

Examining Three (Four) Forms of Fungi – SP11

Background Information

For everyday purposes, fungi may be categorized into three categories according to their basic form: mushrooms, yeasts & molds. Mushrooms are shaped like umbrellas. Yeasts consist of single cells. And molds are fuzzy, shapeless, fairly flat fungi. Although these three categories are quite handy, they are not used in the classification of fungi because they do not reflect the evolutionary relationships among fungi.

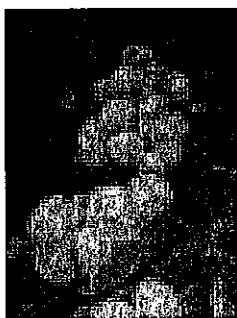
In this investigation you will observe and compare the structures of a yeast, a mushroom, and a mold.

Problem: How are yeasts, mushrooms and molds similar? How are they different?

PROCEDURES:

Part A1: Ascomycota (Yeast) Under the Scope:

→ Ascomycota

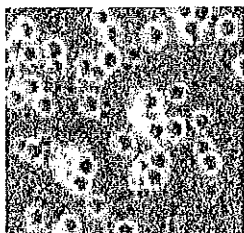


Ascomycetes are commonly known as sac fungi. They are so named because they form spores for sexual reproduction in sacs known as asci. Ascomycetes have both asexual and sexual reproduction stages.

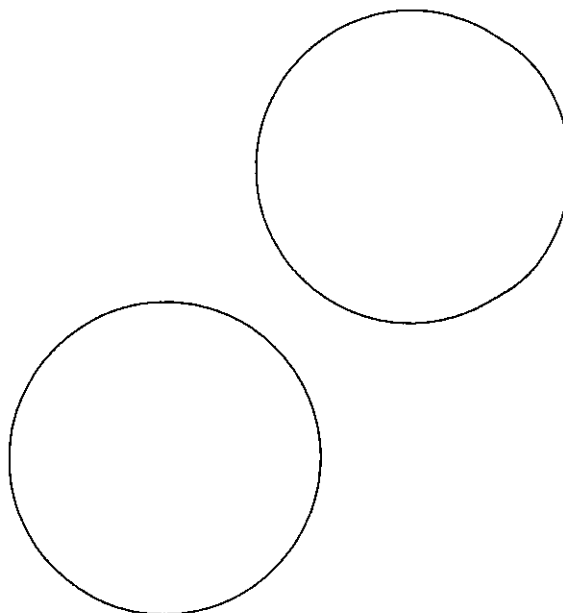
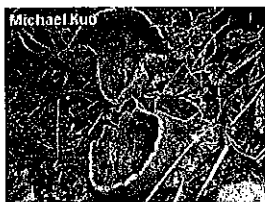
Truffles, morels, and some unicellular yeasts are all found in the Division Ascomycota. They live in damp areas, under the soil, or are found as saprobes on plant material. Half of the species in the Ascomycete Division have symbiotic relationships with algae, this is known as a lichen.

(<http://science.northern.edu/biology/genbio/images/ascomycota.html>)

1. Yeast (2)



2. Peziza (cup fungi) (1)



PART A2: Live Yeast

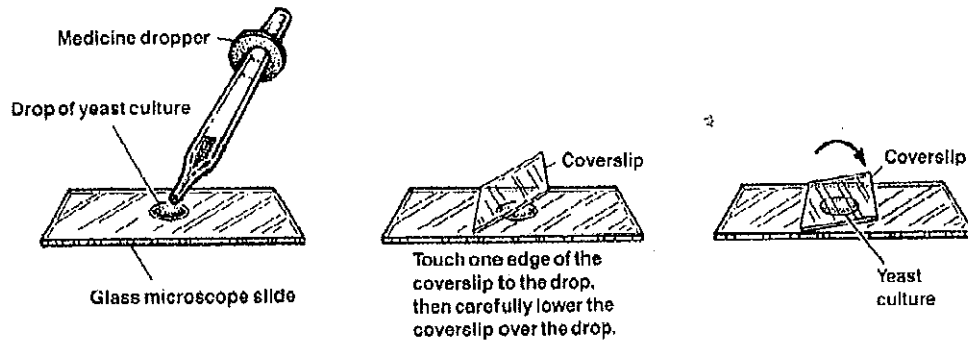
Materials:

yeast culture
1 coverslip

2 medicine droppers
hand lens

1 glass microscope slides
microscope

1. Look closely at the yeast culture. Smell it cautiously by waving your hand over the culture and directing the fumes toward your nose. CAUTION: never inhale fumes directly from a container. Record your observations.
2. Examine the yeast culture with the magnifying glass. Record your observations.
3. Using a medicine dropper, place a drop of yeast culture on a glass slide and cover it with a coverslip.



4. Examine the yeast under the low and high (40X) powers of the microscope. Make a drawing of what you observe. Next to the drawing, record your observations. Be sure to write down in your observation the name of the organism in the drawing and under what magnification you observed it.

Yeast DATA:

| Unaided Eye | Magnifying Glass | Scope Low Power | Scope High Power |
|-------------|------------------|-----------------|------------------|
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Yeast QUESTIONS:

1. What color are the yeast cells? _____
2. Did you see any signs of reproduction in the yeast cells? Explain. _____

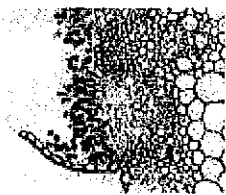
Part B1: Basidiomycota Under the Scope

→ Basidiomycota

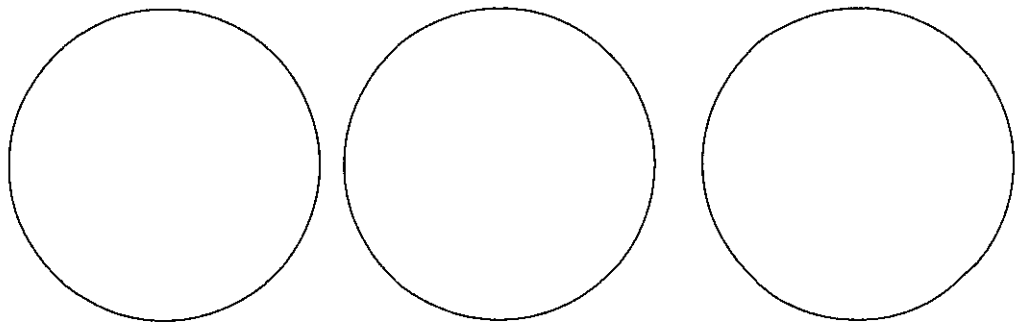
The Division Basidiomycota (Latin = little pedestal) is also known as club fungi because of its club-shaped basidium. The basidium is produced in the diploid stage of the basidiomycete life cycle. The Division includes many decomposers of wood and plant matter. They are the fungi which can best decompose the polymer lignin, found in wood. Mushrooms, puffballs, shelf fungi, and stinkhorns, are all basidiomycetes along with two problematic plant parasites, rust and smut.

(<http://science.northern.edu/biology/genbio/images/basidiomycota.html>)

1. Black Stem Rust (3)
2. Mushroom Gills (1)



3. Puccinia (1)



PART B2: Mushroom Dissection Lab

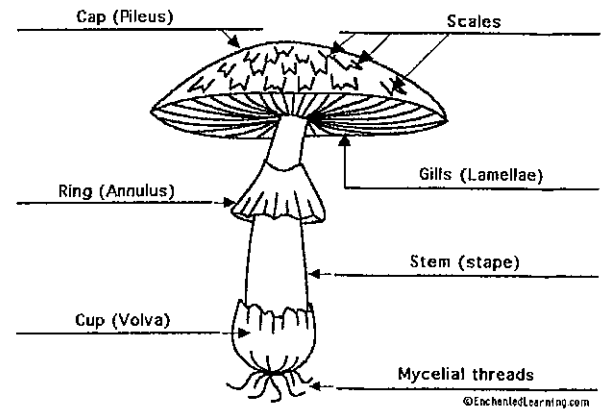
Purpose: The purpose of this lab is to acquaint students with various parts of a typical fungus while practicing observation skills.

CAUTION: Although the mushrooms used in this lab are intended for food, **DO NOT EAT OR TASTE THE MUSHROOMS USED IN THE LAB.**

Background: Fungi are critical parts of most ecosystems and an important part of the diet of many students (and teachers). Mushrooms in the genus *Agaricus* are raised commercially and sold in most grocery stores. The mushroom is actually the fruiting body or reproductive structure of a fungus. In this lab activity students will locate and identify the principle parts of the typical mushroom and study them with both dissecting and compound light microscopes.

Materials:

| | |
|-----------------------|---------------------------|
| Mushroom | Compound Light Microscope |
| Dissecting Microscope | Microscope slide |
| Water Eye Dropper | Paper towels |



Forceps
Cover slip

Procedure:

1. Get your mushroom and place it on the paper towels in front of you. Examine it closely. On a sheet of paper draw a diagram of your mushroom, **labeling the cap, stem and gills**. If the gills are not visible, remove the tissue (it's called a veil) protecting them gently with your forceps. Be careful not to touch the gills with the forceps. Mushroom diagram →

2. Grasp the cap firmly with one hand and the stem with the other hand. Gently wiggle and/or twist the stem until it breaks away from the cap.

3. Pinch the stem between your fingers until it breaks into two or more long pieces. Gently pull the pieces apart. The thin, hairlike filaments you will see where you split the stem are the hyphae. Place the stem section under the dissecting microscope and examine the hyphae. What do they look like? Draw and describe them on your answer sheet. Hyphae diagram →

4. Place the stem pieces on a corner of your paper towel and turn your attention to the cap. Look at the underside of the cap to study the gills. Each gill is lined with thousands of small structures called basidia. Using your forceps, gently remove one gill from the cap. You will get better results if you GENTLY grasp the gill near where it attaches to the cap. Try to avoid touching the free edge, the one along the bottom of the gill, with your forceps. The basidia you want to see under the microscope are fragile and easily damaged if you aren't careful.

5. Place the gill on a microscope slide and use the standard procedure for preparing a wet mount. Gill & Basidia diagram→

6. Place the slide on the microscope and examine the gill under low power. Look at the edge of the gill that was not attached to the mushroom and look for the little finger-like projections. Switch the microscope to high power. Look at the finger-like projections under high power. These are the basidia. If your mushroom is mature the basidia may have spores attached to them. Notice how tiny the basidia and the spores are. Draw and **label the gills, basidia and spores**.

7. After completing your observations and recording your data, clean off your slide and cover slip and place them as directed by your instructor. Wrap the mushroom pieces in your paper towel and dispose of them in the appropriate trash container. Return the microscope and dissecting scope to their proper locations.

Questions and Conclusions:

1. The mushroom you examined contained basidia. To what major group of fungi does *Agaricus* belong?

2. Fungi reproduce by spores. How are spores structurally different from seeds? Is a spore asexual or sexual?

3. How are spores dispersed?

4. What are the advantages and disadvantages of reproducing by spores?

5. Is it autotrophic or heterotrophic? Explain how you know.

6. Smell the mushroom. Compare its smell with some other odor you are familiar with.

7. Where are the spores produced? Label this with a bracket on your previous drawing.

8. When we look at a mushroom we are not looking at the main body of the fungi, only at the reproductive fruiting body. Where is the main part of the organism?

9. Why doesn't the mushroom have any green leaves?

10. Mushrooms produce millions of spores. How does the structure of the gills allow for the production of so many spores? (Hint: surface area)

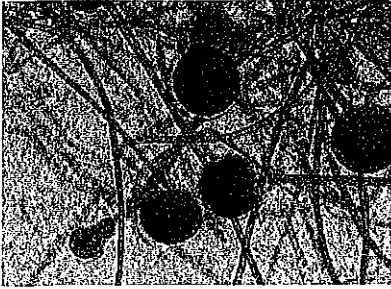
11. Many fungi grow in rings. This was once thought to be a magical place where fairies danced. One type of mushroom is even named the fairy ring mushroom. Give a more reasonable explanation for why they grow in rings. Hint: It is not because the spores fall in rings. Think about the mycelium and the search for food

12. Each year a group of mushrooms grow on the school lawn. They are destroyed when the lawn is mowed for the first time each year. Yet each year they continue to grow in the same place. Explain why.

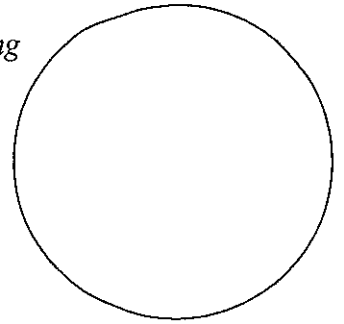
Part C1: Zygomycota Under the Scope

→Zygomycota

1. Rhizopus (black bread mold) (?)



The Division Zygomycota stands for zygote fungi. During sexual reproduction, zygosporangia structures are produced, housing the fertilized gametes. The hyphae of zygomycetes are coenocytic, meaning that there are only divisions (septa) between the nuclei of the hyphae when reproductive cells develop. The zygomycete fungi usually live in the soil, or on decaying plant and animal material.



(<http://science.northern.edu/biology/genbio/images/zygomycota.html>)

PART C2: Live Bread Mold

Materials:

bread mold culture medicine droppers 1 glass microscope slides
1 coverslips hand lens microscope forceps

1. Examine the bread mold both with and without a magnifying glass. CAUTION: Do not try to smell the bread mold. Some people are allergic to mold spores. Make a drawing of the bread mold. Record your observations next to your drawing.
2. As you did in part A, place a drop of water in the center of your slide.
3. Using the forceps, remove a tiny bit of the bread mold. Place the sample of bread mold in the glass water slide. Cover it with a coverslip.
4. Observe the bread mold under the low & high (40X) powers of the microscope. Record your observations as you did for the yeast.

Yeast DATA:

| Unaided Eye | Magnifying Glass | Scope Low Power | Scope High Power |
|-------------|------------------|-----------------|------------------|
| | | | |

Bread Mold QUESTIONS:

1. What is the color of the hyphae in the bread mold? _____

2. Describe how the hyphae are arranged in the bread mold. _____

Analysis & Conclusions:

1. Compare the colors of the yeast cells and the hyphae of the mushroom stalk & bread mold. _____

2. In which kind(s) of fungi did you observe fruiting bodies and spores? What did these structures look like? _____

3. Are the hyphae arranged differently in the mold and in the mushroom? Why do you think this is so? _____

4. Would you expect yeasts or molds to spread more rapidly? Why? _____

5. Why is it an advantage for molds and mushrooms to produce many spores? _____

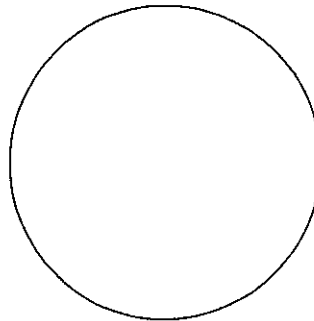
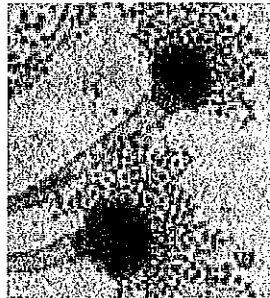
6. Some people think that beer “smells funny.” What is a possible reason for this? _____

7. In areas where leaves fall in the autumn, some people have “allergy attacks” in November, especially if it has been rainy. What do you think might be the cause of the allergies? Explain. _____

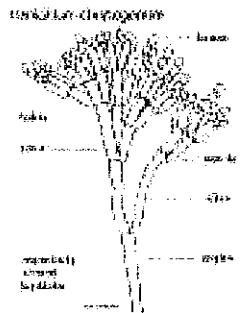
Part D: Deuteromycota Under the Scope:

→ Deuteromycota

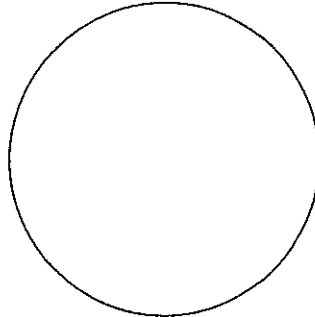
1. Aspergillus (1)



2. Pennicillium



(1)



Etc.:

Lichen (5)

