

The Fungus Among Us

FUNGAL FOLKLORE

Mushrooms have been the source of a great deal of superstition, myth, and folklore throughout most of recorded human history, and with good reason. The Kingdom Fungi is host to many strange, biological phenomena such as colour changes of the flesh, poisonous and hallucinogenic qualities, offensive odours, rapid growth, and bioluminescence. The uncanny, rapid, and often overnight emergence of these enigmatic life forms lay behind a long-standing, cross-cultural belief that mushrooms were spawned by the interaction of thunder and lightning. In the Middle Ages, the rapid growth of mushrooms contributed to their being relegated to the realm of the occult. They were seen as the craftsmanship of evil spirits, witches, or the devil, and numerous folktales animated the occurrence of human diseases brought on by eating or touching them. On a more positive note, nearly all European countries attribute magical and spiritual power to mushrooms, and many ancient societies used mushrooms for shamanistic and divination rites.

The suspicious habit of some mushrooms to grow in circles, or “fairy rings”, led people to believe these were dangerous places where elves danced, toads met, deer rutted, or the devil set his churn at night. Superstition likely had a hand in naming many mushroom species including Witch’s Butter, Witch’s Hat, Elfin Saddles, Elfin Cups, Fairy Hair, Fairy Stools, Destroying Angel, Satan’s Bolete, and Devil’s Urn. Like fairy rings, glow-in-the-dark mushrooms and mycelia (the non-reproductive feeding portion of a fungus) have also been the subject of ancient myth and old wives’ tales and often considered to be a potent source of magic.

Nowadays, fungi are deeply connected to fairy folklore as well as modern children’s literature and films. Just crack open any book of fairy tales and more likely than not, you will find an illustration of the classic Fly Agaric, *Amanita muscaria*, with its shiny blood-red cap dappled with white spots. Mushrooms also play a significant role in Lewis Carroll’s *Alice in Wonderland*, on top of one of which sits the hookah-smoking caterpillar. The caterpillar advises Alice to eat from one side of the mushroom to grow larger and eat from the other side to become smaller; this is reminiscent of the hallucinogenic effects of *A. muscaria* which can cause a distortion of size perception. As well, bioluminescent mushrooms are featured in Pixar’s animated movie *A Bug’s Life*.

FUNGI IN FOOD AND MEDICINE

Shikate, portobello, crimini, oysters, morels, boletes, truffles...these are the names of some fungal friends you might recognize from a recipe, the grocery store, or a fancy high-end gourmet restaurant. Avid mycophagists, or people that eat fungi, will be ready instantaneously to discuss and debate the subtle attributes of the meaty bolete or earthy shiitake. Too often myco-cynics have declared that mushrooms have “no nutritional value” but this is entirely untrue; though they are low in calories, they are a great source of essential vitamins and minerals as well as some protein. The popular oyster mushroom, for example, contains the amino acids lysine and tryptophan (which are absent in grains) as well as nicotinic acid, riboflavin, pantothenic acid and vitamins B, C and K. With the increasing popularity of vegetarianism, the food industry is looking to mushrooms to make “meatless” vegetarian products using mycoproteins.

Aside from seeing a mushroom on your plate, there are many more subtle ways the Kingdom Fungi finds its way into our stomachs. The use of yeasts was first documented in 6000 BC with their primary uses being the formation of alcoholic beverages and the leavening of breads. The mold *Aspergillus niger* is used to produce citric acid by fermenting sugar. Citric acid is an extremely popular food additive and preservative and is commonly found in soft drinks. Though made famous by its antibacterial properties, *Penicillium* species also contribute to food production; *P. camemberti* is used in making Brie and Camembert cheeses (the mycelium is still strongly evident as the rind of these cheeses!), and *P. roqueforti* colours and flavours Roquefort and Danish blue cheese.

Before the discovery of penicillin in 1928 by Scottish scientist Alexander Fleming, an infection from a scratch might lead to amputation of a limb or even death. Besides the well known penicillin, a whole host of antibiotics are of fungal origin. Other fungal compounds such as Cyclosporine function as immunosuppressants for organ transplants; regulators of immune system activity; and cholesterol lowering agents.

Though there is a growing trend towards a more widespread use of mushrooms in the western nutraceutical industry, fungi have been central in Chinese pharmacopeia for centuries. The Shiitake mushroom contains lentinan which is an antiviral and antitumour agent; the reishi mushroom boosts immune system, slows tumour growth, improves circulation and heart function, and aids digestion. Many North American species such as the honey mushroom, maitake, and Tuckahoe have been shown to have an effect on cancers and hepatitis. Traditionally, the dried powder of old puffballs has been used as an astringent by First Nations people.

FUNGI AS PESTS

Sadly, fungi are more known throughout history for their bad deeds than for their good. In addition to being responsible for famine and emigration as in the Irish potato blight, fungi have also led to the hanging of innocent people during the Salem witch trials. Ergotism is a term used to describe poisoning caused by the *Claviceps purpurea* fungus which typically grows on rye grain. There are two types of ergotism: the first results in gangrene and loss of limbs and the second causes convulsions and hallucinations. During the Salem witch trials of 1692, two girls fell ill and began to accuse the townsfolk of bewitching them. As a result, 250 innocent people were arrested and 19 hanged. The most likely explanation of their “bewitching”, however, was ergotism caused by eating bad bread. Ergotism made many earlier appearances in history during the Middle Ages as St. Anthony’s Fire. Victims would claim that their limbs were “burning” which was due to ergot’s vasoconstrictive properties and inadequate blood flow. Nowadays, what was once foe, has become friend; ergotamine

is now marketed under names of Cafergot, Ergate, Migril to treat migraines and has also been used to lessen chance of hemorrhage after childbirth.

Each year rusts and smuts are responsible for approximately 13% loss of crops, specifically wheat, oats, corn, rye, beets, pears, peas and cherries as well as damage to hemlocks, pines, coffee trees and fig trees. These fungi damage the leaves of their hosts, causing the plant to lose water and decreasing their food generating potential. Powdery mildew can also be found as parasites on leaves of flowering plants such as apple trees, pumpkins and rose and lilac bushes.

Another fungus is currently receiving a lot of bad press, that is the species responsible for Dutch elm disease which is an insect transmitted disease that is leaving once tree-canopied city streets as barren as the arctic. How does this happen? Well, beetles carrying sticky spores of the fungus *Ophiostoma* bore into the wood of an American elm tree. The tree reacts to the presence of the fungus by plugging its own water transportation system, which leads to wilting and finally the death of the whole tree. In the process, the fungus breaks down the wood thereby making it more nutritious for the beetles and grubs that also feed on the fungus. Measures can be taken to stop Dutch elm disease. The transportation of infected firewood is a likely way for the disease to spread, so making sure elm firewood is not transported or stored is a good start. Once a tree has contracted the disease, treatment methods can be very expensive and usually only have temporary results. Alberta hosts a group called STOPDED (the Society to Prevent Dutch Elm Disease) that promotes awareness of Dutch elm disease.

Unfortunately, the wrath of fungi does not end here. Fungi cause more than a hundred diseases or mycoses in humans. These range from the generally innocuous athlete's foot, to candidiasis (yeast infections and thrush), to respiratory diseases and systemic infections. The mould *Aspergillus* produces aflatoxins which contaminate food, cause liver damage and are the most potent carcinogens known. As well, both home owners and ship owners will readily shake their fists at the dry rot fungi that bring great destruction to wood structures.

FUNGI AND POLLUTION

In recent years, there has been a noticeable decrease in the number of both edible and poisonous mushrooms growing in European forests as well as a drop in the size of the mushrooms that are growing. Of the fungi listed on the Red data lists of threatened and endangered species, 1/3 are mycorrhizal. The reason behind this is not yet concrete, but the number one suspect is air pollution from factories, farms, and automobiles; there is a correlation between increased levels of sulphur oxides, nitrogen oxides and other air pollutants and a decrease in mushroom populations (both number of fruiting bodies and diversity of species). It is unknown whether or not this phenomenon is also occurring in North America as records haven't been kept here for as long as in Europe. This decline may actually be harming forests as trees may lose their mycorrhizal partners and, as a result, age and die more quickly. An additional factor to consider in forest health is that larger fungi can accumulate heavy metals in their mycelia, thereby concentrating toxic material in upper soil layers where it may damage trees and other plants, and of course, any animals along the food chain that ingest the fruiting bodies.

LICHENS AND RADIATION

Lichens are sponges of radioactive materials that come to them from the atmosphere, and cause effects all through the food chain. In 1965 a study was launched to examine the effects of radioactive fallout from nuclear bomb tests. The scientists were expecting to use the Sami people as a control group due to their isolated location, but the results showed that the Sami people's tissues had 55X more radioactivity than the Finns living further south and up to 1/3 of the maximum permissible radioactivity according to the standards of the time. It was found that radioactive cesium and strontium were concentrated by lichens then eaten by reindeer which were then eaten by people. Similarly, after the Chernobyl disaster in 1986, meat from reindeer in Norway and Sweden had 10X the legal limit of measurable radiation and in some areas it exceeded the limit by 20X. The rate of lichen growth is also highly dependent on the condition of the air; where the air is polluted, they will grow very slowly, if at all.

Although valuable indicators of ecological health, lichens are also of economic importance to humans. Half of all lichen species tested show some antibiotic activity and some other lichen extracts have been shown to reduce tumours in mice. The lichen *Usnea*, recognizable as Old-man's Beard and commonly found hanging from tree branches, has been used medicinally for at least 1000 years. The active compound in this lichen is usnic acid, a potent antibiotic and antifungal agent that is now marketed under the name Usno. Extracts of *Usnea* are also widely used in the perfume and fragrance industry. Lichens have also been used through the centuries as a dyeing agent.

CONSERVATION

The world is losing its biological richness. As a result of human activities, species of living organisms are being driven irretrievably into extinction every day. Changes in land management worldwide are cited as the biggest factor in the decrease of diversity of fungi. Many fungi are host specific and localized, therefore loss of a host is paramount. Clearly there are challenges to fungal conservation—specifically the fact that they are generally hidden underground and therefore we are dependent on the presence or absence of fruiting bodies for population assessments. In conservation efforts, we must take into account relationships between flora, fauna, and fungi with the understanding that everything in the natural world is inextricably connected. It is vital to maintain the integrity of all members of the ecosystem to sustain the health of the forest and ultimately, the Earth.

Fungal Folklore and Beyond

OBJECTIVE

- To stimulate interest in fungi through student-specific exploratory activities

BACKGROUND INFO

There isn't a fairytale-loving child who is not familiar with the bright red cap and dappled scales of the classic *Amanita muscaria*, the fly agaric mushroom. Anyone ever so fortunate as to meet this most spectacular mushroom in its natural habitat will immediately understand why so much folklore surrounds the Fungi--this mushroom is simply too beautiful and too mysterious to be of this earth--and this is just the beginning! Some fungi, like the Jack o' Lantern and the mycelia of the honey mushroom, glow in the dark! Coral mushrooms look like they were taken directly from the ocean and dropped in the forest. The basket stinkhorn is decorated in a gown of the finest lace and an Octopus Stinkhorn could easily be mistaken for a large, neon spider!

Folklore and mythology are typically traditional stories and legends that are transmitted orally from generation to generation. Such stories are often born from attempts to explain natural phenomena like the northern lights, unusual physical characteristics of animals (like a beaver's flat tail), and of course, mushrooms.

In this activity, students will be introduced to some of the mythology surrounding mushrooms throughout the ages. Using these tales as a springboard, students explore the world of mushrooms through whatever creative medium they find appealing--be it poetry, drama/skits, or art.

TEACHER INSTRUCTIONS

1. Explain to your students that fungi have long been thought to be mysterious and magical. It wasn't until very recently that people understood what mushrooms are and where they come from. Ask your students if they are aware of any folklore/myths about mushrooms (like the origin of fairy rings) and then share some fungal folklore from the next page with your students.
2. Refer to the activity suggestions on page 63 to help guide students through their own explorations into fungi and folklore.
3. You may wish to set aside an area of the classroom to display all of your students' wonderfully mushroomy creations.

Activity 4.1



GRADES

3-6

TYPE OF ACTIVITY

Teacher read and student-led activities

MATERIALS

- assortment of fairytale books containing mushrooms (esp Brian Froud books) or access to a library with a supply of fairy tale books
- mushroom picture books or field guides with good plates (eg. Arora's Mushrooms Demystified),
- art supplies for painting and drawing
- clay/playdoh
- props for skits
- copies of "What's in a Name" chart on page 63 for each student or an overhead of the chart

SOURCE

Text adapted from FAIRY RINGS AND FUNGAL SUPERSTITIONS <http://www.virtualmuseum.ca/~mushroom/English/Folklore/fairy.html#>

ON ORIGINS

- The sudden and rapid eruption of mushrooms from the soil led people to believe that dark or terrible forces were at work. Lightning strikes, meteorites, shooting stars, earthly vapours, and witches have all been proposed as agents of their origin.
- In parts of Africa, mushrooms were sometimes regarded as souls of the dead or as symbols of the human soul.
- In Silesia, morel mushrooms were once believed to be the work of the Devil.
- In parts of Central America, a children's tale relates that mushrooms are little umbrellas carried by woodland spirits to shelter them from the rain; the spirits leave the mushrooms behind at dawn when it is time to return to their underground world.

ON FANTASTICAL FAIRY RINGS

- In France, fairy rings were called sorcerers' rings and in Austria, witches' rings.
- A Tyrolean legend claims that the rings were burned into the ground by the fiery tail of a dragon.
- In Holland, they were said to mark where the Devil rested his milk churn.
- In England, they were considered places where fairies came to dance. The mushrooms around the perimeter of the ring were seats where the sprites could rest after their exertions. People in rural England claimed to have seen fairies dancing at fairy rings as recently as a hundred years ago.
- One common theme in all these traditions is the belief that dire consequences await anyone foolhardy enough to enter a fairy ring. Trespassers would be struck blind or lame, or even disappear to become slaves in the fairies' underground realm.
- Occasionally fairy rings were said to bring good luck to houses built in fields where they occur.
- In Wales, it was also widely believed that if animals grazed within a fairy ring, their milk would putrefy.
- In another tradition, the rings were sites of buried treasure, but there was a catch—the treasure could only be retrieved with the help of fairies or witches.
- If a maiden washed her face with dew of the grass from inside a ring, the fairies would spoil her complexion.

ON THE NOTORIOUS *AMANITA MUSCARIA*: THE FLY AGARIC

- Even Santa Claus has been linked to fungi. One anthropologist has suggested that his red and white outfit symbolizes Fly Agaric. Siberian shamans were known to consume this mushroom, and Santa's use of the chimney is similar to a shaman custom of leaving a dwelling through its smoke hole during a festival.
- According to the Norse, Odin and his attendants were riding across the sky on their horses when suddenly they began to be pursued by demons. In order to escape these demons, they had to ride their horses very hard. As a result, the horses began to foam at the mouth and bleed. The blood and foam mixed and wherever it struck the ground, a red fly-agaric with white spots sprang up.
- Koryak Siberians have a story about the fly agaric which enabled Big Raven to carry a whale to its home. In the story, the deity Vahiyinin ("Existence") spat onto earth, and his spittle became the wapaq, and his saliva becomes the warts. After experiencing the power of the wapaq, Raven was so exhilarated that he told it to grow forever on earth so his children, the people, can learn from it.
- Some pop culture uses of the mushroom are in the video game series Super Mario Bros. and the dancing mushroom sequence in the 1940 Disney film *Fantasia*.

WHAT'S IN A NAME?

Of all the living things that have been identified, classified, and named, fungi have received the bear's share of odd ones. Listed below are some of the common names given to mushrooms. These names alone are rich sources of inspiration for young artists exploring "all things mushroomy".

Yuck on a Stick	Witches' Butter	Dryad's Saddle	Fuzzy Foot	Dead Man's Fingers
Bleeding Mycena	Train Wrecker	Destroying Angel	Fried Chicken	Angel's wings
Tree Ears	Parrot Mushroom	Laughing Mushroom	Old Man of the Woods	The Blusher
Pinwheel	Slippery Jack	Horse Mushroom	Liberty Cap	Cannon Ball
Inky Cap	Sweating Mushroom	Apricot Jelly	Hen of the Woods	Poison Pie
The Gypsy	The Prince	Turkey Tail	Orange Peel	Jack-O-Lantern

ACTIVITY SUGGESTIONS

For the writers...

Pass out copies of the "What's in a Name" table and have students write their own mythologies about one of these oddly named fungi.

For the pen and brush artists...

Encourage students who like to draw or paint to create an illustration of one of the mushrooms listed above.

For the hands on artists...

Students who like to make things with their hands could invent their own mushroom and mold it out of clay or playdoh. After seeing the colour plates in a book like Mushrooms Demystified, they will know that the sky is the limit! Have them name their mushroom and share it with the class.

For the actors...

Students interested in acting could perform a 5-minute skit demonstrating one of the mythologies you shared with the class, or they may act out their own mythology.

For the researchers...

Send book-loving students to the library and have them hunt down pictures of mushrooms in fairy tale books. Have older students document where they found the mushrooms (both in context and bibliographical).

Guess the Guest of Honour



Activity 4.2

GRADES

3-6

TYPE OF ACTIVITY

Word search

MATERIALS

- copies of page 65
- pencils

VOCABULARY

antibiotics
 bioremediation
 Dutch elm disease
 potato blight
 lichen
 mildew
 mould
 mycorrhizas


OBJECTIVE

- To increase awareness in students of the prevalence of fungi and fungal products in all areas of our lives

BACKGROUND INFORMATION

Fungi have been called the “hidden kingdom” because most of their body is hidden underground. However, fungi are also “hidden” in many everyday products from soy sauce to soda pop. Each of the words hidden in the word search is an example of some of the fungus among us.

TEACHER INSTRUCTIONS

1. Hand out copies of page 65.
2. Review the instructions with the students. They are to circle each LETTER of the words they find in the word search. For example,

3. Starting in the top left hand corner, write the remaining letters in the square boxes provided below to reveal a secret message.
4. Good luck to everyone!

GUESS THE GUEST OF HONOUR ANSWER KEY



Secret message:
 SOME ARE SMALL,
 SOME HUMONGOUS!
 LET'S DISCOVER THE
 FUNGUS AMONG US!

Guess the Guest of Honour



Directions ▶

Circle each individual letter of the words in the word search. Then, starting in the top left hand corner, enter the unused letters into the blanks below to reveal the secret message. Good luck!

- Allergies
- Antibiotics
- Athlete's foot
- Bioremediation
- Cheese
- Dyes
- Compost
- Dutch elm disease
- Fairy tales
- Potato blight
- Lichens
- Mildew
- Mould
- Mycorrhizas
- Perfumes
- Pizza
- Puffball
- Ringworm
- Soda pop
- Soy sauce

E	A	S	E	M	U	F	R	E	P	S	L	A	S	O
C	S	N	M	E	A	Z	Z	I	P	O	I	T	A	S
R	O	A	T	P	E	S	M	A	L	Y	C	H	L	E
S	O	M	E	I	O	M	E	H	U	S	H	L	M	I
O	N	G	P	S	B	P	O	U	S	A	E	E	L	G
D	Y	E	S	O	I	I	A	E	T	U	N	T	S	R
D	I	S	C	O	S	D	O	D	V	C	S	E	E	E
E	S	E	E	H	C	T	M	T	O	E	R	S	T	L
P	U	F	F	B	A	L	L	L	I	S	H	F	E	L
M	R	O	W	G	N	I	R	F	E	C	U	O	N	A
W	E	D	L	I	M	G	U	S	A	H	S	O	M	M
S	A	Z	I	H	R	R	O	C	Y	M	C	T	O	O
T	H	G	I	L	B	O	T	A	T	O	P	T	N	U
F	A	I	R	Y	T	A	L	E	S	G	U	S	U	L
N	O	I	T	A	I	D	E	M	E	R	O	I	B	D

Secret Message:

_____ ,
 _____ !
 _____ ,
 _____ !



Activity 4.3

GRADES

K-6

TYPE OF ACTIVITY

mushroom hunt

MATERIALS

See text body

VOCABULARY

foray

mycorrhizas

symbiosis

decomposition

nutrient cycling

Hurray for Foray

OBJECTIVE

- To introduce students to mushroom hunting

BACKGROUND INFORMATION

In many countries around the world, mushroom hunting is considered a national pastime. Some people hunt mushrooms for their edibility, others for their medicinal properties, and some for pure entertainment! A mushroom hunt, or **foray**, is a fantastic way to help kids connect with the natural world around them. The great thing about fungi is that they are literally everywhere! You don't need to arrange a complicated field trip to a forest to find mushrooms. There is a very good chance you can find them in your schoolyard or on your front lawn! A guided foray is a sure way to illustrate the ecological concepts already touched on in this guide: find a mushroom growing near a tree, and talk about **mycorrhizas**; discover some lichen on a rock and explain **symbiosis**; unearth some rotting leaves and converse about **decomposition** and **nutrient cycling**. There is a fantastical fungal world just waiting to be found!

PART 1: PREP DAY

MATERIALS

- an assortment of mushroom field guides and/or posters
- copies of pages 74 to 82 for each student
- a few types of mushrooms from the grocery store i.e., field mushrooms, shiitakes, wood ears, Chinese white fungus (Tremella), enoki, oyster mushrooms, chanterelles, morels
- rulers
- "Fungus Fred goes Foraying" by Maggie Hadley (optional).-- see Suggested Resources and Sources page 91

TEACHER INSTRUCTIONS

- Collect an assortment of mushroom field guides from a local library. If you can find posters of mushrooms (like the ones for sale at www.fungiperfecti.com), this would be very helpful too. It would be beneficial at this time to have students assemble their Field of Fungi mini field guide from page 73.
- In preparation for the foray, bring some domestic mushrooms to look at together as a class. Use these specimens to point out physical characteristics that will be useful in identifying wild specimens.

3. Review the basic parts of the mushroom: cap, gills/spines/pores, scales, stem, ring, cup and mycelium. Depending on the mushrooms you were able to acquire, discuss the presence or absence of these features. Please note that it is extremely unlikely you will find domestic mushrooms with mycelia intact. Note however that the *entire* mushroom is made up of tightly packed hyphae.
4. Encourage students to take a closer look at the mushrooms. Use the following questions to guide your investigations:

CAP

- What colour is it?
- Is it smooth, sticky or scaly?
- What is underneath the cap: gills? pores? spines? or none of the above?

STEM:

- How long is it?
- How wide?
- Is it smooth or rough?
- What colour is it?
- Is it hollow inside?
- Does the mushroom have a cup on the bottom?

IDENTIFICATION

- What group is it from? You may wish to use the Key to The Fungal Treasure on page 26 to help answer this question.
 - What colour is the spore print?
 - Can you find a picture of it in a field guide?
 - What is it called?
 - Where was it growing (if a wild specimen)? In a woodland? grassland? near or under a plant? on wood? in soil? on manure?
5. Try to get a spore print from a fresh mushroom (see part 3 of this activity) to give students a chance to familiarize themselves with the technique.
 6. Take the time to discuss edibility of mushrooms. Let students know that even though the mushrooms they have examined today were edible, they must never ever eat any wild mushroom that has not been identified by an expert as being safe. Although only a few mushrooms are deadly, many will cause hallucinations, nausea, vomiting and diarrhea, and liver or kidney failure. It is never worth the risk of getting sick!
 7. Ask students if they know what old wives' tales are. Do they know any? Review some of the common tales about mushrooms and explain that they are false. Some examples are: deadly ones will darken silver; if it peels it is good to eat; if animals eat them, so can humans. There is NO SIMPLE TEST to assess the edibility of a mushroom.
 8. You could share (and explain!) a little riddle/joke from Terry Prachett with your students about poisonous mushrooms:
 1. All fungi are edible
 2. Some fungi are not edible more than once"
 9. As a class, you may wish to read the story book Fungus Fred goes Foraging by Maggie Hadley.

PART 2: THE HUNT

MATERIALS

- wax paper or bags for collected mushrooms (never use plastic bags as they accelerate decomposition of the specimens)
- trowel or knife to dig mushrooms from the ground
- permanent markers
- plastic cups
- sandwich bags (for lichen collection)
- digital camera
- magnifying glass or hand lens for each group
- notepad
- pencils
- rulers
- copies of data cards from the field guide page 82

TEACHER INSTRUCTIONS

1. Assemble a foray kit ahead of time so you will be prepared when the weather is suitable (ideally that means a warm day just after a rain).
2. Ask your students where they think a good place to look for mushrooms will be. All answers will be right as mushrooms can grow virtually anywhere--including under concrete. Some good places to begin the hunt are in shady spots, wooded areas, decaying leaves, damp rotting wood, or dead trees. However, you can also find them on lawns and flower beds, sidewalks, parking strips, manure and sawdust piles, stumps, trees, shrubs; pasture, barnyard for meadow mushrooms and dung loving species; forest or woodlot areas...virtually anywhere!
3. Remind students never to put their hands in their mouth after handling wild mushrooms.
4. There is a good chance you will encounter puffballs, shaggy mane mushrooms (which have very varied diets), and little brown mushrooms.
5. You may have students hunt in pairs or small groups, or you may prefer to stay together as a class; do what works for your group to maximize the "hands-on" component.
6. When students spot a mushroom, have them sketch the basic structure on one of the "data sheets" from their field guide. Also have them measure the mushroom and take note of its habitat before collecting it. Was it from a grassy area? Were there trees nearby? Was it growing in woodchips? Explain that the habitat is like the mushroom's home address and this will help with identification later on.
7. When collecting mushrooms, dig up some of the surrounding soil rather than just breaking the stem, and collect only big, distinctive, colourful types. Digging up soil will help keep identifying features intact. Talk again about the difference between plants and fungi; picking a mushroom is like picking a fruit but pulling a plant or flower up by the roots will kill the whole plant. Use a shallow basket to collect, and wrap in waxed paper to separate and protect it or put the mushroom into a plastic cup. Take a few a mushrooms back to the classroom for spore printing, closer examination and identification.
8. While collecting mushrooms, have students note the habitat they are collecting from and label the specimen accordingly. It would be beneficial to photograph the mushrooms in their natural habitat as well. It can be tricky to remember habitat once back in the classroom.

9. You might look for **lichens** on boulders, grave stones, or on tree bark. Remind the students that lichens are easily harmed by pollution, so they may not be found in areas with high pollution. To collect a lichen, break off a SMALL piece of bark, and put it in a sandwich bag and label. You can view it under a hand lens.
10. Point out the ecology of the mushrooms you find. Are there mushrooms near decaying leaves? These mushrooms are **decomposing**! Are there mushrooms growing close to a tree? These could very likely be **mycorrhizal** mushrooms. Talk about mycorrhizas. Guide the students into explaining the relationship. Review the term **mycelium**; if you're observing a mushroom, this is just the tip of the mycelial iceberg! This is why fungi are called the "hidden kingdom".
11. Highlight some fungal trivia throughout the foray. For example:
 - puffball spores were used by First Nations people to stop bleeding
 - the Iceman Otze was found with bracket fungus on him
 - bracket fungi can be used to start fires or as an artist's canvas
 - fairy rings are a source of a great amount of folklore
 - shaggy mane mushrooms disperse their spores by "melting"
 - stinkhorns 'use' flies to distribute their spores
 - the mycelium of a honey mushroom is thought to be the largest organism on earth and it glows in the dark!
12. Remember, though these instructions may seem complicated, this foray is meant simply as an introduction to mushroom hunting and should remain fun at all times! Do not get caught up in details. Flow with the rhythm of the class and explore with the intention of fostering an interest in ecology and the natural world.

PART 3: THE DEMYSTIFYING

MATERIALS

Identification

- assortment of field guides specific to the local area. A superb example of a field guide with lots of colour plates and a fun attitude is David Arora's [All That the Rain Promises and More.](#)
- mini field guide from page 73
- a dissecting microscope (optional)
- pencil crayons

Spore Printing

- knife
- a black and a white piece of paper
- a glass
- pencils
- fixative spray

TEACHER INSTRUCTIONS

1. With a little luck you will return from your foray with a plethora of fungal friends! Now you and your students can begin solving the mystery of who's who.

THE FUNGUS AMONG US

2. Refer students to their data cards and their specimens. Have the students “fill in any blanks” they did not fill in before. Now that you are back in the classroom, encourage them to colour their sketches to match the mushrooms.
3. To begin, have the students decide which group their mushrooms belong to. Guide them through the identifying features such as the reproductive structures under the cap (gills, pores or spines?).
4. Set a few mushrooms aside to be spore printed. Choose a few mature, undamaged, even-shaped caps with gills.
5. Get to know your mushrooms! Smell them, touch them, and talk about them. How are they similar or different to the store-bought varieties? What would be a good name for them if you were going to name them yourself and why?
6. Direct your students to the field guides. Once they have decided on the group they think the mushroom(s) belong to, have them try to find it in a field guide. Draw attention to the presence of both Latin and English names for each mushroom. Inform them that the Latin name is a universal code that is understood all around the world. This way mushroom hunters from Japan to Russia to Canada can all speak the same language when referring to a mushroom they’ve found. The Latin name is backwards from their own name in that their ‘family’s name’ is written first (*Genus*) and their individual name second (*species*).
7. Do not get stuck on the details of accurate identification. This is an exercise in familiarization with field guides, and not intended to be a class in taxonomy. Unless some very obvious species are found (like puffballs and shaggy manes), it is likely you will have a basket full of little brown mushrooms. Tell students that identifying these mushrooms can be tricky even for mushroom experts!
8. Explain that there is one technique that can be helpful in identifying plain looking mushrooms-- spore printing; like a fingerprint, a spore print can reveal the secret of a mushroom’s identity. Remind students that spores are similar to seeds with one major difference. What is it? Spores are a single cell and don’t ‘pack a lunch’; they need to land on a direct food source to germinate.
9. Lead the class through spore printing:

Spore Printing

1. Cut the stem very close to the cap.
2. Place the cap gill-side down on a piece of paper that is black on one half and white on the other.
3. Now place a bowl or glass jar over the cap to protect it from disturbance.
4. Leave the cap for 2 hours or more.
5. Carefully remove the bowl and cap and take a look at the print left behind.
6. Spray with clear fixative to preserve the print.
7. What colour is the print? Did spores show up on the dark side or the light side or both?

DISCUSSION

1. Try and get some feedback about the foray. Did students enjoy the mushroom hunt? What did they learn about where mushrooms like to grow?
2. What else would they like to learn about mushrooms? As a class you could compile a list of questions and direct them to a local mycological club. The contact information for organizations affiliated with NAMA are listed on the following page.

Canadian Mycological Societies Contact List

Keep in mind that the co-coordinators for these programs are volunteering their own time. Please, give them time to respond to your inquiries.

BRITISH COLUMBIA

Vancouver Mycological Society

#101-1001 W Broadway Box 181
Vancouver, BC V6H 4E4

www.vanmyco.com

The Vancouver Mycological Society is an amateur organization devoted to the study of mushrooms. Meetings are held on the first Tuesday of each month (except - December, January, July and August). Meetings are at the Van Dusen Botanical Gardens - Classroom, Oak and 37th Avenue, 7:30 p.m.. Call their mushroom hotline (604) 878-9978 for more information on VMS forays, field trips, meeting programs and events.

South Vancouver Island Mycological Society

2552 Beaufort Rd.
Sidney, BC, Canada V9L 2J9

www.svims.ca

SVIMS is a small society interested in all aspects of mycology and mushroom appreciation. Its members include professional mycologists, mushroom growers, mushroom pickers, cooks, photographers, and other enthusiasts. Meetings are held at 7:00 p.m. on the 1st Thursday of Feb.-June and Sept.-Nov., at the Pacific Forestry Centre, 506 Burnside Road West, Victoria, B.C.

SVIMS members produce a great newsletter which is available for viewing at their website.

Fraser Valley Mushroom Club

c/o Othmar Kagi
32522 Best Avenue
Mission, British Columbia, V2V 2S6

www.fvmushroomclub.ca

EMail: [info \[at\] fvmushroomclub.ca](mailto:info@fvmushroomclub.ca)

Contact: Othmar Kagi

Sunshine Coast Shroom

5027 Bear Bay Road
Garden Bay, British Columbia V0N 1S1

www.scsroom.org

EMail: [info \[at\] scsroom.org](mailto:info@scsroom.org)

Contact: Ann Harmer,
Shroomworks [at] bluffhollow.ca

ALBERTA

Alberta Mycological Society

#1921-10405 Jasper Avenue
Edmonton, AB T5J 3S2

www.wildmushrooms.ws

THE FUNGUS AMONG US

The AMS meets on the the 4th Wednesday of the month at 7:00 pm at the Riverbend Library located at the strip mall at Rabbit Hill Road and Terwillegar Drive. Members will receive 4 newsletters during the year with interesting articles, foray information and maps. There is also the opportunity to exchange yarns and ideas with other members with similar interests.

ONTARIO

Mycological Society of Toronto

2106-812 Birnhamthorpe Rd.
Toronto, ON M9C 4W1

www.myctor.org

Contact: Michael Warnock

This is mostly a group of amateurs supported by a number of active or retired professional mycologists eager to collect, study and identify fungi, particularly the larger mushrooms. The Society encourages activities that explore the ecological role of fungi, and support the conservation of wild mushrooms. They organize five informative meetings a year for their members. These are held at the Civic Garden Centre in Toronto. Guest speakers are invited to give presentations on various topics associated with the field of mycology. The annual Cain Foray usually takes place on the third weekend of September in the Haliburton area. After the fungi are gathered and identified, they are displayed at the "Fungi Fair" held at the Civic Garden Centre (Lawrence and Leslie) on the Monday following that weekend.

QUEBEC

Cercle des Mycologues de Montréal

4101 Rue Sherbrooke Est
Montréal, QC H1X 2B2
www.mycomontreal.qc.ca

The CMM is based in Montréal, QC. The members are French-speaking, or bilingual, French-English. All the literature is in French.

NORTH AMERICA

North American Mycological Association
Rebecca Rader, Executive Secretary
PO Box 64
Christiansburg, VA 24068-0064

www.namyco.org

Contact: Sandy Sheine, Education Committee

Email: rebeccahrader@hotmail.com

NAMA, the North American Mycological Association, is a non-profit organization of amateur and professional mycologists with more than 60 affiliated local mycological clubs throughout North America. NAMA's mission is "to promote, pursue, and advance the science of mycology."

Fields of Fungi Mini Field Guide

OBJECTIVE

- To familiarize students with the major groups of fungi

BACKGROUND INFORMATION

Field guides are essential tools to any naturalist interested in identifying local species. They generally provide information about the distribution, **habitat**, distinguishing features, common and scientific names, and size of species. Exposing students to field guides will show them the diversity of fungi and the colour plates may spark an interest to "get to know" some of their local fungal friends.

TEACHER INSTRUCTIONS

1. Make single-sided copies of pages 74-82 for each student.
2. Talk to your students about the value of field guides to the scientist and naturalist.
3. Tell them they are going to make their own field guides then hand out the pages and have the students cut them out. Fold the page in half so that the mushroom is on one side and the text is on the other. Stack the pages according to page number.
4. Using a heavy duty stapler, staple the guide together with 2 staples on the top seam.
5. The distinguishing features of many of the fungi in this mini guide have been highlighted. Using a combination of posters, an assortment of field guides and the text provided next to the drawings, have the students colour in the drawings of the fungi. Remind them that there can be a great deal of variation in colour from mushroom to mushroom, even withing the same species, so there is no right or wrong way to colour.
6. Ask them which fungi they are already familiar with and where they may have seen these mushrooms. Remind them that the place where mushrooms grow is called their **habitat**.
7. Take notice that some of the information provided in the field guide would be useful to help answer questions raised through activities in the educator's guide, and you may wish to encourage your students to use their field guides for this purpose.
8. Recommend your students take the field guides with them if they go on a foray.

EXTENSIONS

1. Have students choose a group and then research some of the species in the group and then present some interesting facts to the class.

Activity 4.4



GRADES

3-6

TYPE OF ACTIVITY

Colouring and Assembly of a Mini Field Guide

MATERIALS

- copies of pages 74-82
- scissors
- pencil crayons, crayons or markers
- assortment of field guides for mushrooms of North America (see sources)
- heavy duty stapler
- mushroom posters (optional)

VOCABULARY

habitat

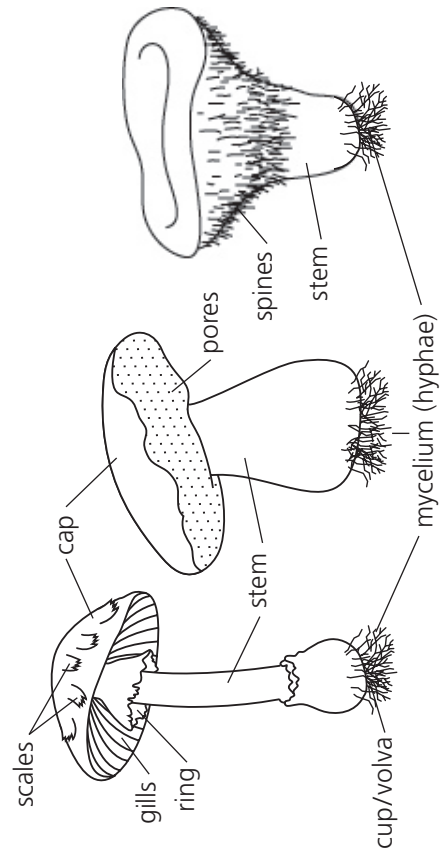
Fields of Fungi

MINI FIELD GUIDE



GILLS, PORES, OR TEETH?

A review of shroomy terminology



The Golden Rules of Mushroom Hunting

1. **NEVER** eat a fungus unless you are absolutely sure that it is safe. Get help from an expert and...

IF IN DOUBT, DON'T EAT IT!

There's no quick and easy test to show if a mushroom is poisonous.

2. **ALWAYS** wash your hands after touching fungi.
3. **NEVER** go onto someone's property without getting permission first.
4. Watch out for **POISON IVY**. Remember, leaves be three, let it be - or it could ruin your day.

Agarics "The Gilled"

WHAT DO THEY LOOK LIKE?

They have a **cap** and **stem** with **gills** underneath the cap.

WHERE ARE THEY FOUND?

Anywhere and everywhere!

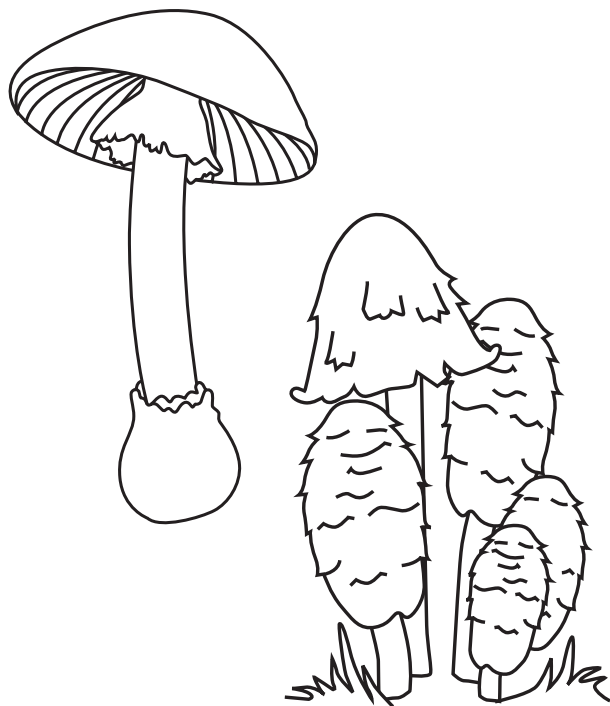
FUN FACTS

- Most commonly thought of as "mushrooms"
- 4000 species
- Found on all continents except Antarctica
- The deadly Destroying Angel mushroom is from this group as is the glow-in-the-dark Jack o' Lantern mushroom!
- A single mushroom may produce as many as 10,000 million spores!

1

FIELDS OF FUNGI

MINI FIELD GUIDE



Shaggy Mane

Boletes “The Pored”

WHAT DO THEY LOOK LIKE?

They have a **cap** and **stem** with **pores** underneath the cap; these mushrooms look “spongy”.

WHERE ARE THEY FOUND?

These mushrooms are usually found growing on the ground but sometimes grow on wood. They are also **mycorrhizal**; see if you can find the tree they are partners with.

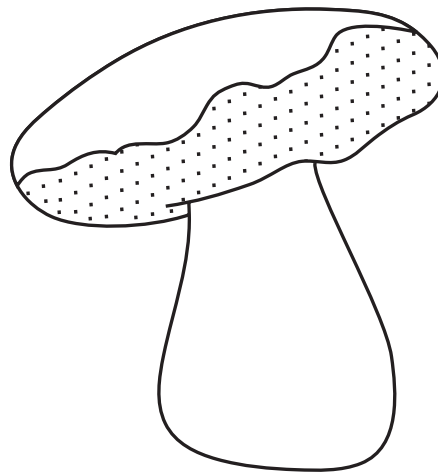
FUN FACTS

- One bolete called the Devil’s Bolete, turns from a creamy colour to bright sky-blue if you cut its flesh. The man who discovered this mushroom said that after he had smelled it, he was sick for days, so he thought it must have been created by the devil.

2

FIELDS OF FUNGI

MINI FIELD GUIDE



Chanterelles

WHAT DO THEY LOOK LIKE?

These mushrooms are vase or trumpet-shaped with **ridges** that start under the **cap** and go down the **stem**.

WHERE ARE THEY FOUND?

These mushrooms are also **mycorrhizal**; see if you can find the tree they are partners with.

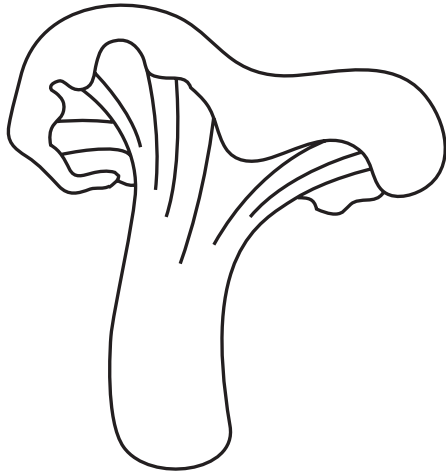
FUN FACTS

- The chanterelle is prized for its wonderful smell, which most people describe as “fruity and like apricots.”
- Some people even make a chanterelle sorbet as a dessert!

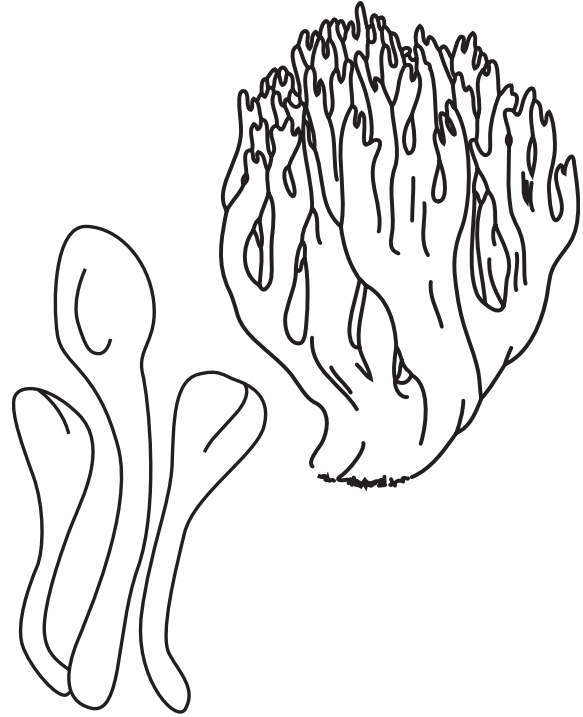
3

FIELDS OF FUNGI

MINI FIELD GUIDE



Coral fungi



Club fungi

Club & Coral Fungi

WHAT DO THEY LOOK LIKE?

Coral fungi are usually branched and really do look like marine coral! They can be white, yellow, orange, red, purple, or tan.

Club fungi are finger-like or club-shaped and can be almost any colour as well.

WHERE ARE THEY FOUND?

They are found on the forest floor, on twigs, or on well decayed logs.

FUN FACTS

- Some coral fungi can be up to 20kg in weight.

Teeth Fungi

WHAT DO THEY LOOK LIKE?

These fungi have a **cap** and **stem** with “teeth” or **spines** that hang like icicles.

WHERE ARE THEY FOUND?

Teeth fungi can grow either on wood or on the ground.

FUN FACTS

- Some teeth fungi are edible and can be found for sale in Chinese markets.
- Some of these mushrooms are used for natural dyes.
- The branching teeth fungi can look like coral fungi but they hang down (like stalactites) whereas the coral fungi grow up (like stalagmites).

4

FIELDS OF FUNGI

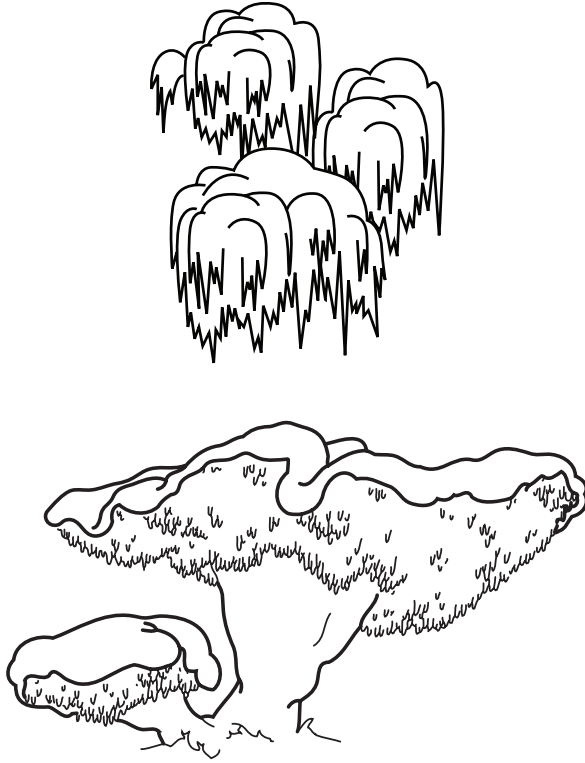
MINI FIELD GUIDE

5

FIELDS OF FUNGI

MINI FIELD GUIDE

Hanging tooth fungi



Polypores

WHAT DO THEY LOOK LIKE?

Also called **bracket fungi**, they have **pores** on their underside but no cap or stem like the boletes and are tough (like leather or wood).

WHERE ARE THEY FOUND?

These mushrooms grow on trees and are heavy-duty wood recyclers!

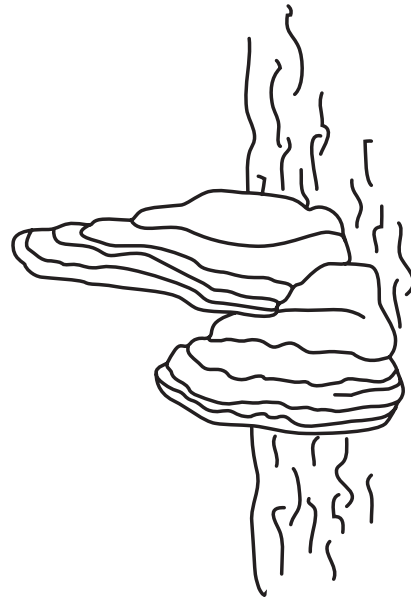
FUN FACTS

- Shelf fungi are used as herbal medicines and were found in a bag on the body of the 5,300 year-old Ice Man mummy (Otze).
- Artists sometimes use these fungi as a canvas.
- If the tree where the mushroom is growing falls over, the mushroom will regrow so its pores always face downward.

6

FIELDS OF FUNGI

MINI FIELD GUIDE



Jelly Fungi

WHAT DO THEY LOOK LIKE?

Jelly fungi are rubbery, seaweed-like mushrooms. They can be white, orange, pink, rose, brown or black. They could be shapeless, shaped like cups, railroad spikes or branched like coral.

WHERE ARE THEY FOUND?

Jelly fungi often grow on logs, stumps and twigs. Some species are **parasitic** on other fungi, mosses, ferns or plants.

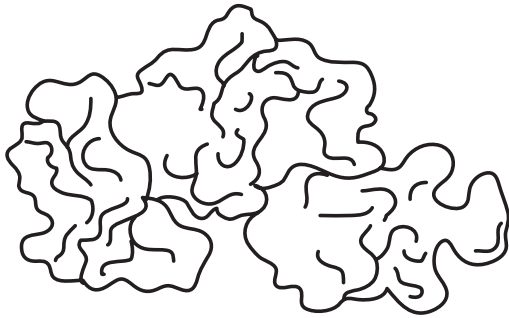
FUN FACTS

- They shrink when the air is dry and then swell up again when it rains.
- The common name of yellow to orange species is witches' butter.

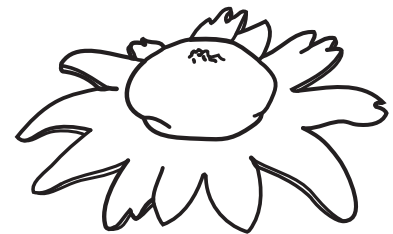
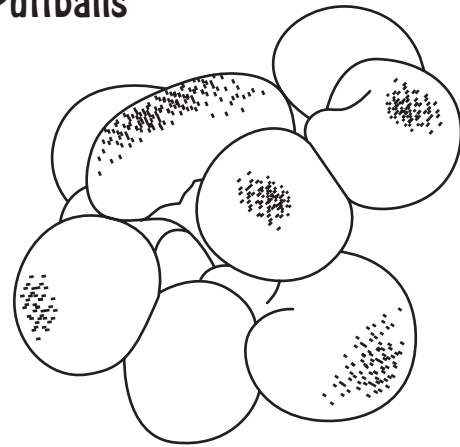
7

FIELDS OF FUNGI

MINI FIELD GUIDE



Puffballs



Earthstar

Puffballs & Earthstars

WHAT DO THEY LOOK LIKE?

Puffballs are round or pear-shaped.

Earthstars are also round or pear-shaped when young, but they open into a star shape with a thin-skinned spore sac in the centre.

WHERE ARE THEY FOUND?

Puffballs are found directly on the ground or on rotten wood. They can be found in meadows, under small stands of trees, around forest openings, and even in your playground! Look for them in late summer and fall.

FUN FACTS

- Some puffballs can be as large as a watermelon.
- They have been called wolf farts or fairy farts.

8

FIELDS OF FUNGI

MINI FIELD GUIDE

Bird's Nest Fungi

WHAT DO THEY LOOK LIKE?

Bird's Nest fungi really do look like a miniature bird's nest. They are very, very small--usually no more than 1cm in diameter.

WHERE ARE THEY FOUND?

The best place to look for these mushrooms is on wood or twigs.

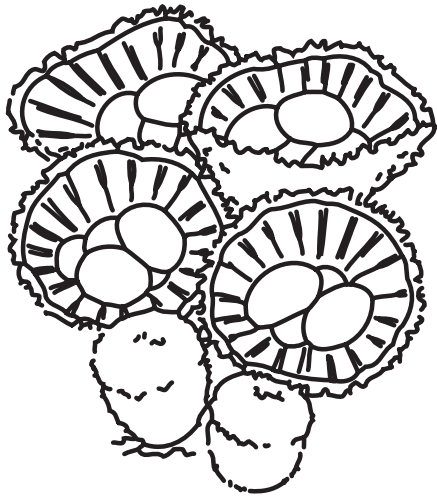
FUN FACTS

- When raindrops fall into the cup, the eggs (that hold the spores) are splashed out some distance away from the nest.

9

FIELDS OF FUNGI

MINI FIELD GUIDE



Basket stinkhorn

Stinkhorns

WHAT DO THEY LOOK LIKE?

You may actually smell this mushroom before you see it! They have a **stem** and a **cap-like**, smelly, slimy top with a **cup** or **volva** at its bottom. The beautiful **basket stinkhorn** lives in the tropics and actually has a lacy skirt. When these mushrooms are small, they look like perfect hardboiled eggs.

WHERE ARE THEY FOUND?

These mushrooms are found on the ground, on rotten wood, on lawns, or in gardens or mulch.

FUN FACTS

- Some stinkhorns can reach a length of 20 cm in only 2-3 hours!
- Their bad smell is meant to attract flies to distribute their spores.

Cup Fungi

WHAT DO THEY LOOK LIKE?

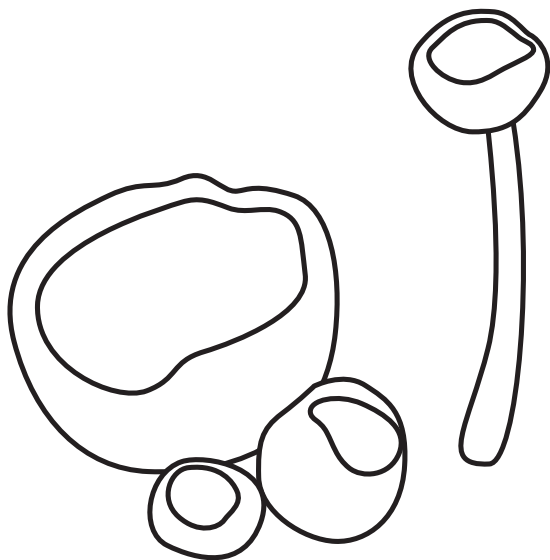
These mushrooms can look like little cups, ears, flasks, goblets, saucers, or orange peels.

WHERE ARE THEY FOUND?

They are found in a wide variety of habitats including in damp basements! Look for them during cool, early spring weather, and again in the fall.

FUN FACTS

- The cup or saucer shape is to expose a large area of hymenium, not to catch raindrops. If you breathe on a ripe cup fungus, you may see it puff.



Earth Tongues

WHAT DO THEY LOOK LIKE?

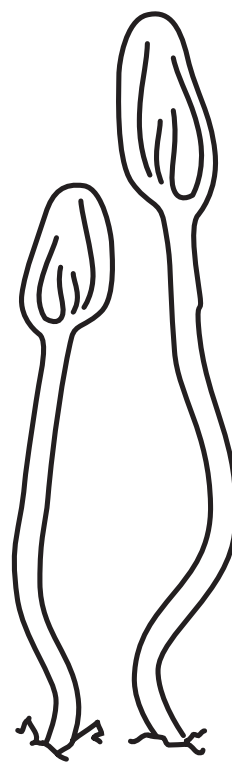
These mushrooms look like mini fire poker or lollipops. They can also look like matchsticks with flattened “heads” or tongues.

WHERE ARE THEY FOUND?

The larger earth tongues live on soil, humus or wood while most of the smaller ones are parasitic on plant stems, leaves and other tissues.

FUN FACTS

- One type of earth tongue named *Neolucta* has been called a “fungal dinosaur”.



Morels & Elfin Saddles

WHAT DO THEY LOOK LIKE?

Morels have a **stem** and honeycomb-like **cap**.

False morels have a wrinkled **cap** and look like little, brown brains.

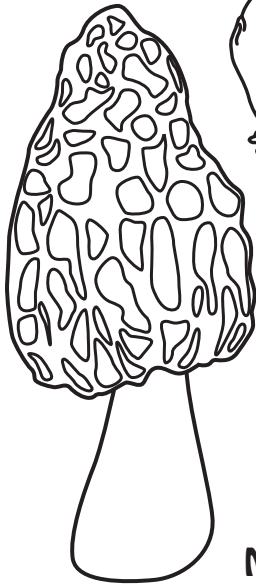
Elfin Saddles have a **cap** that is wrinkled and saddle-like or cup-shaped as well as they have a **stem**.

WHERE ARE THEY FOUND?

Morels and elfin saddles grow in many different habitats. Look for these “early birds” in the spring!

FUN FACTS

- Morels are considered such a delicacy that they sell for \$50-60 per kilogram.
- False morels are very poisonous when eaten raw because they contain gyromitrin which is an ingredient in rocket fuel.



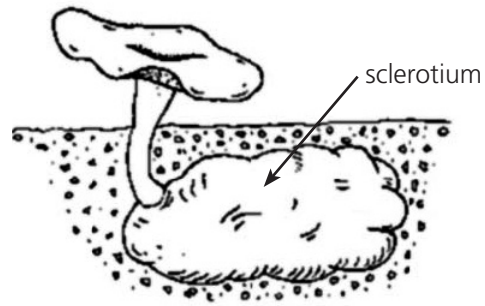
Morel



Elfin Saddles



Truffle



Canadian Tuckahoe

Truffles

WHAT DO THEY LOOK LIKE?

Both truffles and the Canadian tuckahoe look like old potatoes.

WHERE ARE THEY FOUND?

Both of these fungi live underground so they are hard to find! They are also **mycorrhizal**; see if you can find the tree they are partnered with.

FUN FACTS

- Truffles have been called “gold in the soil” and have been considered magical.
- Collected by people for at least 3600 years
- An amount the size of a candy bar would cost \$800.
- The truffles’ spores are spread by chipmunks that find the truffle from their delicious smell.

Checklist of Fungi I Have Found

- | | |
|---------------------------------------|--------------------------------------------|
| <input type="checkbox"/> Agarics | <input type="checkbox"/> Bird’s Nest Fungi |
| <input type="checkbox"/> Boletes | <input type="checkbox"/> Stinkhorns |
| <input type="checkbox"/> Chanterelles | <input type="checkbox"/> Cup Fungi |
| <input type="checkbox"/> Club Fungi | <input type="checkbox"/> Earth Tongues |
| <input type="checkbox"/> Coral Fungi | <input type="checkbox"/> Morels |
| <input type="checkbox"/> Teeth Fungi | <input type="checkbox"/> Elfin Saddles |
| <input type="checkbox"/> Polypores | <input type="checkbox"/> Truffles |
| <input type="checkbox"/> Jelly Fungi | |
| <input type="checkbox"/> Puffballs | |
| <input type="checkbox"/> Earthstars | |

Draw the fungi you find here:

How many centimetres tall is it?
.....

Is it growing on a tree or on the ground?
.....

Does it have gills, pores or spines under the cap?
.....

Which group does it belong to?
.....

Draw the fungi you find here:

How many centimetres tall is it?
.....

Is it growing on a tree or on the ground?
.....

Does it have gills, pores or spines under the cap?
.....

Which group does it belong to?
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.....