

## Activity Student handout

# GROWIN' GLOWIN' FUNGI

Grow your own bioluminescent fungus

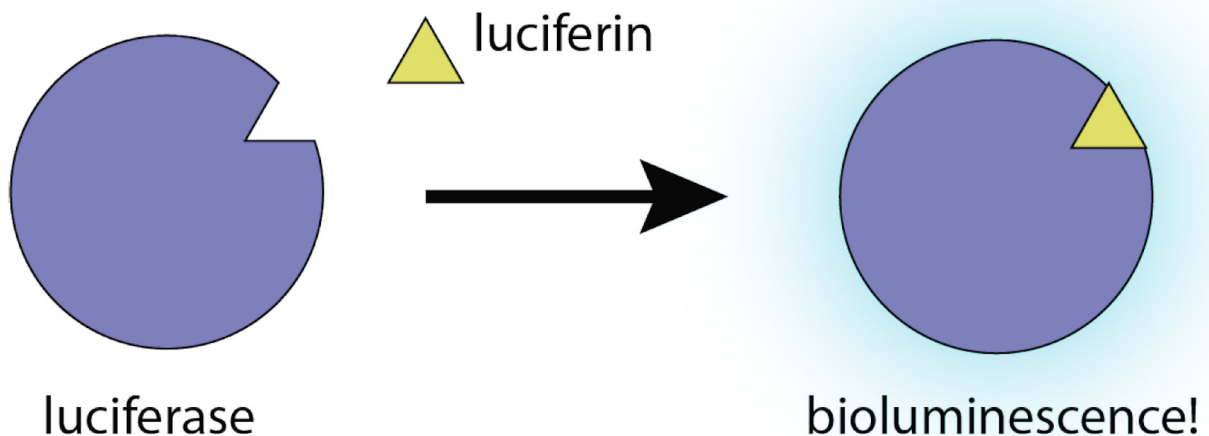
## Materials

- Bioluminescent Fungus Kit  
*Available from Carolina Biological Supply ([www.carolina.com](http://www.carolina.com)). Link is provided as information, not endorsement.*
- Pen, pencil, crayons, or colored pencils

## What is bioluminescence?

**Bioluminescence** is light produced by a **chemical reaction** inside a living thing.

Bioluminescent species may use different specific reactions to generate light, but the recipe for this 'living light' often contains two key ingredients: a **luciferase** enzyme and a **luciferin** molecule. The luciferase enzyme contains a small area that finds and binds the luciferin molecule. When the luciferin molecule binds to the luciferase enzyme, a chemical reaction occurs and the luciferin releases light that we can see!



# Where can we find bioluminescent species?

Have you ever been walking outside in the summertime and noticed the flickering of little lights in the sky as day becomes night? These flashing lights likely come from fireflies, a fantastic example of a bioluminescent animal. Scientists think that fireflies actually use their bioluminescence to communicate with each other!



Most bioluminescent organisms live in the ocean but there are also some species, like the fireflies, that spend their lives on land. Did you know that scientists have described glowing species of insects, snails, and even worms?! While nobody has described a bioluminescent plant (yet!), there are actually around 77 scientific records of bioluminescent **fungi**!



Fungal bioluminescence (called 'Foxfire' or 'Fairy Fire') in *Panellus stipticus*

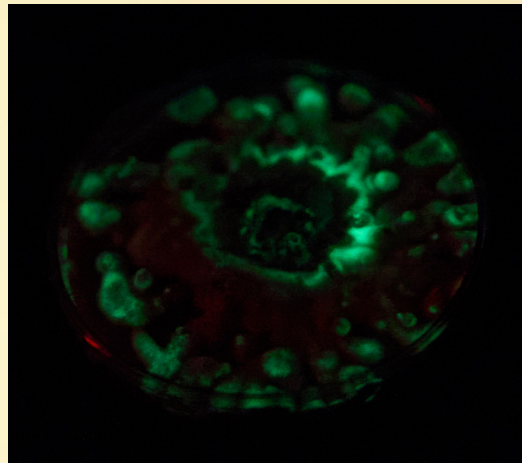
Many fungi perform very helpful ecosystem services like decomposing dead matter into nutrients that other organisms can use. Others are edible and tasty like morels, portobello, and oyster mushrooms. The drug penicillin, which comes from a fungus, can help keep us healthy by attacking harmful bacteria. While fungi like these are thought to be helpful from the perspective of humans, some species are known to have a more negative impact on their environments. Over the next month, you will be making careful observations about the growth and bioluminescence of *Armillariella mellea*, a fungal species that has been known to cause extensive damage to the trees in the forests where it lives.

# WANTED

The Notorious Forest Tree Pathogen

*Armillariella mellea*

Alias: Honey Fungus



**Wanted for the destruction of the roots of healthy trees!**

## Distinguishing features:

- Low-level bioluminescence
- Glow is observed only in the 'mycelium'
- The fruiting bodies (mushrooms in the case of this species) are not luminescent

## Known hangouts:

- Fruiting bodies will be found clustered at the base of infected trees
- This fungus can be seen growing (and glowing!) in North America, Asia, and Europe

# The Fungi Facts

Before getting to know your new fungal friend through careful observations you may be thinking, “This isn’t what I thought a fungus looked like! Where’s the mushroom?” To help you understand this activity better, let us quickly go over this and a few other common misconceptions and misunderstandings about fungi.



**All fungi look like mushrooms**

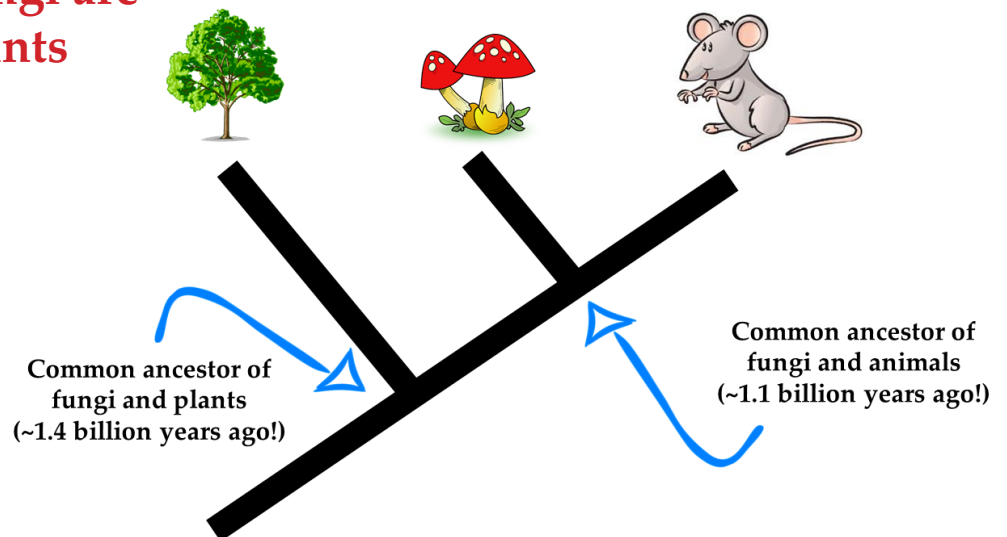


**Mushrooms are formed during the reproductive phase for some fungi, but not all fungi make mushrooms to reproduce!**

Fungi have a diversity of reproductive strategies, and only some fungi make **fruiting bodies** (mushrooms are just one example) as part of that process. Often less noticed is the **mycelium**, the vegetative part of the organism that typically grows underground, but can actually grow on a variety of surfaces. You can easily observe the thread-like mycelium of your fungal culture by examining the bottom of your plate.



**Fungi are plants**



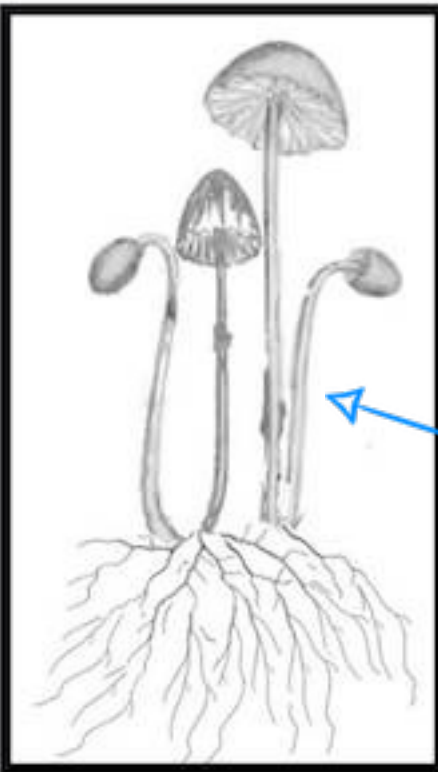
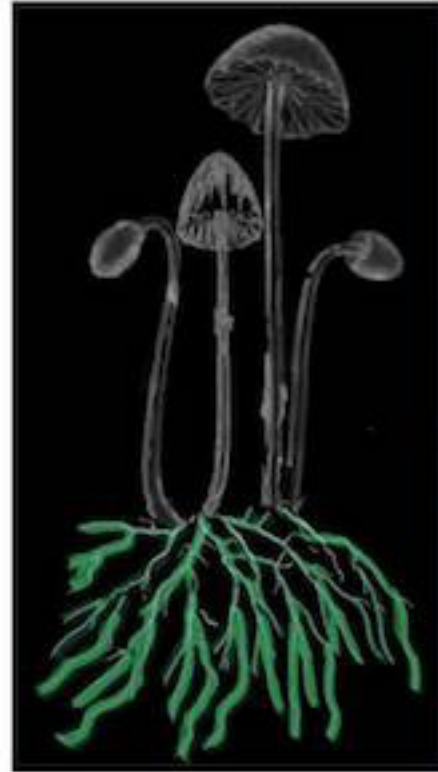
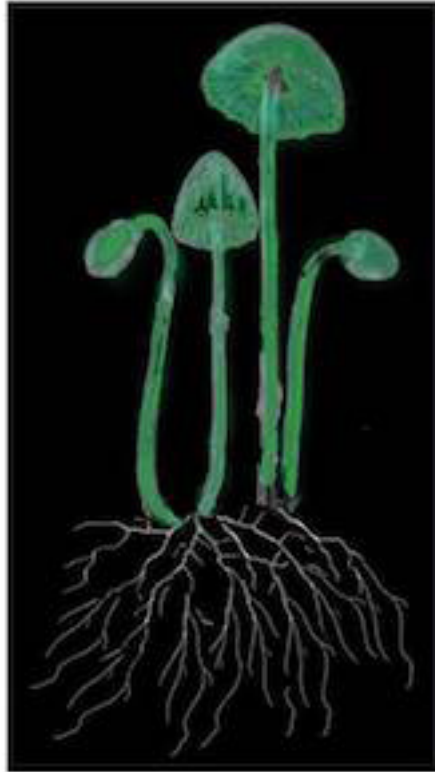
**Fungi are not plants, but their own kingdom!**

In fact, fungi and humans are closer relatives to each other than either are to plants! When scientists compare the DNA sequences of plants, animals, and fungi they discovered that the DNA of fungi was more similar to animal DNA than plant DNA. Fungi, plants, and animals are all on their own evolutionary paths!



# The Fungi Facts

In the case of your bioluminescent fungus, only the mycelium will emit light. There are fungi though in which only the fruiting body or both the fruiting body and mycelium are luminescent!



*Psst! Feel free  
to color your  
own  
bioluminescent  
fungi here!*

Cannot get enough Fungi Facts? visit: <http://tolweb.org/Fungi/2377>

## Activity: Part 1

Use the space below to document weekly observations. Taking notes, sketching, or coloring are all great ways to record your observations! Be sure to collect observations in light (left) and dark (right) conditions. Week 0 will include your first day of observations.

Week 0

Date:

## Week 1

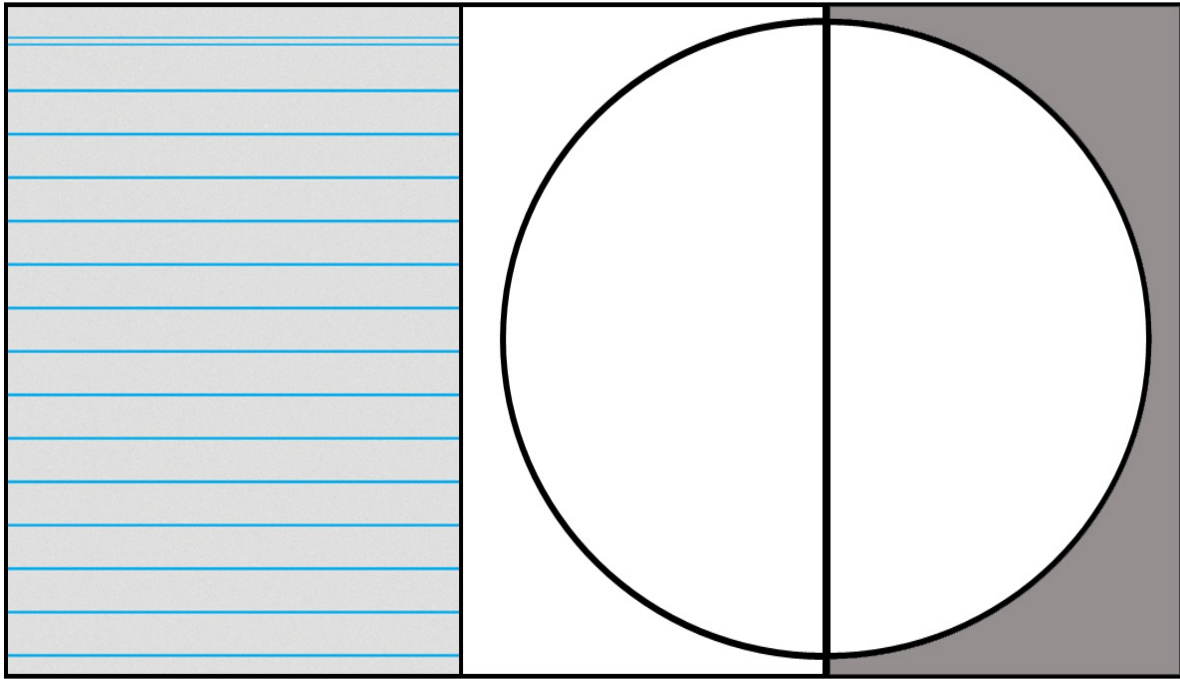
Date:

# Activity: Part 1

Continue recording your observations in the space below.

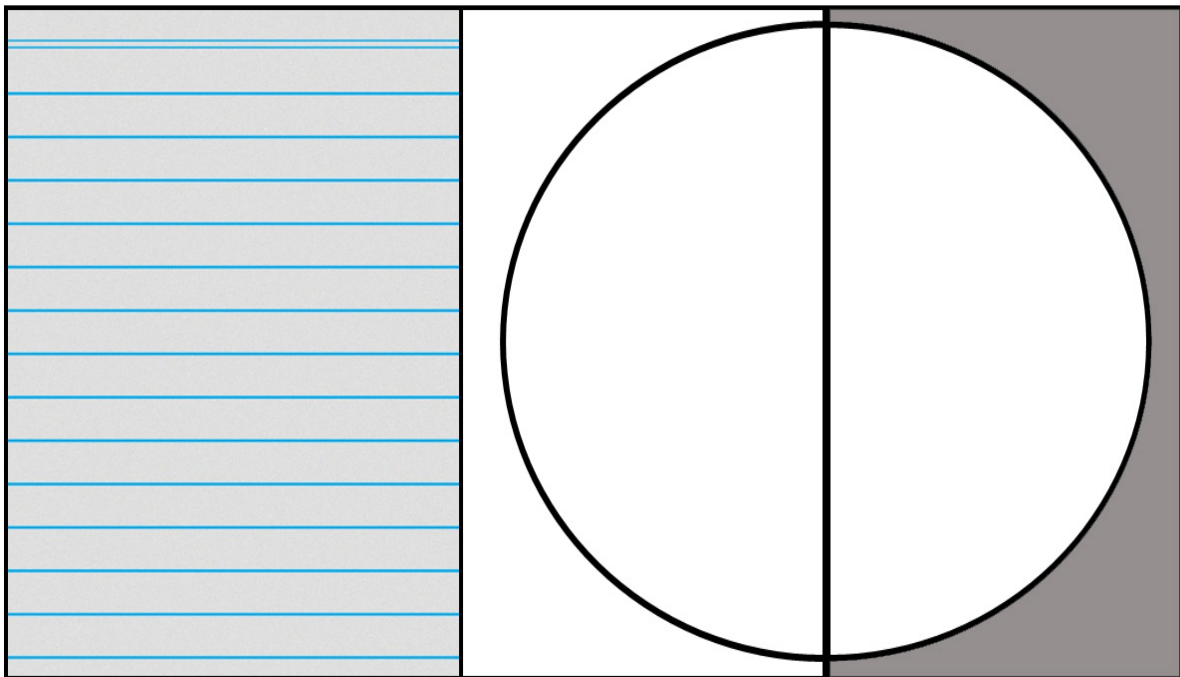
Week 2

Date:



Week 3

Date:

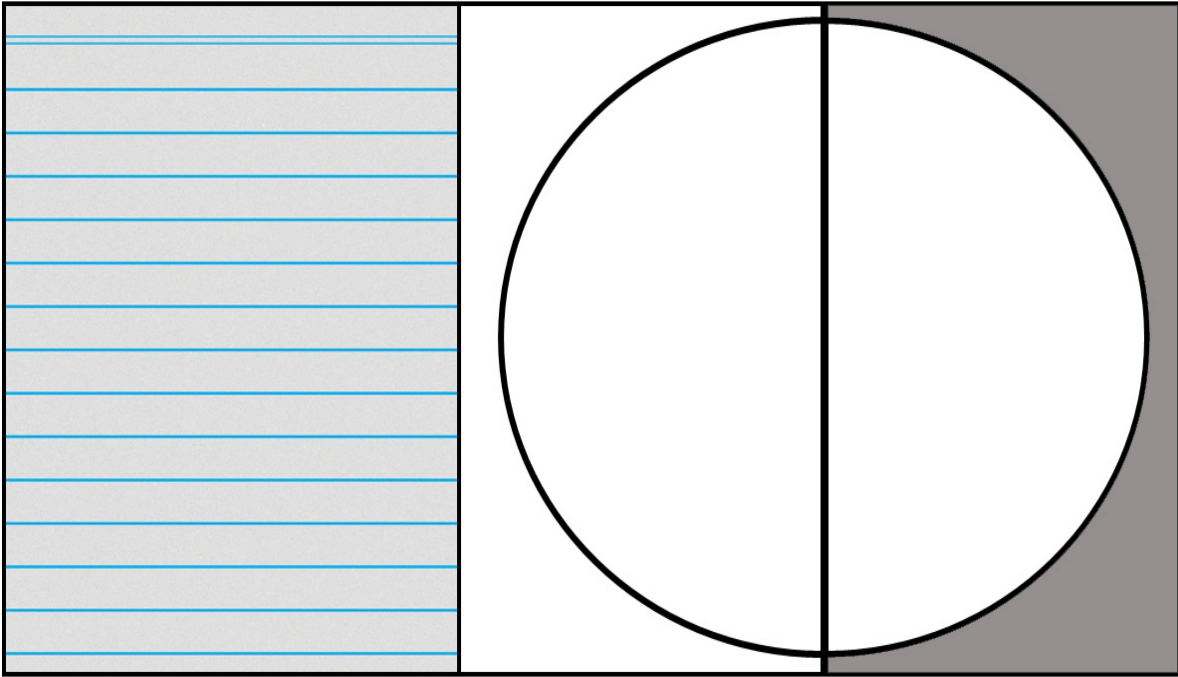


# Activity: Part 1

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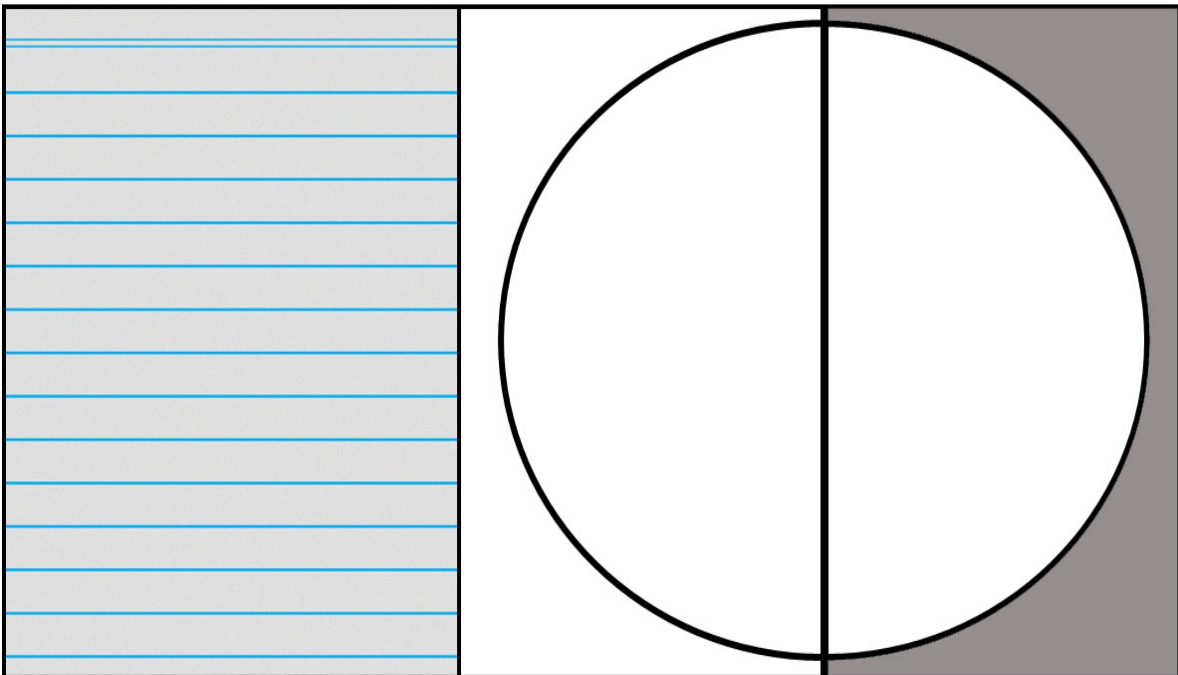
Week 4

Date:



Week 5

Date:





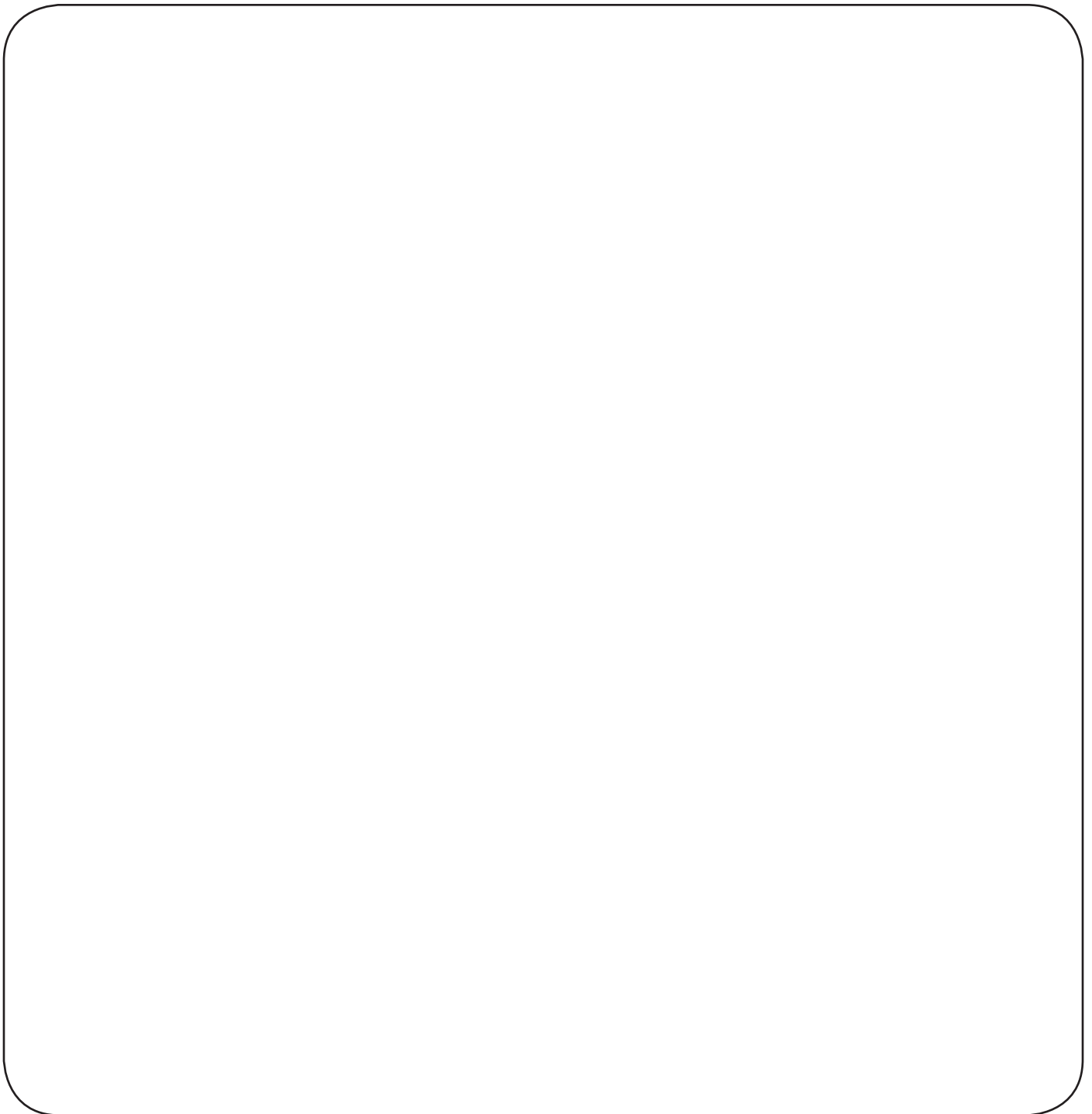
## Activity: Part 2

With an adult's help, find an example of a species of bioluminescent fungi that emits light from the fruiting body. Draw that species in the box below.

Hint: Take a look at *Panellus stipticus* or *Mycena fera* for example

**Genus:**

**Species:**



# Glossary

**Bioluminescence** - light produced by a chemical reaction within a living thing.

**Chemical reaction** - two or more substances interact to become a new substance.

**Fruiting body** - a reproductive structure formed in some groups of fungi.

**Fungi** - plural for **fungus**, eukaryotic organisms classified in a separate kingdom from plants and animals.

**Luciferase** - the type of enzyme (a protein) used in a bioluminescent reaction.

**Luciferin** - the small molecule broken down during a bioluminescent reaction.

**Mycelium** - the vegetative portion of a fungal organism which is a mass of hyphae. **Hyphae** are the filaments that make up the body of fungi and are involved in a variety of functions, including nutrient absorption and water transportation.

**Pathogen** - a disease-causing organism.

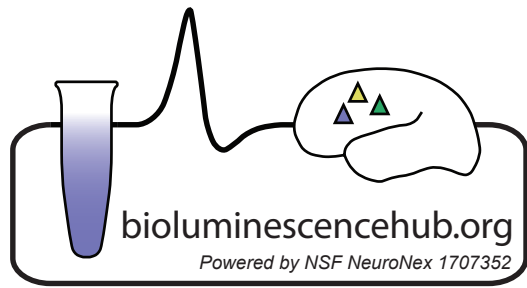
## Learn More

To learn more about fungi and bioluminescence, visit the following (non-affiliate) websites:

- The Bioluminescence Web Page: <https://biolum.eemb.ucsb.edu/>
- National Geographic Encyclopedia:  
<https://www.nationalgeographic.org/encyclopedia/bioluminescence/>
- Tree of Life Web Project, <http://tolweb.org/Fungi/2377>

*Photos:*

*Common Firefly, Art Farmer (Evansville, IN); Panellus stipticus, Ylem, WikiCommons; Armillariella mellea, Dr. Nathan Shaner; Amanita muscaria, Onderwijsgek; WikiCommons*



Activity  
Teacher / Parent

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## Learning Objectives

At the end of this activity, students should know...

- Bioluminescence is light created by a chemical reaction within or by a living thing.
- There are terrestrial bioluminescent organisms.
- There are bioluminescent fungi.
- Light emission in fungi can be observed in the mycelia, the fruiting bodies, or both structures.

## Tips

Part 1:

- *Armillariella mellea* emits a low-level bioluminescence. For optimal viewing, students should work in a location that is as dark as possible. Additionally, allowing your eyes enough time (5-10 minutes) to adjust to the darkness is ideal.
- The culture may take 1-2 weeks for bioluminescence to be observed. Encourage students to still make and record observations. The culture will likely last 8 weeks.
- It is possible that other organisms (bacteria and other fungi) will make the bread crumb agar their home. Students can include this information in their observations as well. It is still possible to observe bioluminescence despite their presence. To minimize the risk of contamination, advise your learners to keep the culture closed.

Part 2:

- **Email us a photo of your students' drawings and your mailing address, and we will send you a prize! We might use your drawing on our website!**

## Questions?

Enjoy this activity? Want to learn more? Let us know!

Email us at [bioluminescencehub@gmail.com](mailto:bioluminescencehub@gmail.com) and follow us on Twitter and Instagram @BiolumHub.