 - A. mouthparts
 - B. wings
 - C. gills
 - D. algae
3. _____ move from salt water to fresh water.
 - A. Tadpoles
 - B. Dragonflies
 - C. Mosquitoes
 - D. American eels
4. The “morph” in metamorphosis means _____ .
 - A. change
 - B. larvae
 - C. form
 - D. none of the above
5. The immature form of an animal is often called a _____ .
 - A. larva
 - B. mollusk
 - C. crustacean
 - D. hemolymph

Minnesota Comprehensive Assessments Practice Items Answer Key

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www.mndnr.gov/young_naturalists/morph.

1. Cells clusters inside a cocoon are called **B. imaginal buds**.
2. Larvae often have strong **A. mouthparts**.
3. **D. American eels** move from salt water to fresh water.
4. The “morph” in metamorphosis means **C. form**.
5. The immature form of an animal is often called a **A. larva**.

Vocabulary

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www.mndnr.gov/young_naturalists/morph.

- algae** aquatic plants without leaves, roots, or stems (e.g., seaweed)
- amphibian** cold-blooded vertebrate that breeds and develops in water, but spends time on land as an adult
- continental shelf** shallow area near the coastline
- cues** signals or signs that prompt action
- crustacean** arthropod with several pairs of legs, a shell, antennae, and eyes on stalks (crayfish)
- denizen** inhabitant
- digestive tract** tube between mouth and anus; stomach and intestines
- humidity** amount of moisture in the air
- immature** young, not fully grown
- insect** arthropod with three body segments, two antennae, three pairs of legs, and two sets of wings
- juvenile** young or youthful
- mollusk** invertebrate with a soft, unsegmented body, usually with a shell (clams, snails, slugs)
- primary prey** most common animal that a predator eats
- spinneret** structure that produces silk in spiders and caterpillars
- translucent** allowing light to pass through, but diffusely