

Name _____

Pictures _____ / 25

Part I _____ / 75

Part II _____ / 75

Part III _____ / 75

= Total _____ / 250

General Mycology -- BOT/MBIO 4810/5810

Final Exam! -- 250 points

10 May, 2005

Score (this section) _____ / 125

Part I: Questions from first part of class (75 points TOTAL)

Multiple choice (4 points each; 40 points total)

1. True False Fungi are eukaryotic.
2. True False A culture medium using 27.3 g boiled potatoes and 14.9 g glucose per liter is a defined medium.
3. I just cleaned out our refrigerator. As I was throwing moldy food onto the compost pile, I marveled at the pink tufts of mycelium poking out of one food item. Since this fungus was thriving in our refrigerator, I can conclude it is a(n):
 - a. thermophile
 - b. acidophile
 - c. bibliophile
 - d. psychrophile
 - e. mesophile
4. True fungi acquire food by:
 - a. photosynthesis
 - b. ingesting food particles and digesting them internally
 - c. secreting digestive enzymes and absorbing the small food molecules
 - d. fungi feed by more than one of the above methods
5. Which of the following statements about the evolutionary relationships between fungi is FALSE?
 - a. ascomycetes and basidiomycetes are sister groups because they share dikaryotic cells.
 - b. oomycetes and zygomycetes are sister groups because they both have aseptate hyphae.
 - c. cellular and acellular slime molds are unrelated to each other.
 - d. chytrids are the simplest true fungi, and zygomycetes seem to be the group most closely related to the chytrids
6. Biologists use many "species concepts" to define the lines between species. When a field mycologist classifies a mushroom based on how the gills attach to the stipe, she is using the ___ species concept; when a plant pathologist classifies a fungus based on the plant host it colonizes, he is using the ___ species concept.
 - a. evolutionary ... biological
 - b. biological ... evolutionary
 - c. morphological ... ecological
 - d. ecological ... morphological
 - e. morphological ... evolutionary
 - f. biological ... ecological

Total (this page): _____

7. A good way to select for a wide variety of fungi while selecting against bacteria is to:
- incubate the cultures at freezing temperatures
 - raise the pH above 7
 - incubate the cultures in the absence of oxygen
 - incubate the cultures in the dark
 - none of the above are very good strategies
8. Brown rot fungi digest ___ in wood, while white rot fungi digest ____ in wood.
- | | |
|--------------------------|--------------------------|
| a. cellulose ... keratin | d. cellulose ... lignin |
| b. lignin ... cellulose | e. lignin ... keratin |
| c. keratin ... lignin | f. keratin ... cellulose |
9. Since penicillin is not required for the growth of *Penicillium*, it is considered to be a:
- | | | |
|-----------------------|-------------------------|------------------------|
| a. primary metabolite | b. secondary metabolite | c. tertiary metabolite |
|-----------------------|-------------------------|------------------------|
10. The main difference between chitin and cellulose is:
- chitin has nitrogen; cellulose does not
 - chitin is a protein; cellulose is a polysaccharide
 - chitin contains lysine; cellulose does not
 - chitin makes up the cell membrane; cellulose makes up the cell wall
 - chitin occurs only in animals; cellulose occurs only in plants

Short answer (point values as specified; 35 points total)

11. It is not possible to design a culture medium on which ALL types of fungi will grow. List two reasons why not (6 points).

a. _____ b. _____

12. Let's say you isolate many different fungi from a papaya in my kitchen. Now you want to subculture each of the different types onto fresh plates to try to achieve pure cultures. In general, should you subculture from the *center or the edge* of each colony, and *why?* (6 points)

13. Describe how to make a moist chamber, and explain why it promotes the growth of fungi that otherwise might be hard to find on a substrate (5 points).

Total (this page): _____

14. Many foods such as beer, tempeh, and soy sauce are produced by yeasts and filamentous fungi that carry out fermentation. Most other fungi, on the other hand, carry out aerobic respiration just like you. What are the differences between aerobic respiration and fermentation in terms of ...:
- a. the amount of ATP generated per glucose molecule? (4 points)

 - b. the fate of pyruvate generated after glycolysis? (4 points)

 - c. the fate of NADH generated during glycolysis? (4 points)

 - d. the terminal electron acceptor? (4 points)
15. Name one useful product of fungal fermentation (2 points).

Part II: Questions from second part of class (75 points TOTAL)

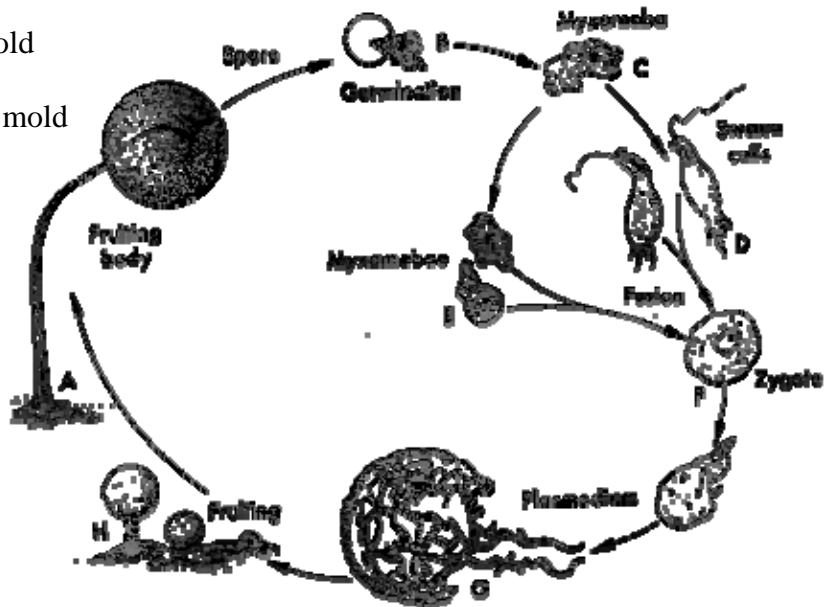
Multiple choice (4 points each; 40 points total)

1. Some mycology classes and textbooks books include an old grouping called “Phycomycetes,” which includes fungi (and fungus-like organisms) with aseptate hyphae. Other mycologists do not like to teach the concept of the “Phycomycetes,” probably because that group of organisms would contain:
- a. sporangial fungi
 - b. flagellated species
 - c. evolutionarily unrelated species
 - d. both saprophytes and parasites
 - e. haploid and diploid organisms
2. Fungi lacking meiosis will also lack:
- a. ascospores
 - b. conidia
 - c. basidiospores
 - d. hyphae
 - e. more than one is correct

Total (this page): _____

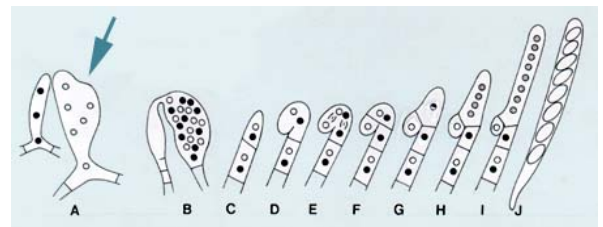
3. The type of basidium you would expect to find in a typical mushroom is a _____, whereas a rust or smut would have a _____.
- crucially septate basidium ... holobasidium
 - transversely septate basidium ... holobasidium
 - holobasidium ... transversely septate basidium
 - transversely septate basidium ... crucially septate basidium
 - tuning fork basidium ... transversely septate basidium
4. Zygomycetes:
- usually produce more zygospores than mitospores
 - produce flagellated cells for dispersal
 - produce zygosporangia when compatible gametangia fuse
 - are typically slow-growing fungi

5. The picture at right depicts the life cycle of an organism we observed in class this semester, namely:
- Physarum*, the acellular slime mold
 - Saprolegnia*, the water mold
 - Dictyostelium*, the cellular slime mold
 - Fusarium*, the sweet-smelling conidial fungus
 - Rhizopus*, the black bread mold



6. Chytrids:
- are flagellated fungi
 - sometimes have hyphae
 - can reproduce sexually or asexually
 - are true fungi
 - a, b, c, and d are all correct
 - only a and c are correct

7. The sequence at right depicts the formation of the:
- ascus
 - basidium
 - oospore
 - zoosporangium
 - conidiophore



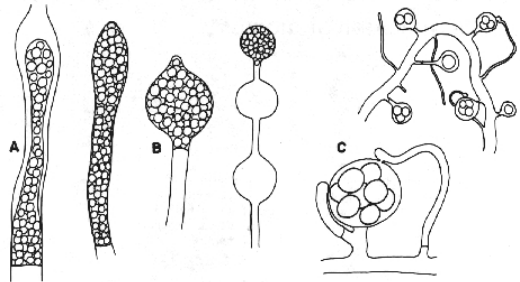
8. For the picture above, circle the letter of the drawing depicting plasmogamy.
 A B C D E F G H I J
9. In the picture above, circle the letter of the drawing depicting karyogamy.
 A B C D E F G H I J

10. The spores depicted in J are (circle one): a. haploid d. diploid c. dikaryotic

11. List two features of oomycetes that make them like fungi, and two features that make them unlike fungi (4 points)

	Similarities with true fungi	Differences from true fungi
1.		
2.		

12. For the oomycete depicted at right, what sort of spores will emerge from the structure marked A (2 points)?



13. For the picture at right, what is the name of the structure marked C? (2 points)

14. List three types of ascocarps, and describe (or sketch) how they differ from each other (6 points)

15. A journal article is entitled: “A light and electron microscopic study of mitosis in the clamp connection of *Auricularia auricula-judae*.”

a. Is the fungus an ascomycete, basidiomycete, or zygomycete? (2 points)

b. What is the function of clamp connections, and how do they achieve that function? (4 points)

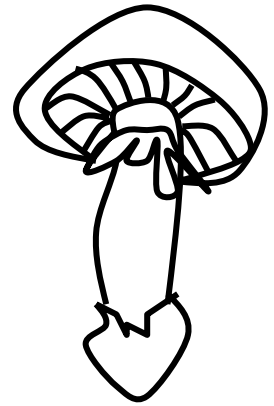
16. Explain why basidia usually produce 4 basidiospores, whereas asci usually produce 8 ascospores (4 points).

Total (this page): _____

17. In the sketch at right, label the cap, gills, volva, stipe, and annulus (5 points).

18. Which of the structures you labeled is/are derived from the universal veil?
(2 points)

19. What is the difference between an anamorph and a teleomorph? (4 points)



Part III: Questions from third part of class (75 points TOTAL)

Multiple choice (3 points each; 24 points total)

1. True False More plant species form ectomycorrhizae than any other type of mycorrhizae.
2. True False Gyromitrin, coprine, and psilocybin all affect humans by the same cellular mechanisms.
3. Which group of fungi accounts for the most lichens?
 - a. ascomycetes
 - b. basidiomycetes
 - c. zygomycetes
 - d. oomycetes
 - e. chytrids
4. The pathogen that causes Valley Fever is:
 - a. *Candida* sp.
 - b. *Amanita muscaria*
 - c. *Histoplasma capsulatum*
 - d. *Mucor* sp.
 - e. *Coccidioides immitis*
5. Which of the following is NOT among the weapons that fungi use to colonize or damage human hosts?
 - a. capsules
 - b. chitinase enzymes
 - c. germ tubes that puncture phagocytes
 - d. mycotoxins
 - e. scavenging iron from red blood cells
6. What fungal target(s) do antifungal drugs exploit?
 - a. ergosterol in the fungal cell membrane
 - b. glucan in the fungal cell wall
 - c. hydrophobic amino acids
 - d. enzymes that produce keratin
 - e. a and b only
 - f. a, b, c, and d

Total (this page): _____

7. Which of the following is INCORRECTLY matched with its toxin? (Remember, some fungi produce more than one toxin).
- Claviceps purpurea* (ergot) – alkaloids
 - Claviceps purpurea* (ergot) – lysergic acid amides
 - Aspergillus flavus* – aflatoxins
 - Amanita phalloides* – amatoxins
 - Morchella* spp. (morels) – orellanine

8. Leaf-cutting ants:
- absorb nutrients from the air, so they are exquisitely sensitive to air pollution
 - feed leaf fragments to fungi in underground “gardens”
 - contain nematode-trapping fungi in their guts; they derive nitrogen from the nematodes that live in the leaf fragments they cut
 - cultivate mycorrhizal fungi by moving endophytes from leaves to roots

9. Draw lines to match each human disease with its characteristics (5 points):

Candidiasis	AIDS indicator; spores inhaled, often from pigeon droppings
Cryptococcosis	Dimorphic fungus; spores inhaled
Histoplasmosis	Eats keratin in nonliving skin layers
Ringworm	Infection may be superficial or systemic; pathogen produces pseudohyphae
Sporotrichosis	“Traumatic implantation” into subcutaneous layers

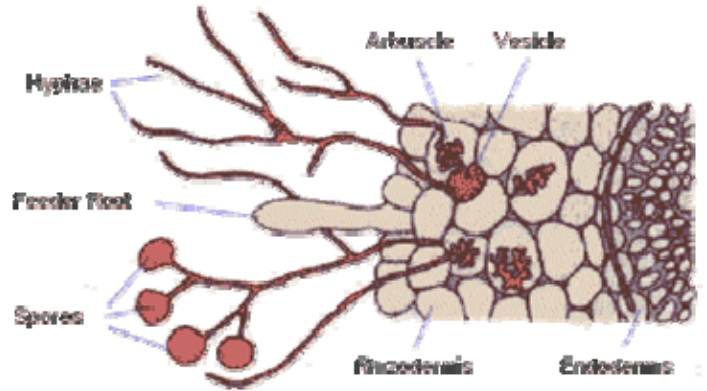
10. Draw lines to match each plant disease with its pathogen and characteristics (3 points):

“Bunt” of wheat	Caused by the ascomycete <i>Ophiostoma ulmi</i> ; spread by bark beetles
Dutch elm disease	Caused by the basidiomycete <i>Puccinia graminis</i> ; 5 spore forms
Stem rust of wheat	Caused by the basidiomycete <i>Telletia</i> sp.; spores replace grain

11. a. In a lichen, how do the fungi and algae physically interact? (3 points)
- b. What does the fungus get from the alga? (2 points) _____
- c. What does the alga get from the fungus? (2 points) _____
- d. It is estimated that lichens account for 19% of the fixed nitrogen entering an old growth Douglas Fir forest by litter fall. How can a lichen contribute fixed nitrogen when fungi are unable to fix nitrogen? (3 points)

Total (this page): _____

12. a. What sort of mycorrhiza does the picture to the right depict? (2 points)



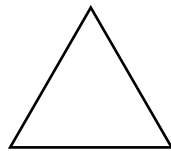
(Gisl, U., *Bodenzoologie*, Georg Thieme Verlag Stuttgart, 1987, P. 220)

b. Describe how this relationship benefits both the plant and the fungus (4 points).

13. Use what you know about the history of fungicides in agriculture to explain why the oldest fungicides cause the most environmental problems, whereas the newest fungicides have a high probability of selecting for resistance in target fungi (4 points).

14. Michelle really wants to know what is killing her lucky bamboo! She thinks it might be *Colletotrichum*, a fungus that causes disease in many plant species. How should she use Koch's postulates to determine whether *Colletotrichum* really is the culprit? (6 points)

15. a. Fill in the three sides of the disease triangle (3 points).



b. How does Integrated Pest Management (IPM) use the disease triangle to minimize the amount of disease in a field? (4 points)

16. A week or so ago, I received an email that said the following: “I am a freelance writer interested in doing a story on mushroom hunters in Oklahoma. I was hoping that I could do a quick interview with you about this subject. In particular I am curious about (1) how difficult it is to tell the difference between the poisonous and edible varieties. I'm also interested in (2) the potential risk of eating the wrong kind.” How would you have answered the emailer’s two questions? (6 points)

17. I found an FAQ on the Doctor Fungus website that asked this: “I'm confused about this yeast thing. Is *Candida* yeast the same as Baker's yeast or Brewer's yeast?” How would you answer this question? Briefly explain your answer (4 points).

I thought you might enjoy this, in case you didn't see it in the news:

Danna sent me an article from Yahoo! News dated Wed., Apr 13, 2005 and entitled “Slime-mold Beetles Named for Bush, Cheney and Rumsfeld”

Three new beetles of the genus *Agathidium* have been named after members of the current administration: *A. bushi*, *A. cheneyi* and *A. rumsfeldi*.

Two former Cornell University entomologists, Quentin Wheeler and Kelly Miller, were in charge of naming 65 new species of slime-mold beetles, which they discovered while studying the insects' evolution and classification.

Wheeler, who is now head of entomology at the Natural History Museum in London, said that the choice to name beetles after President George W. Bush, Vice President Dick Cheney, and Secretary of Defense Donald Rumsfeld was out of admiration for their principles, not because they look like the beetles.

The slime-mold beetles are so-called because they feed on fungi-like molds.

Total (this page): _____