

TEACHERS GUIDE

TO “FUNGUS AMONG US”

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in *Minnesota Conservation Volunteer*, September-October 2022, mndnr.gov/mcvmagazine.

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 mndnr.gov/mcvmagazine and click on *past issues*.

Thank you for bringing Young Naturalists into your classroom!

“FUNGUS AMONG US”

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SUMMARY. Neither animals nor plants, mushrooms are a vital part of nature. In this colorful feature story, young naturalists learn about the important role mushrooms play in ecosystems and learn fun facts about a few of Minnesota’s most common mushroom species.

SUGGESTED READING LEVELS. Third through middle school grades

MATERIALS. KWL organizer; optional resources include dictionaries, video viewing equipment, Internet access art supplies, large map of the Americas, 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. “Fungus Among Us” 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

3. Planning and carrying out investigations.
6. Constructing explanations (for science) and designing solutions (for engineering)
8. Obtaining, evaluating, and communicating information

CROSSCUTTING CONCEPTS

1. Patterns
2. Cause and effect
5. Energy and matter
6. Structure and function

DISCIPLINARY CORE IDEAS

Life Sciences 1: From molecules to organisms: Structures and processes.

Interactions, energy, and dynamics

Earth and Space Sciences 3: Earth and human activity

Engineering, Technology, and the Application of Science 2: Links among Engineering, Technology, Science, and Society

SOCIAL STUDIES

Citizenship and Government (Benchmarks: 3.1.4.6.2, 4.1.1.1.1, 5.1.4.6.1)

Geography (Standard 3.3.1.1, 4.3.1.1, 5.3.1.1; Benchmarks 3.3.1.1.1, 3.3.1.1.2, 4.3.1.1.1, 5.3.1.1.1)

ENGLISH LANGUAGE ARTS (GRADES 3-8)

Reading: Informational Text (Grades 3-8)

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, 6.5.2.2, 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, 5.2.7.7, 6.5.7.7, 7.5.7.7, 8.5.7.7)

WRITING (GRADES 3-8)

Text Types and Purposes (Benchmarks 3.6.1.1, 3.6.2.2, 4.6.1.1, 5.6.1.1, 5.6.2.2, 6.7.1.1, 6.7.2.2, 7.7.1.1, 7.7.2.2, 8.7.1.1, 8.7.2.2)

Research to Build and Present Knowledge (Benchmarks 3.6.7.7, 3.6.8.8, 4.6.7.7, 4.6.8.8, 5.6.7.7, 5.6.8.8, 6.7.7.7, 6.7.8.8, 7.7.7.7, 7.7.8.8, 8.7.7.7, 8.7.8.8)

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)

Presentation of Knowledge and Ideas (Benchmarks 3.8.4.4, 4.8.4.4, 5.8.4.4, 6.9.4.4, 7.9.4.4, 8.9.4.4)

LANGUAGE (GRADES 3-8)

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

READING LITERACY IN SCIENCE AND TECHNICAL 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: LITERACY IN SCIENCE AND TECHNICAL SUBJECTS (GRADES 6-8)

Research to Build and Present Knowledge (Benchmark 6.14.7.7)

ARTS (GRADES 3-8)

Artistic Process: Create or Make (Benchmarks 0.2.1.5.1, 0.3.1.5.1, 4.2.1.5.1, 6.2.1.2.1)

Artistic Foundations (Benchmark 6.1.3.2.2)

For current, complete Minnesota Academic Standards, see www.education.state.mn.us. Teachers who find other connections to standards may contact *Minnesota Conservation Volunteer*.

PREVIEW. What do your students already know about mushrooms? Give them a chance to share their thoughts and observations. Then divide them into small groups to do a [KWL activity](#). Within the groups, have students describe what they know (K) about these fascinating fungi and what they wonder (W) about them. Give each student a copy of the organizer (see 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. Check out the [THC and KLEW frameworks](#).

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.

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.

ASSESSMENT. You may use all or part of the study guide, combined with vocabulary, as a quiz. Other assessment ideas include: (1) Have students write the word "MUSHROOM" vertically on a piece of paper with one letter for each line. Then challenge them to write down eight sentences describing what they learned about mushrooms, with each sentence beginning with one of the letters. (2) Have students write multiple-choice, true-false, or short-answer questions based on the article. Select the best items for a class quiz.

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. Go on a mushroom hunt! Look on the sides and near the base of dead trees, under logs, in damp habitats such as lawns and gardens. Use the photos in this story, [iNaturalist](#) or a mushroom guide to identify the various ones you find. As students find mushrooms, record their findings in a chart that has three columns: Type of Mushroom; What It Is Growing On or Near; Interesting Observations (older students might include an additional column for noting evidence of interactions). Using this information when you return to the classroom, help students summarize observations as pattern statements. Then encourage students to review their observations for any that don't fit patterns. Use this to talk about why scientists look for patterns and how patterns can help us make sense of the natural world.

2. Watch and discuss the TED talk "[6 Ways Mushrooms Can Save the World](#)." Have students choose one of the ideas presented, identify a question they have about it, and use library and internet resources to find the answer. Based on what they learned about mushrooms in the Young Naturalists article and in the TED talk, what other ideas can they come up with for applying mushrooms to solve human challenges? Alternatively, students could watch National Geographic's "[You Didn't Know Mushrooms Could Do All That](#)," which highlights different ways mushrooms are being studied to help society, such as for antibiotics, building materials, water filtration, toxic waste cleanup, pest abatement, and textiles. Students could pick one of these uses that interests them, learn more through internet research, then share what they find through a report, oral presentation or poster.

3. Minnesota is one of only three states with a state mushroom. Use this as a civics lesson to learn how the Minnesota Legislature makes laws. Who proposed the morel in the first place? What was the process by which it achieved this designation? What is the value of having such a designation?

4. There are dozens of species of bioluminescent fungi, including the jack-o-lantern mushroom mentioned in this Young Naturalists story. Watch [National Geographic's Glow-in-the-Dark Mushrooms: Nature's Night Lights](#) video. After learning about the researcher's work to determine why that species of mushroom glows at night, encourage students to make their own speculations, drawing from what they have learned about mushrooms through the Young Naturalists story. Then prompt students to think about how they might test their hypotheses, either by modifying the methods used by the researcher in the video or creating their own plan. Students might also be encouraged to conduct research to learn more about bioluminescence in other species and how it serves as an adaptation in a variety of ways.

5. Using the mushrooms featured at the end of the story, or others of students' choos-

ing, have students make a 3D model of their mushroom. Combine these creations for a classroom mycology museum that could be shared with other students or school guests. Students could prepare information about their mushroom that could be displayed or orally shared with the museum visitors.

6. The Young Naturalists story mentions a few ways mushroom spores are dispersed. One way that has been more recently discovered suggests mushrooms are quite the ingenious engineers! Share with students what researchers discovered using math, physics, and videography about how mushrooms actually can create their own wind to disperse their spores (see the article in Science Daily, "[The mushrooms, my friend, are blowing in the wind...](#)") What applications could this discovery have for humans?

7. Filmmaker Louie Schwartzberg said, during an interview and film screening for [Fantastic Fungi](#) that if he were invited to give a graduation speech, his advice to graduating seniors would be to go out and live their lives like a mycelium network, connecting with others, nurturing others, sharing with others; it is relationships that make the world go round. He believes we can learn about what it means to be human by studying nature, and he tries to convey this through his films. Encourage students to learn more about the "Wood Wide Web" (perhaps through BBC's [How Trees Secretly Talk to Each Other](#)), and then respond to Mr Schwartzberg's advice. Would living like a mycelium network be a good way to live? Have students write an opinion piece, supporting their point of view with reasons.

WEB RESOURCES

[Minnesota Mycological Society](#)

MINNESOTA DNR

GENERAL TEACHER AND STUDENT RESOURCES

[Minnesota DNR Teachers' Resources](#)

RELATED MCV ARTICLES

[Nature's Recyclers \(Young Naturalists feature\)](#)

[The Secret Lives of Fungi](#)

[Mirrors of Minnesota](#)

VIDEOS

[Fungi Education Network Videos](#)

[Mushroom Reproduction](#)

OTHER RESOURCES

[Fungi Identification Cards](#)

[Mushroom Reproduction](#)

STUDY QUESTIONS ANSWER KEY

1. True or false: All mushrooms have caps and stems. **False. Although some look like the stereotypical “toadstool,” mushrooms come in a variety of shapes.**

2. Mushrooms are a member of the **fungi** family.

3. The main part of a mushroom is made up of

- a. yeast
- b. **hyphae**
- c. spores
- d. enzymes
- e. lignin

4. How long does a mushroom last once it emerges? **It varies a lot – from a few days to years.**

5. Why shouldn't you eat a mushroom? **Because it could make you very sick or paralyze or kill you.**

6. True or false: A good time to look for mushrooms is after it rains. **True. Mushrooms like moisture, so they may appear after a rain.**

7. Which of these can help you identify a mushroom?

- 1. The shape of the cap
- 2. Whether it has a stem
- 3. The kinds of plants growing around it
- 4. Whether it has gills or pores
- 5. Whether it's growing by itself or in a cluster
- 6. **All of the above**

8. What time of year is good for finding morels? **Springtime.**

9. Match the mushroom to the trait:

Hen of the woods – **can grow 2 feet in diameter**

Oyster mushroom – **kills and eats tiny worms**

Jack-o-lantern – **glows in the dark**

Yellow morel – **Minnesota's state mushroom**

Common puffball – **shaped like a pear**

Fly agaric – **has bumps on its cap**

10. True or false: a bird's nest fungus has eggs instead of spores. **False. It holds its spores inside egglike structures.**

11. What time of year would you be most likely to find a golden chanterelle?

a. spring

b. summer

c. fall

d. winter

e. a and b

f. b and c

g all of the above

12. Where in Minnesota would you be most likely to find a jack-o-lantern mushroom?

North-central and southeastern Minnesota

Challenge Question: Look at the scientific names of the various mushrooms described. Are any similar to words that are familiar to you? What clues might that provide to what they are like? List as many such connections as you can. Don't worry about being right or wrong—let your imagination soar! **Example: Bird's nest fungus = *Cyathus striatus*. "Striatus" sounds like "striped," and the photos shows that the cup holding the "eggs" is striped.**

MINNESOTA COMPREHENSIVE ASSESSMENTS ANSWER KEY.

1. How do spores move from place to place? **The wind blows them or an animal carries them.**

2. A symbiosis is a close relationship among two different living things. When a mushroom and a tree form a symbiosis, how does each benefit? **The mushroom obtains sugar from the tree, and the tree obtains nutrients and water from the mushroom. In addition, the mushroom allows the tree to share resources and information with other trees.**

3. Which of these is NOT a shelf fungus?

Hen of the woods

Chicken of the woods

Turkey tail

Oyster mushroom

4. How are the "eggs" of a bird's nest fungus like the pores of a chicken of the woods mushroom? **Both hold spores.**

5. Which mushroom looks like a storybook toadstool? **Fly agaric**

VOCABULARY LIST

deciduous – a tree that sheds its leaves in the fall

enzymes – molecules that help chemical reactions happen

extract – remove

indispensable – impossible to get by without

parasitic – taking resources from another

thrive – grow bigger and/or healthier

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