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| **iLearn BI 101** | **Tabletop Lab: Fungi Diversity** |

You will need one additional resource, which can be found in the course module:

* **Gallery of Mushrooms:** This is a slideshow of species you will identify in part 1.

Collect the following supplies from home:

* 6” ruler with centimeters
* Kitchen knife and cutting board
* 1 mature mushroom (with gills visible) – purchased fresh from grocery store
* Deli container (like for sour cream) or a small bowl
* Several Lichen specimens collected from your yard or local park (or online images of various lichen species that are native to your area)
* Hand lens or magnifying glass

**Introduction:**

Fungi are recognized by several features; they are eukaryotic, heterotrophic, organized with threadlike cells called hyphae, and reproduce using spores. Hyphae often interweave with one another to form a three-dimensional body called a mycelium, but, if present, such a structure represents only a small percentage of the entire body. The following activities will introduce you to the subtleties of fungal life and how fungi are similar and different from true plants.

**Comparative Morphology**

Complete this table.All terms will be used and each will be used only once.

cellulose

consumer

decomposer

external

glycogen

internal

starch

producer

|  |  |  |  |
| --- | --- | --- | --- |
|  | Fungi | Plants | Animals |
| Trophic level |  |  |  |
| Cell wall material | chitin |  | (none) |
| Digestion |  | (irrelevant) |  |
| Food storage carbohydrate | glycogen |  |  |

**Part 1: Fungi Specimen Identification**

In the Fungi Diversity module in the course you will find a PowerPoint presentation with 5 images of different fungi forms. Use the following dichotomous key to fungi on the next page to determine what group/division\* they belong to and complete the table below.

|  |  |  |
| --- | --- | --- |
| Specimen # | Specimen name/Description | Group of Fungi |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

\* ***Division*** is equivalent to phylum level, in classification hierarchy. It is an alternate term used in botany (plant studies) and mycology (fungi studies).

**Key to Some Major Groups/Divisions of Fungi**

|  |  |
| --- | --- |
| **1a** Fungus consisting ***only*** of narrow, thread-like strands (hyphae)  **1b** Fungus consisting of a more solid body (mycelium), may also demonstrate hyphae | Go to 2  Go to 3 |
| **2a** Mold growing on bread; hyphae/threads are white but whole thing appears graying because speckled with black spores  **2b** Not typically growing on bread; but if on bread, different from appearance described above | **Bread Mold (Zygomycota)**  **Water Molds (Oomycota)** |
| **3a** Photosynthetic organisms present in the fungus; surface area large (fungus often flat, sometimes cylindrical but also hollow, or cord-shaped, the body up to 2 mm thick); fungus surface green, greenish white, or sometimes brown, gray, or black  **3b** No photosynthetic organisms present in the fungus; surface area proportionately smaller (fungus mushroom-like, cup-like, vase-like, shelf-like, or other shapes, often more than 2 mm thick); fungus surface usually white, brown, or gray | **Lichens**  Go to 4 |
| **4a** Spores form inside a sac  **4b** Spores form outside a club-shaped cell, from spore bearing surface such as gills, teeth or pores on lower/ventral surface | **Sac Fungi (Ascomycota)\***  **Club Fungi (Basiodiomycota)\*\*** |

\* Examples of Sac Fungi: morels, false morels, cup fungi, truffles, etc.

\*\* Examples of club fungi: gilled mushrooms, boletes, puffballs, etc.

**Part 2: Fungi Microscopic Examination**

***Coprinus plicatilis*, Pleated Inky Cap****.**  Small, common lawn mushroom that grows in little clumps of one to several individuals scattered throughout small areas of lawn.  They have delicate caps that are deeply pleated and almost translucent.  They are brownish, but often with a grayish or even blackish tinge.  The wiry white stalk is relatively tall.  They typically only last a day or two, but while fruiting, new ones will come up each morning for up to several weeks at a time.  Unlike other ***inky-caps***, this one does not auto-digest its gills i.e. decompose their reproductive surfaces; this may be because they dry out before having a chance to do so.

Below are links to websites that give you four different views of *Coprinus sp.*: A macroscopic view and three views from a microscope at varied magnifications.

1. [As viewed from above](http://www.morelmushroomhunting.com/coprinus_plicatilis.htm)
2. [Microscopic views](http://www.usca.edu/biogeo/zelmer/122/fungi/basidio/)

**Analysis:**

After viewing the links above, answer the following questions. You may also want to consult your text to read more about Basidiomycota, which is the respective division for this organism.

1. After examining the last microscopic image in the 2nd link, describe how you identified the spores.
2. What is the name of the cell that the spores develop in? (Hint: examine the lifecycle of Basidiomycetes)
3. What structure contains the cells you identified in #2?
4. What is the name for the nuclei that are contained inside the spores? Are they haploid or diploid?

**Part 3: Mushroom Dissection and Spore Print**

**Purpose**: In this activity you will have the opportunity to really look closely at a mushroom specimen, readily purchased from your local grocery store. It is important that you do not use wild mushrooms for this activity unless you are absolutely sure they are not toxic. Some species of mushroom, particularly mushrooms native to the Pacific Northwest, can be highly toxic simply by touching.

As you dissect you will be observing aspects of your mushroom, such as size, color, location of spore production. These are all examples of data you would collect if you were examining the mushroom for identification purposes.

**Materials**:

* 1 mature mushroom (with gills visible) – purchase fresh from grocery store
* 1 black and white blotter paper – print the last page of this document
* Kitchen knife & cutting board
* Deli container (like for sour cream) or a small bowl

**Methods**: You will record detailed observations, take measurements, and use your data and observations to aid in the self check quiz associated with this lab.

1. **Mushroom Dissection:**
2. Sketch the whole specimen from a side view - try to make your sketch life sized. Use color pencils if this will help it look more realistic.
3. Take measurements on the width of the cap in cm. Record this measurement in your sketch.
4. Take measurements of the stem length, from just under the cap to the base of the stem. Record this measurement in your lab report and label it on your sketch.
5. Next, remove the stem from the cap, cutting as close to the cap as possible without damaging the cap or gills contained within. Measure the diameter of the stem where the attachment site was. Record this measurement in your sketch. Record the internal color of the stem as well. What is the texture or appearance of the stem?
6. Next, cut a pie like wedge from the cap (approximately 1/8 – ¼ of the cap size).
7. Take this pie slice and carefully remove the darker colored gill section. Make an accurate sketch of this structure next to your whole specimen sketch.
8. **Spore Print:**

Since you do not have access to a microscope, examining spores can be a challenge at home. You had the opportunity to look as some microscopic views in the previous activity, but sometimes it is much easier to make connections with the lesson with hands on experience.

A single mushroom spore cannot be seen by the naked eye, but a large collection of them can be easily seen, and is in fact one more tool that mycologists use for identification purposes. Specifically, the color of the spore print is indicative to the group the mushroom belongs to. Although we will not be going beyond making the spore print, it is still a worthy learning experience and, gosh darn it, it is just really cool to see! Since you are unsure whether your spores are dark or light colored, the black and white blotter paper allows you to view the print with both dark and light backgrounds to capture the best view possible in one try.

1. Place the larger portion of the remaining cap onto the black and white blotter paper, gill side down, so that it is positioned over the line where black meets the white (down the middle).
2. Take the cap and the black and white spore paper to place in a dry, safe location (like the top of the refrigerator) and place a deli cup or bowl over the specimen. The deli cup or bowl should not bear down weight on the specimen, but simply protect it and contain the spores. Let this set for 48 hours.
3. After 48 hours, come back to your spore print, and gently lift the deli cup/bowl off the print, then carefully lift the cap. Observe your spore print. If it was successful you should see a grayish or brownish cast of where the gills were, it may be cloud like on the paper. If you don’t see this, replace the cap and covering and allow to sit another day. If no spores print after three days then the specimen is likely is not mature enough and may not make a print. It is highly recommended that you try again
4. Take the spore print and put a strip of clear, shipping tape over the print to protect it. Write down a description of your spore print next to the sketches you made in the last activity.

**Part 4: Lichen**

Lichens are not actual organisms; they are a symbiotic association between fungi and green algae or cyanobacteria. The majority of the structure, called a mat, is the fungal component *(*mycobiont). The mat is constructed from fungal **hyphae**, while spaces within the structure house individual algal or bacterial cells (photobiont). Regardless of whether it an algae or a bacteria species, the photobiont is a photosynthetic organism. The mat contributes protection and water, while the photobiont produces enough extra sugar to sustain the fungi.

In order to get the most out of this activity, live specimens are recommended. Go outside and collect several different varieties of lichen. Try to find specimens of different colors: shades of green, white, yellow, black, or orange can all be found in various species of lichen. If you cannot find live samples in your area, then do a Google image search to find some lichen varieties that are known to be native to your area. Answer the following questions as you examine your specimens.

1. Many lichens are very flat and thin, how does relate to the way they get food (Think surface area)?

If the photobiont is green algae, the lichen is usually green or greenish white (when wet), or orange or yellow. If the photobiont is a cyanobacterium, the lichen is black, gray, or brown.

1. Examine the lichen specimens that you collected. Does your lichen have a green algae symbiont or a cyanobacteria symbiont? Explain how you derived your conclusion.

Specimen #5 in the slide show from activity 2 is ***Lobaria*** ***pulmonaria,*** a lichen.

1. What type of photosynthetic organism is conspicuous in the *Lobaria?*

Look at the pale underside of the *Lobaria.* It will sometimes have small swellings, which may look like pepper.

1. The swellings contain a second photosynthetic organism. Is it a green algae or cyanobacteria?
2. The conspicuous photosynthetic organism in *Lobaria* provides all the food necessary to keep the lichen alive. So why does it have the second photosynthetic organism? What special contribution can this make to the lichen symbiosis? (Hint: Remember from the Nutrient Pollution lab, we learned cyanobacteria are capable of fixing atmospheric nitrogen?)

Black and white blotter paper for your spore print: