

A young man with a green cap and blue shirt is crouching in a lush green forest. He is holding a large, smooth, white mushroom with both hands. The forest is filled with various green plants and trees, creating a dense and vibrant background.

What's that mushroom?

Secrets of fungi and forests

Penny Firth
16 June 2025 for
Lifetime Learning Institute

A young man with a green cap and blue shirt is crouching in a lush green forest. He is holding a large, white, oval-shaped object, likely an egg, with both hands. The background is filled with dense foliage and trees.

DISCLAIMER:
I am an amateur!

Penny Firth

Photos by Firth unless
otherwise marked

Frequently Asked Questions

What is it?



Can I eat it?

Frequently Asked Questions

What is it?

Amanita bisporigera

“Destroying Angel”



Can I eat it?

Only once.



Frequently Asked Questions

What is it?



This is NOT a foraging class

Can I eat it?

Today's talk:

1. Fungi Basics
2. How I am learning mushrooms



Three multicellular kingdoms of life

- ***Plant Kingdom***
- ***Fungal Kingdom***
- ***Animal Kingdom***



What is a fungus?

- *Not a plant or an animal*
- *External food sources & digestion*
- *Chitin cell walls*
- *Spores for reproduction*



Timeline of Earth

Prokaryotes
Bacteria Archaea

Eukaryotes
"Protists" Plants Fungi Animals



Cenozoic 0

Mesozoic

Paleozoic 500

Millions of years ago

Precambrian 2500

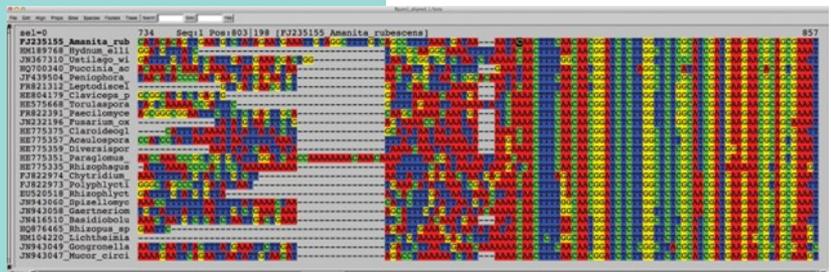
4500

- First humans
- Extinction of dinosaurs
- Plants and symbiotic fungi colonize land
- Oldest animal fossils
- Origin of multicellular eukaryotes
- Oldest eukaryotic fossils
- Oxygen produced by cyanobacteria begins to appear in atmosphere
- Oldest chemical evidence of eukaryotes
- Oldest prokaryotic fossils
- Oldest chemical evidence of life
- Origin of life
- Earth cool enough for crust to solidify
- Origin of Earth

Fungi & animals diverge

Plants diverge

Animals & Fungi more closely related than Plants & Fungi



Animals have
internal digestion.

Fungi have **external**
digestion.



Some animals
(arthropods) have
chitin exoskeleton.

Fungi have **chitin**
cell walls.



Source: Cameron Seafood

Many plants produce seeds.

-multicellular

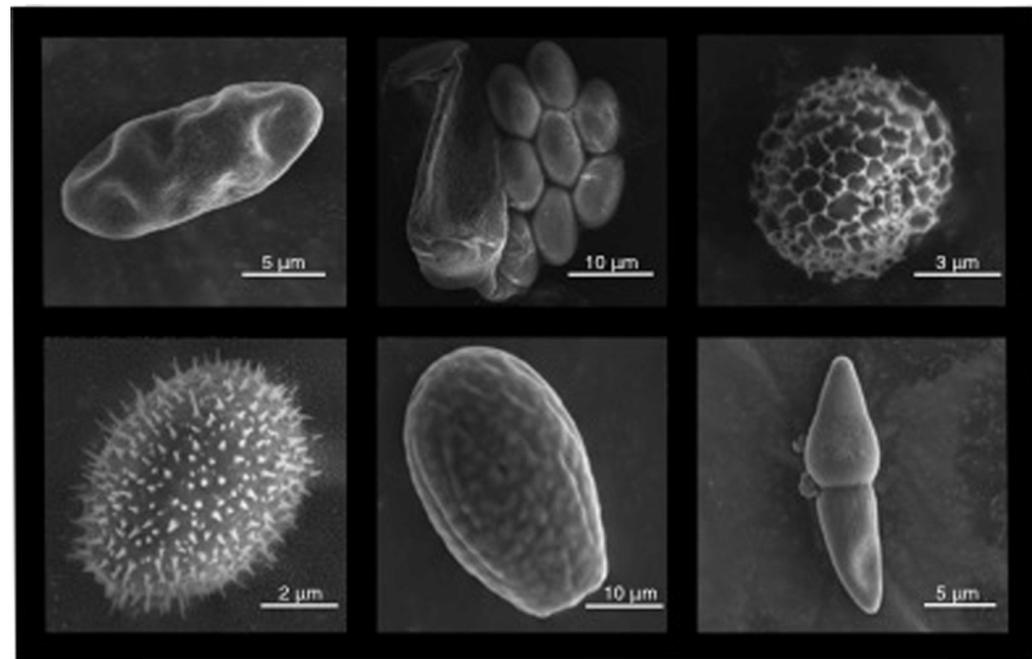
-contain food for embryo



Fungi produce **spores**.

-single cell

-no food for embryo



What are fungal lifestyles and roles?

- *Symbionts*
- *Parasites*
- *Decomposers*



Symbionts

**Extend plant root system with tiny threads: mycelium.
Trade nutrients & water for carbohydrates.
Connect with roots of other trees to form mycorrhizal network.
Help plants survive stress (temp, drought, salt, flooding)**



Amanita jacksonii



Photo by Sir David J. Read
University of Sheffield, UK



Tylopilus plumbeoviolaceus



Calostoma lutescens



Clavulinopsis fusiformis

Parasites & Pathogens

Living host provides food.

Parasite may decompose host after death.



Gymnosporangium juniperi-virginianae "Cedar-apple rust"

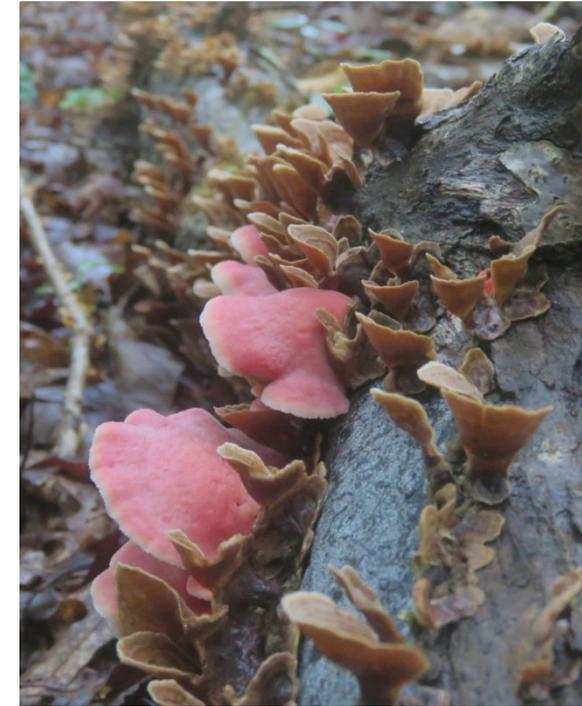


Desarmillaria tabescens
"Honey mushrooms"



Hypomyces sp.
Parasite on bolete mushrooms

Less photogenic:
Chestnut blight
Potato blight
Plant rusts, smuts, mildews
Dogwood anthracnose



Phlebia incarnata
"Rosy merulius"
parasitizing *Stereum lobatum*

Decomposers

Break down and eat organic materials, returning nutrients to soil & improving soil's ability to hold water

Brown rot fungi – degrade cellulose, leaving brown lignin



White rot fungi – degrade cellulose & lignin, leaving pale, fibrous material



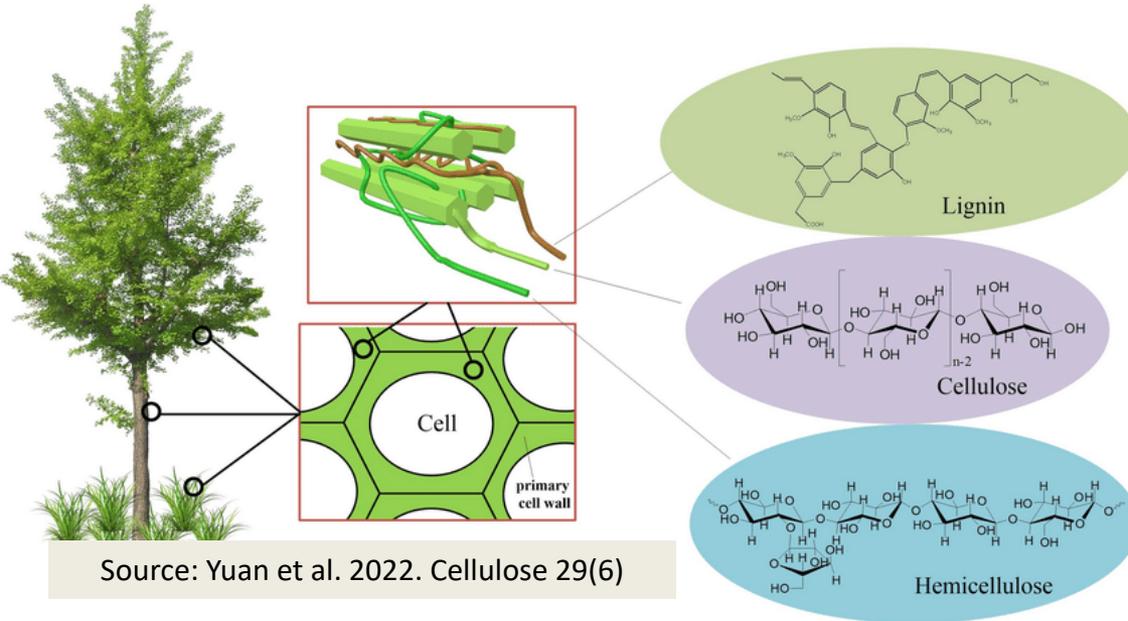
Laetiporus cincinnatus “chicken of the woods”



Trametes versicolor “turkey tail”



Carbon Cycle



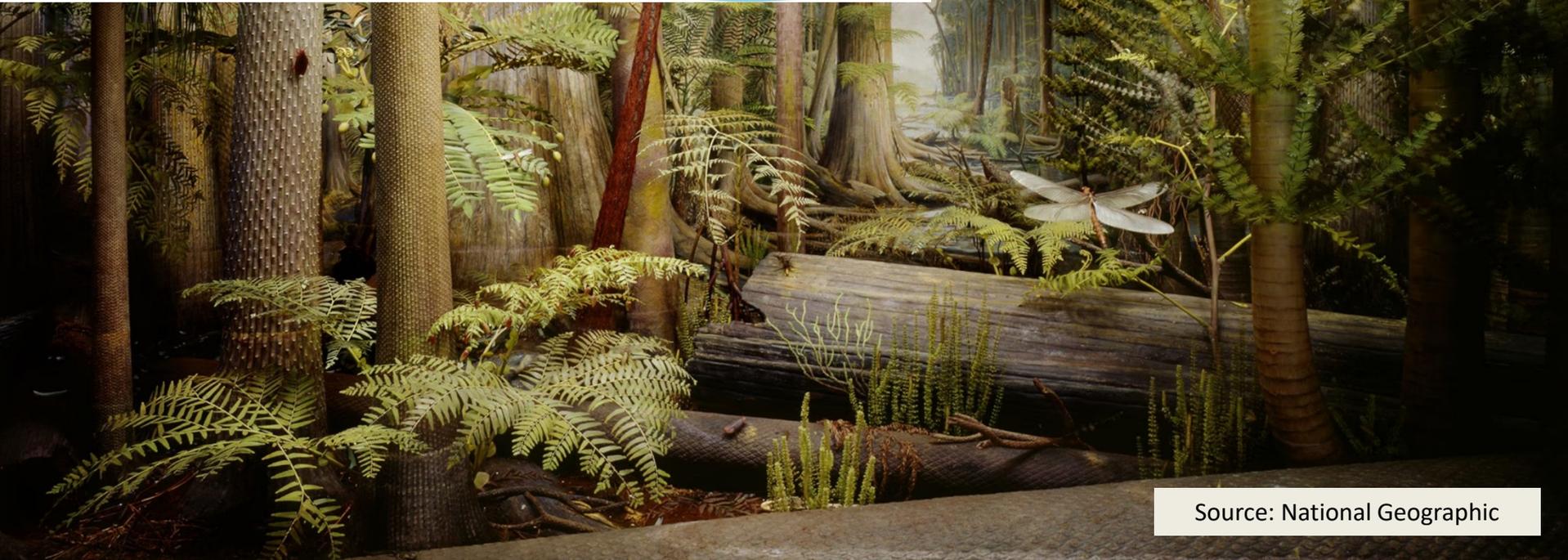
Source: Yuan et al. 2022. Cellulose 29(6)

Plants evolved structural compounds ~400 mya:

- Cellulose
- Hemicellulose
- **Lignin** 

Not much decomp for a long time:
Great coal forests of Carboniferous

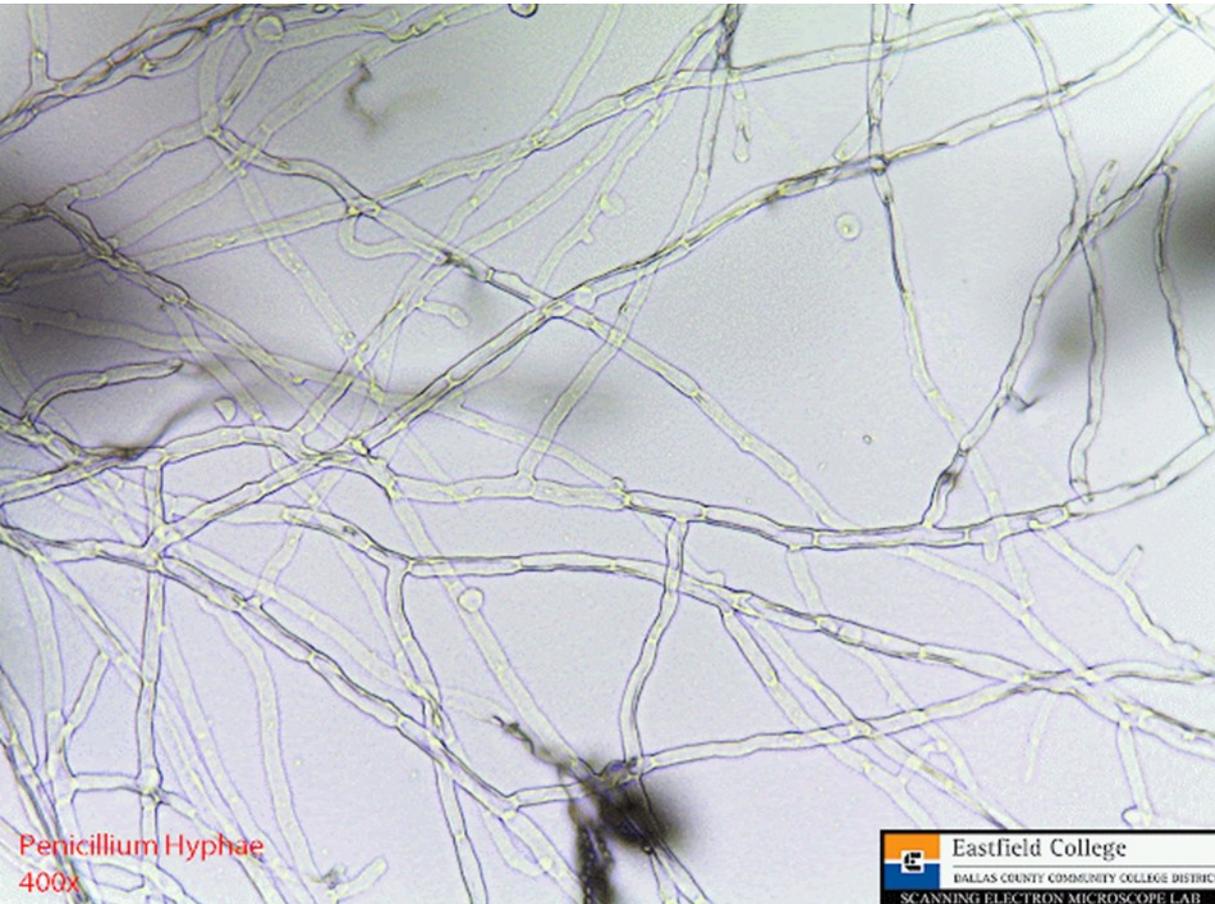
Fungi evolved ability to decompose lignin ~300 mya



Source: National Geographic

Fungi Basics: What is a mushroom?

- ***Fruiting body – usually visible***
 - ***Role is reproduction: produce & distribute spores***
- ***Mycelium – mostly microscopic & out of sight***
 - ***Role is feeding & growth***

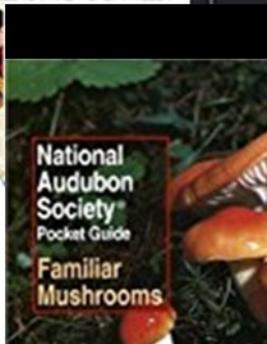
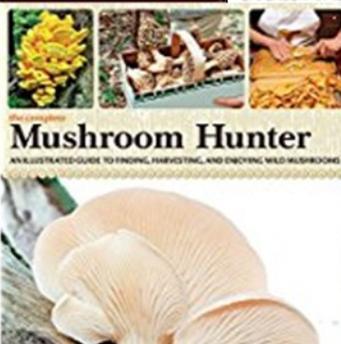
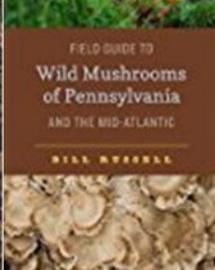
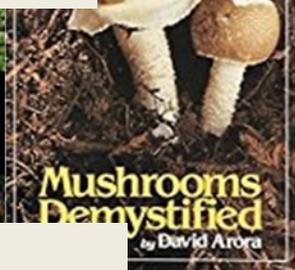
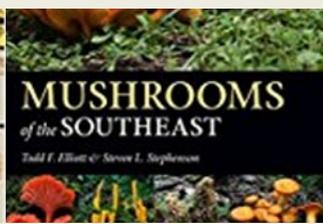
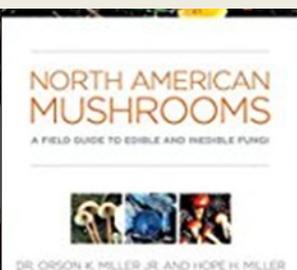
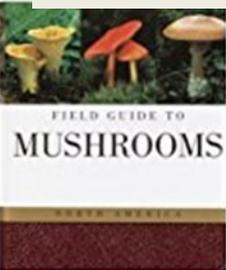


Learning mushrooms...

**Too many to know them all...120,000 known species.
Two to four million undescribed.**



Learning mushrooms...



- Key them out
 - Field guides
 - MushroomExpert.com

MushroomExpert.Com

3100+ MUSHROOMS AND KEYS



This site is the creation of Michael L. L. With some exceptions, the site is based on my collections of North American mushrooms, made over the past 25 years, and the more than 1100 species pages here illustrate and describe these collections, along with collections that have been sent to me by others for study.

MushroomExpert.Com contains no information about the edibility or toxicity of mushrooms. I think mushrooms are much more interesting, engaging, and important than figuring out what happens to humans who digest them—so you will need to consult other resources if eating mushrooms (or avoiding poisonous ones) is your goal.

NEW! Would you like to get an email when new material appears at MushroomExpert.Com? [Let me know](#) and I will add you to the list!

Identifying mushrooms is often much more difficult than identifying birds, for example, or trees. There are tens of thousands of species, many of which have not even been named! Composing mushrooms to pictures is rarely successful. Instead, carefully studying the mushrooms (see the links to the right to get started) and using identification "keys," which ask questions to narrow down possibilities, is a more successful strategy.

Studying Mushrooms
Collecting for Study
Making Spore Prints
Descriptions & Journals
Identifying Mushrooms
Ode & Lute
Pronouncing Latin
Chemical Reactions
Preserving Specimens
Using a Microscope
Mushroom Taxonomy

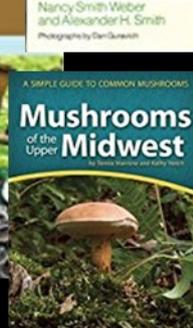
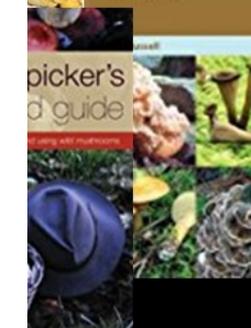
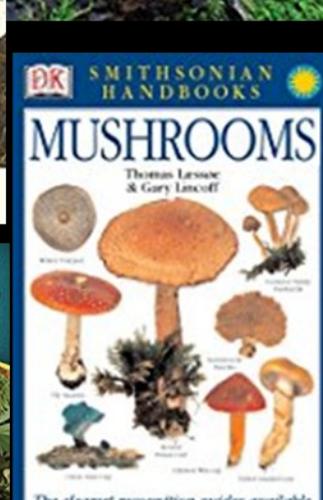
Common Yard Mushrooms

Trees
Identifying trees can be crucial for mushroom identification. For reference, I have made leaf pages for the trees I am familiar with.

Mushroom Identification Keys

Make A Donation
2010: \$848 donated
2011: \$1075 donated
2012: \$835 donated

I am incredibly grateful for the support of my readers. So many have donated over the years, in amounts ranging from a few dollars to hundreds, and many readers donate regularly. Thank you for your generosity! Donations can be made through PayPal, using the button to the right—or feel free to [email me](#) to ask about other ways to donate.



Learning mushrooms...



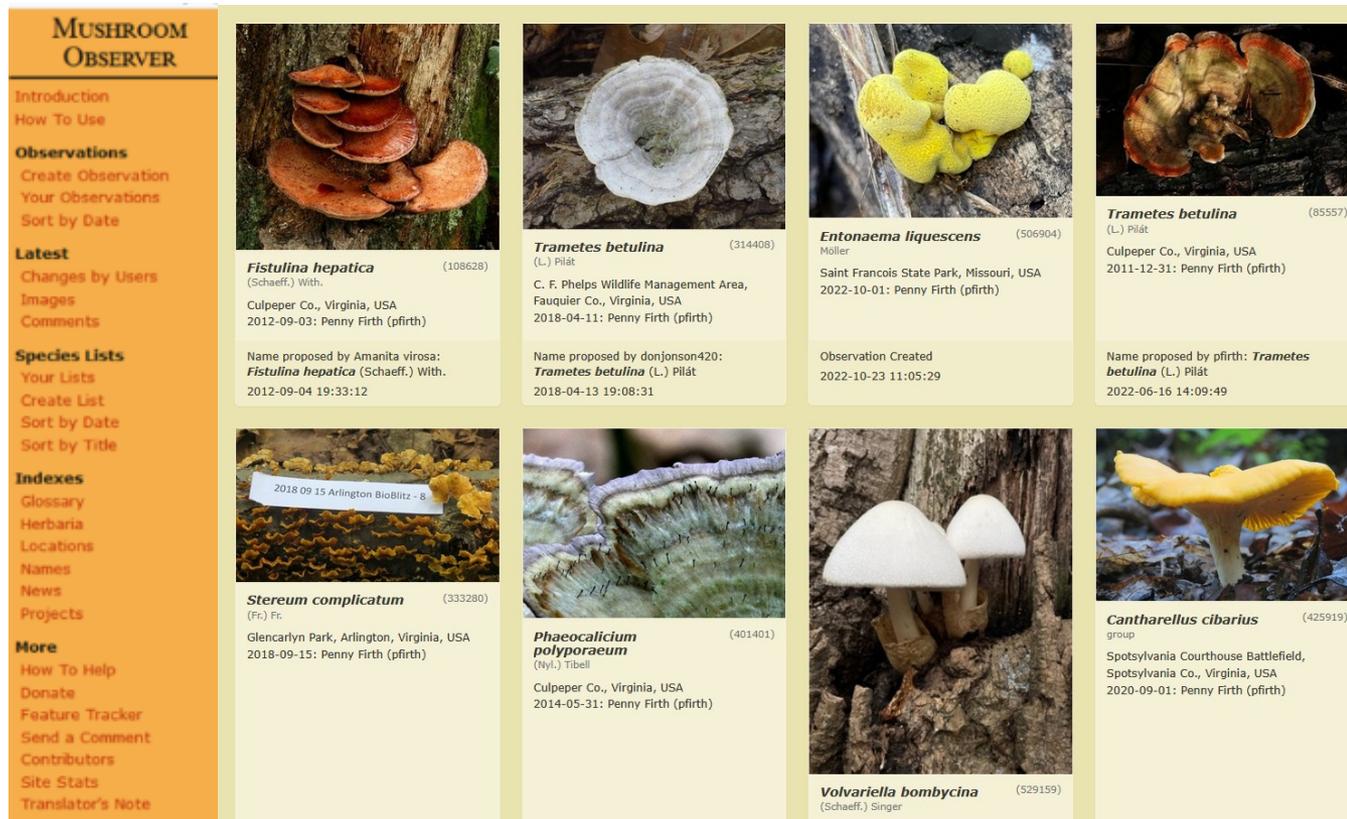
- *Learn from experts*
 - *NAMA*
 - *MAW*
 - *BRMC*
 - *MushroomExpert.com*



North American Mycological Association (NAMA)
Mycological Association of Washington (MAW)
Blue Ridge Mushroom Club (BRMC)

Learning mushrooms...

- **Crowdsourcing**
 - **MushroomObserver.org**
 - **Many Facebook pages**
 - **iNaturalist (limited)**



MUSHROOM OBSERVER

Introduction
How To Use
Observations
Create Observation
Your Observations
Sort by Date

Latest
Changes by Users
Images
Comments

Species Lists
Your Lists
Create List
Sort by Date
Sort by Title

Indexes
Glossary
Herbaria
Locations
Names
News
Projects

More
How To Help
Donate
Feature Tracker
Send a Comment
Contributors
Site Stats
Translator's Note


Fistulina hepatica (108628)
(Schaeff.) With.
Culpeper Co., Virginia, USA
2012-09-03: Penny Firth (pfirth)

Name proposed by Amanita virosa:
Fistulina hepatica (Schaeff.) With.
2012-09-04 19:33:12


Trametes betulina (314408)
(L.) Pilát
C. F. Phelps Wildlife Management Area,
Fauquier Co., Virginia, USA
2018-04-11: Penny Firth (pfirth)

Name proposed by donjonson420:
Trametes betulina (L.) Pilát
2018-04-13 19:08:31


Entonaema liquescens (506904)
Möller
Saint Francois State Park, Missouri, USA
2022-10-01: Penny Firth (pfirth)

Observation Created
2022-10-23 11:05:29


Trametes betulina (85557)
(L.) Pilát
Culpeper Co., Virginia, USA
2011-12-31: Penny Firth (pfirth)

Name proposed by pfirth: ***Trametes betulina*** (L.) Pilát
2022-06-16 14:09:49


Stereum complicatum (333280)
(Fr.) Fr.
Glencarlyn Park, Arlington, Virginia, USA
2018-09-15: Penny Firth (pfirth)


Phaeocalicium polyporaem (401401)
(Nyl.) Tibell
Culpeper Co., Virginia, USA
2014-05-31: Penny Firth (pfirth)


Volvariella bombycina (529159)
(Schaeff.) Singer


Cantharellus cibarius (425919)
group
Spotsylvania Courthouse Battlefield,
Spotsylvania Co., Virginia, USA
2020-09-01: Penny Firth (pfirth)

A photograph of a spotted salamander, likely a Hellbender (Cryptobranchus alleganiensis), resting on a forest floor. The salamander is orange-brown with numerous dark spots and three distinct yellowish-orange spots on its back. It is positioned in the lower half of the frame, facing left. The background is filled with large, light-brown mushrooms with gills, and the ground is covered in dry leaves and twigs. The text "S L O W down" and "Take notice and take pictures" is overlaid in the center of the image.

S L O W down
Take notice and take pictures

Season



Morchella sp. "yellow morel"



Flammulina velutipes "velvet foot"



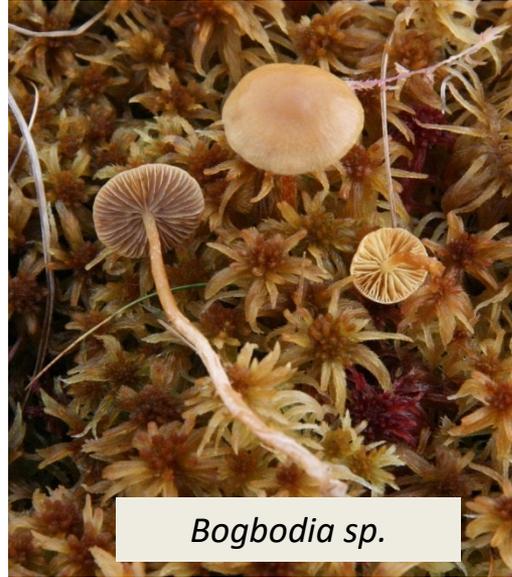
Cantharellus "chanterelle"

Habitat

Rich mixed forest, pine woods, lawn, dry upland, oak/hickory forest, floodplain...



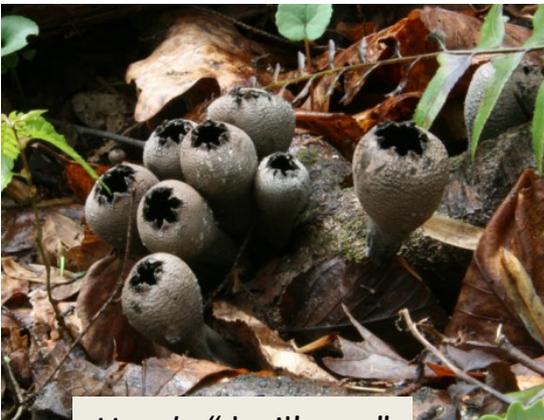
Conocybe apala



Bogbodia sp.



Suillus "slippery-Jack bolete"



Urnula "devil's urn"



Clavaria "amethyst coral"



Coltricia "cinnamon funnel"

Substrate

Dead or living wood, mulch, pine needles, hardwood leaf litter, mushroom, insect...



Pluteus "fawn"



Crucibulum "bird's nest"



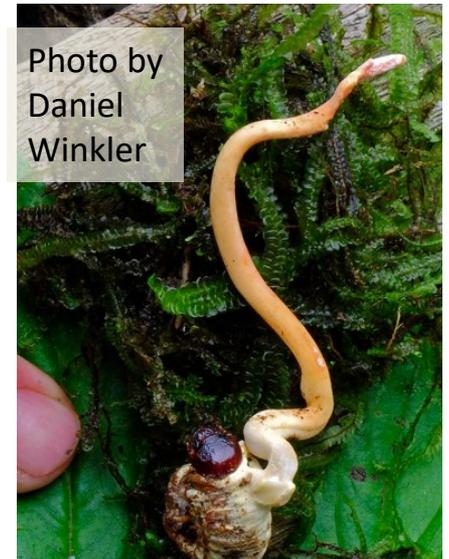
Tetrapyrgos nigripes



Rhodofomes cajanderi
"pine shelf"



Stereum sp. "crust fungus"

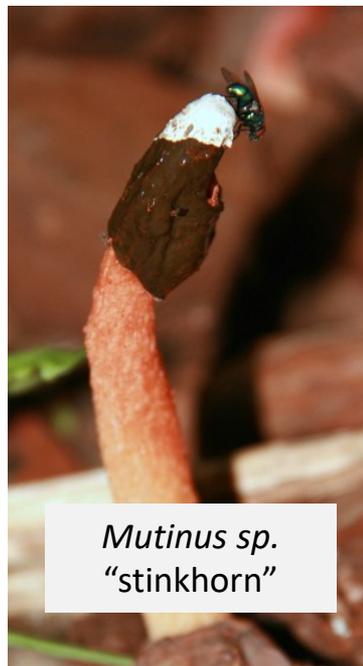


Ophiocordyceps melolonthae
"zombie fungus"

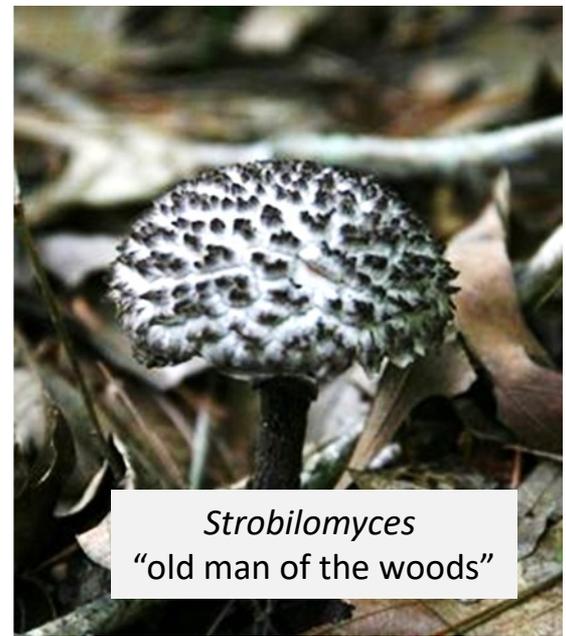
Appearance



Amanita persicina



Mutinus sp.
"stinkhorn"



Strobilomyces
"old man of the woods"



Coprinus "inky cap"



Marasmius "pinwheel"



Sparassis "cauliflower"

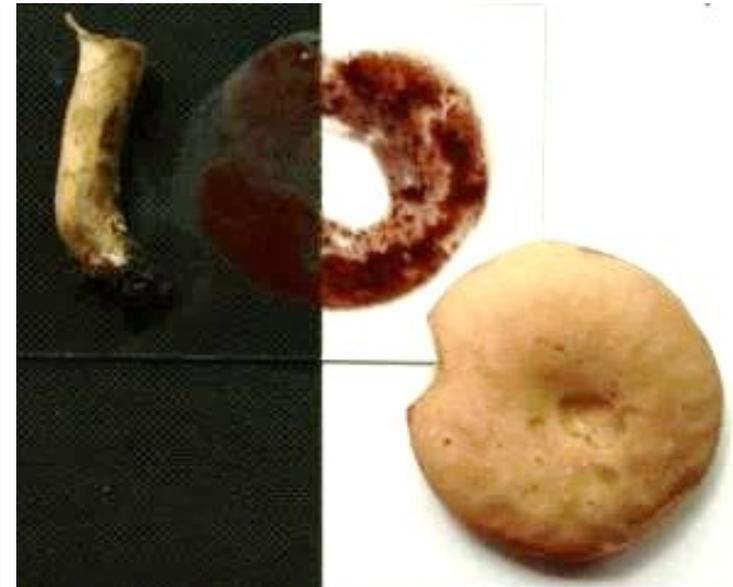
Fertile surface



Stem and base



Spore print



Other features: bruising, latex, odor...



Unmistakable



Entoloma murrayi
"Murray's entoloma"



Cortinarius iodes
"viscid violet cort"



Sarcoscypha occidentalis
"scarlet elf cup"

Unmistakable



Lactarius indigo
"indigo milky"



Cerioporus "dryad's saddle"



Fistulina hepatica
"beefsteak"



Hericium
"hedgehog"

MANY species have lookalikes...



Trichaptum
“violet-toothed polypore”



Stereum
“false turkey-tail”



Trametes versicolor
“turkey tail”



BEWARE lookalikes...

Agaricus cf. campestris
"meadow mushroom"



Chlorophyllum molybdites
"the vomiter"



Cantharellus spp.
“chanterelles”



Omphalotus illudens
“jack-o-lantern”



Armillaria spp.
“honey mushrooms”



Galerina autumnalis
“deadly galerina”



Photo by Tom Volk



Photo by Tom Volk

Lycoperdon perlatum
“gem-studded puffball”



Lycoperdon pyriforme
“stump puffball”



Scleroderma
“pigskin poison puffball”



New things are out there...



Amanita rhodinsulae
Collected Spotsylvania Co., VA
2020 09 09 by PFirth

Only known previously from a single
collection in Rhode Island



Thank you!



Calvatia gigantea "giant puffball"



Arlington BioBlitz 2017

A good foraging class

<https://courses/learnyourland.com>

Adam Haritan

Foraging Wild Mushrooms

This self-paced online course teaches you how to successfully forage mushrooms from the wild. Included in this course are instructional videos on mushroom ecology, mushroom biology, common edible mushrooms, medicinal mushrooms, poisonous mushrooms, cooking techniques, and medicine-making.

[VIEW DETAILS](#)





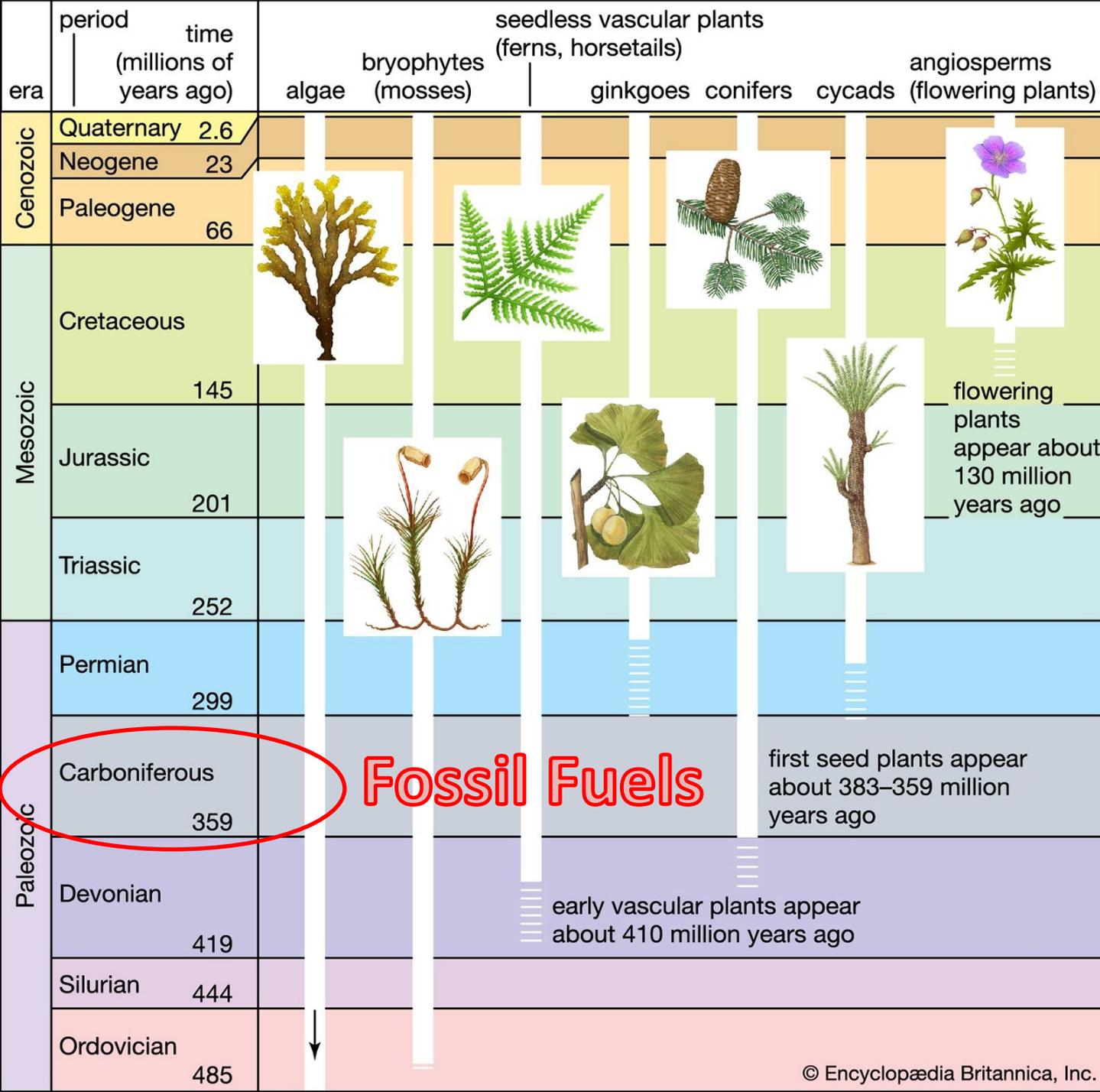
Is it a mushroom?



Cladonia
“reindeer moss”



Fuligo septica
“dog-vomit slime mold”



Fossil Fuels

Fungi evolve lignin decomposition

Plants evolve lignin; early trees

Fungi Basics: Reproduction

