

# **Workshop on Kingdom Fungi**

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## **Introduction**

Kingdom Fungi is an ostensibly monophyletic assemblage of ecologically important organisms that not only perform the vital function of decomposition, but also engage in a wide variety of symbiotic relationships with other species. Although once thought to be related to plants, fungi are now known to share a more recent common ancestor with animals than with plants. Several characteristics set fungi apart from all other organisms, as you have learned in lecture.

In today's workshop, your goals will be to

1. Understand the general terminology associated with fungi, their structure and function.
2. Understand the general life cycle of the fungi, and how this life cycle is similar and different in each of the major fungal taxa.
3. Consider the important ecological roles various fungi play as decomposers and as symbionts in a wide array of symbiotic relationships.

## **I. Structure and Function of Fungi: Terminology**

Discuss the precise meanings of the following terms as they relate to fungi.

### **A. Anatomy**

1. mycelium -
2. thallus -
3. hypha (pl. hyphae) -
4. haustoria -
5. coenocytic -
6. septum (pl. septa) -
7. chitin -
8. mold -
9. yeast -
10. saprobe -

### **B. Life Cycle**

1. sporangium -
2. conidium (pl. conidia) -
3. "+" and "-" mating types -
3. plasmogamy -
4. karyogamy -
5. dikaryotic -
6. fruiting body -

### C. Taxonomy

#### 1. CHYTRIDIOMYCOTA

- a. What characteristics to the Chytridiomycota share with more derived fungi?
- b. What characteristics do Chytrids exhibit that are NOT FOUND in other fungi?
- c. Besides the other fungi, with what other major group are the chytrids believed to share an evolutionary affinity?

#### 2. ZYGOMYCOTA

- a. What is the common name of Phylum Zygomycota? Can you think of a familiar example?
- b. In the Zygomycota, describe each of the following, and *list its ploidy (haploid, diploid or dikaryotic)*:
  - i. mycelium:
  - ii. zygosporangium:
  - iii. zygospore:

#### 3. ASCOMYCOTA

- a. What is the common name of Phylum Ascomycota? Can you think of a familiar example?
- b. In the Ascomycota, describe each of the following, and *list its ploidy (haploid, diploid or dikaryotic)*:
  - i. mycelium:
  - ii. ascocarp:
  - iii. ascus:
  - iv. ascospore:

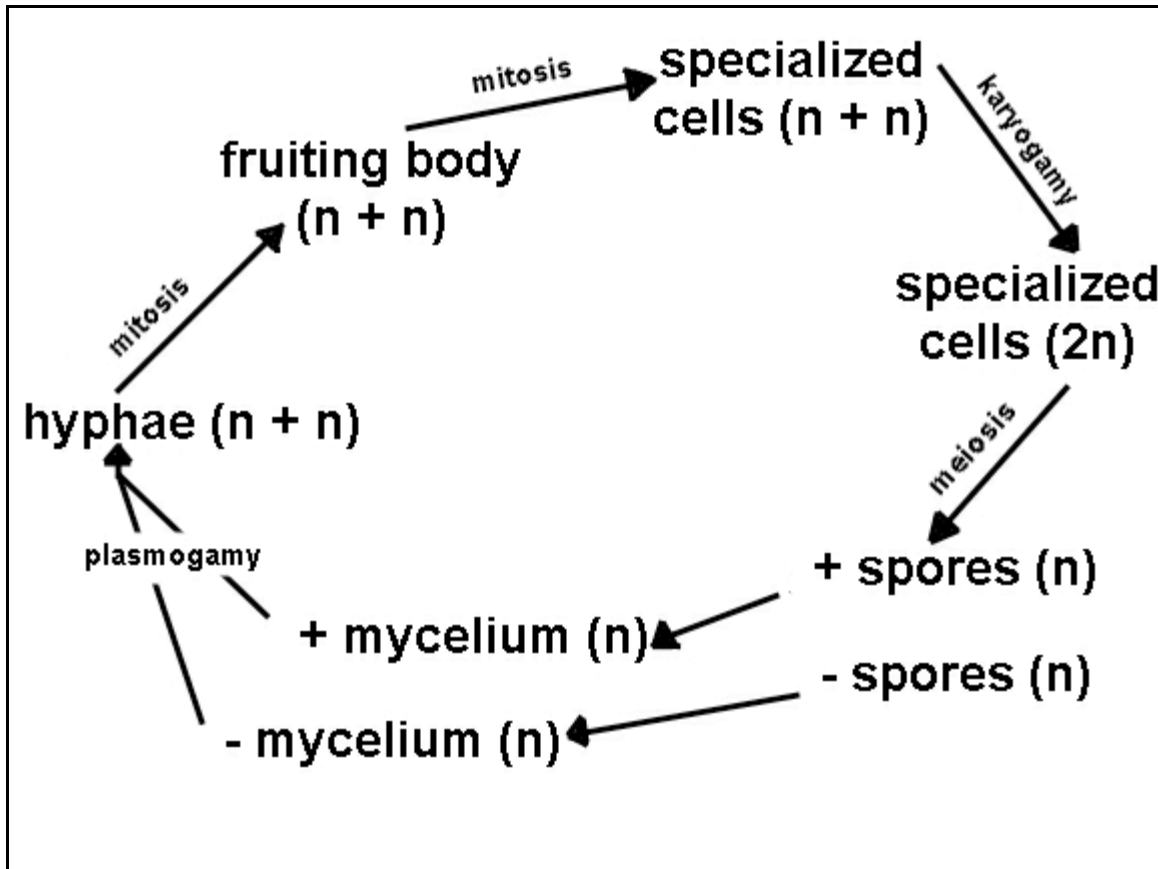
#### 4. BASIDIOMYCOTA

- a. What is the common name of Phylum Basidiomycota? Can you think of a familiar example?
- b. In the Basidiomycota, describe each of the following, and *list its ploidy (haploid, diploid or dikaryotic)*:
  - i. mycelium:
  - ii. basidiocarp:
  - iii. basidium:

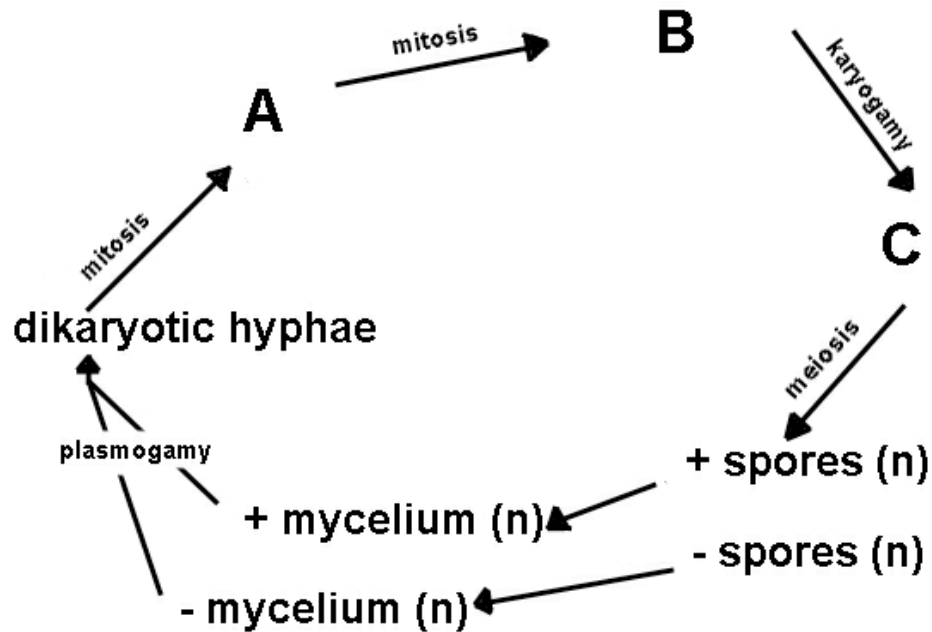
iv. basidiospore:

## II. Fungal Life Cycles

The diagram below shows a generalized fungus life cycle. Study this overview, and note the ploidy of each life cycle stage. Next, use the three template life cycle on the following pages to fill in the names and ploidies of every similar life cycle stage in the (1) Zygomycota, (2) Ascomycota and (3) Basidiomycota.



1. Is the life cycle diagrammed above sexual or asexual? How can you tell?
2. If the generalized fungus above were to engage in asexual reproduction, where on the life cycle diagram would this occur? Draw it into the diagram, indicating the ploidy of all relevant structures.
3. Which of the major fungal taxa do reproduce via asexual spores? Which do not?  
Below is a diagram similar to the one on the previous page, but with three major life cycle stages replaced by "A", "B" and "C".



4. In the Zygomycota:

- What is the name of A? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What is the name of B? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What is the name of C? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What are the resulting spores called? \_\_\_\_\_
- What is their ploidy? \_\_\_\_\_

5. In the Ascomycota:

- What is the name of A? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What is the name of B? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What is the name of C? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What are the resulting spores called? \_\_\_\_\_
- What is their ploidy? \_\_\_\_\_

6. In the Basidiomycota:

- What is the name of A? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What is the name of B? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What is the name of C? - \_\_\_\_\_
- What is its ploidy? - \_\_\_\_\_
- What are the resulting spores called? \_\_\_\_\_
- What is their ploidy? \_\_\_\_\_

7. What do you think is the evolutionary significance of the similarity of life cycles across the three fungal taxa?

### III. Fungi in Symbiotic Relationships

Symbiosis (literally "living together") occurs when two species maintain a close ecological association. There are many different types of symbiosis, each defined by the effect of the relationship on each of the participating populations. Using standard symbiosis shorthand, we will assign a population a "+" if it benefits from a particular relationship, a "-" if it is harmed by the relationship, and a "0" if it is not affected by the relationship. In so doing, we can construct a grid of possible symbiotic relationships, as shown below.

Discuss each type of symbiosis, and then try to name a fungal association that fits into that category. Be sure to note whether the fungal symbiont is population A or population B, and whether it is parasite, host, pathogen, prey item, predator, or other appropriate term. There may be more than one fungal association in any given category, and there may be none in some of the categories. It's up to you to recall them!

type of interaction	pop'n A	pop'n B	nature of effect
mutualism	+	+	obligatory; both populations benefit
EXAMPLES:			
protocooperation	+	+	NOT obligatory; both pop'ns benefit
EXAMPLES:			
competition	-	-	populations inhibit one another
EXAMPLES:			
neutralism	0	0	populations don't affect one another
EXAMPLES:			
predation	+	-	predator (A) kills & consumes prey (B)
EXAMPLES:			
parasitism	+	-	parasite (A) exploits the host (B), but does not kill it outright
EXAMPLES:			
parasitoidism	+	-	parasitoid (A) eventually kills host (B)
EXAMPLES:			
commensalism	+	0	commensal (A) benefits; host (B) not affected
EXAMPLES:			
amensalism	-	0	A inhibited; B unaffected
EXAMPLES:			

#### **IV. Discussion Questions**

1. In what ways might a broad-spectrum fungicide (i.e., one that kills all fungi) applied to an agricultural plant crop be harmful to the crop?
2. Humans have been able to obtain many different medicines (such as antibiotics) from fungi. Of what possible use to the fungi are these compounds?
3. Just about everyone knows that certain species of mushrooms can be hallucinogenic. Of what possible utility to the fungus is such a property?
4. The American Chestnut Tree, which once made up more than 25% of North American hardwood forests, were killed off by a deadly fungal blight that does not affect the closely related Asian Chestnut Tree. It is believed that the fungus was accidentally imported with Asian Chestnut trees imported as ornamentals. Why do you suppose the fungus affects only the North American trees? What does this tell you about the importance of careful control of imported species? Do you think that such accidental importation of pathogens (of plants, animals, etc.) will become more frequent or more rare in the future? Why?
5. If fungi were to suffer a massive, global, multi-species extinction, what do you think the effect on various ecosystems would be? Explain in some detail, using specific examples.