Sample questions based on lectures and labs in Biology of Fungi, PB 110

Fall 2008

These questions are examples of the type of questions that will be asked on exams. I cannot promise that they will be the exact questions, but they will be similar. On exams, there will be some matching, some questions requiring diagrams with labels, some questions about the nuclear condition of fungi (haploid, diploid or dikaryotic; n, 2n or n+n), some short answer questions and some requiring longer answers. I am particularly fond of questions that combine information from several different fungi. While you are studying, you might think of how several of these questions could be combined into one question.

Ascomycota

What is the evidence that ascomycetes are true fungi?

What is the morphological hallmark of the Ascomycota?

In terms of numbers, how important are the ascomycetes to the fungi?

Give examples of three ascomycete model organisms. Why are they thought of this way?

It has been said that yeast is the most famous fungus. Can you support this assertion with some facts?

What are the Tajphrinomycotina? Where were they classified before molecular evolutionary studies?

Diagram the life cycle of Schizosaccharomyces pombe. How does the genus name commemorate the method of cell division?

Diagram the life cyce of Taphrina deformans. What nuclear condition posessed by Taphrina is unusual among Ascomycota?

Yeast, Saccharomyces cerevisiae, has a remarkably complete fungal life cycle, tell me about it. What is the only fungal nuclear condition that it is missing?

What is a bioassay and how would you use one to find a pheronome?

Mating in yeast is as well studied as it is for any organism, with the possible exception of ourselves. Describe switching and pheromone production and perception in this fungus. What happens to the cells when the pheromone is perceived? What is a bioassay for the presence of the pheromones?

If you collect Saccharomyces cerevisiae in nature, what is the likely nuclear condition of the fungus?

Although mating switching and pheromone production are fascinating, they are not the reason that Saccharomyces is famous. What is fermentation (every detail)? Why does the cell rely on it? What does it do for industry?

Eurotiomycetes

Describe the phylogenetic relationships of Eurotiomycetes to other hyphal ascomycetes.

What is the life cycle of Talaromyces flavus? What is the name of its asexual spore-producing state?

Why would one fungus have two names?

What are the parts of a Penicillium conidiospore producing structure? Draw and label it.

How is the life cycle of Eurotium rubrum like that of Talaromyces?

How does Talaromyces produce ascospores? What is the name of the ascoma?

What is a mycotoxin? What is an example of a beneficial mycotoxin from the perspective of humans? How about a deleterious mycotoxin?

Why would a fungus invest energy in a mycotoxin?

What is aflatoxin? What fungus produces it?

What is penicillin? What fungus produces it?

What are two Penicillium species that are used in industry? What do they do?

What is Coccidioides immitis and why should Californians know about it?

Sordariomycetes

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Compare the ascocarps of Neurospora and Eurotium in terms of the development of ascogenous hyphae and asci, their shape and function, and the form of the ascocarp.

How is syngamy (the fusion of gametes) different in Neurospora and Talaromyces?

What evidence is there that the trichogyne makes a pheromone that acts on conidia? What does the pheromone do to the conidia?

What is the evidence is that conidia under the influence of trichogynes make another pheromone? What does the trichogyne do?

After syngamy, what happens to the fertilizing nuclei in Neurospora? Describe and diagram the fate of the nuclei up to the formation of asci?

What do the conidia of Neurospora look like? How are they formed?

Can you name a fungus that has the ascoma of a Sordariomycete and the asci of a Eurotiomycete? How about a fungus with the ascoma of a Eurotiomycete and the asci of a Sordariomycete?

A key difference between the Sordiomycete ascus and the Eurotiomycete ascus is that the former can forcibly discharge its ascospores and the latter cannot. Can you think of a Sordariomycete that does not forcibly discharge its ascospores, but that still has elongated, Sordariomycete-style asci?

How does Ophiostoma ulmi interact with plants and insects?

What do Nectria and Xylaria have in common in terms of their annual progression from asexual to sexual reproduction?

Diagram and label a longitudinal section of a Xylaria perithecium and associated tissue.

In Claviceps purpurea, what spores form on the sclerotium and what spores form in the stroma?

What two, basic types of alkaloids are found in the sclerotium of ergot? What are the pharmacalogical effects of these alkaloids?

Who was St. Anthony and what was his fire? Who did the monks in the Order of St. Anthony care for?

Why is Cryphonectria parasitica such a famous plant pathogen?

What types of spores does Cryphonectria make in the stroma? What are the names of the spore containing structures?

If all of the ascospores made in a Cryphonectria stroma were from homothallic reproduction, how many alleles would you find for any locus?

If all of the ascospores made in one Cryphonectria stroma arose from one heterothallic mating, what would be the maximum number of alleles found at any locus in ten ascospores?

If each of the many perithecia in a stroma of Cryphonectria was a result of a separate heterothallic mating, what would be the maximum number of alleles you could find at any one locus in ten ascospores from one stroma?

Would you let me import plants from Europe, Asia or Africa without checking them for fungi? Why or why not?

Dothidiomycetes and Chaetothyriomycetes

In terms of ascocarp development, what is the difference between a sordariomycete with a perithecium and a dothidiomycete with a pseudothecium?

If you were looking at a fungus with a flask shaped ascocarp, what clues would you use to classify it in either the Sordariomycetes or the Dothidiomycetes?

Draw and label a unitunicate and bitunicate/fissitunicate ascus, include a drawing of spore discharge.

What features of ascospore form are used to infer classification in the Dothidiomycetes or Chaetothyriomycetes?

If you found a fungus with a flask-shaped ascoma that made ascospores with several septations in different planes, is your fungus more likely to be a sordariomycete or a dothidiomycete?

Pezizomycetes/Lecanoromycetes/Leotiomycetes

Draw and label an apothecium including all of its parts.

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Describe ascus discharge in Sordariomycetes, Dothidiomycetes and Pezizomycetes/Lecanoromycetes/Leotiomycetes. What is unique about discharge in the Pezizomycetes et al. and why might it confer an advantage in spore dispersal?

What feature of the ascus is used to differentiate between Leotiomycetes and Pezizomycetes?

Describe our understanding of pheromone action in Neurospora crassa mating. What evidence is there that two pheromones are involved?

How can the large fruiting body of Morchella possibly be related to the small apothecia of Peziza?

What is the toxin in Helvella lacunosa? How might NASA use the toxin?

Assuming that the type of ascocarp made by Peziza or Morchella is ancestral to those of the genus Tuber, describe how the changes might have come to pass.

Draw the ascospores and asci of Tuber and speculate on the method of spore dispersal.

How might Tuber manipulate animals to be effective spore-dispersal agents? Might this method also explain the intense human interest in this fungus?

Lichens & Laboulbeniales

What groups of fungi can form lichens?

Is there a zygomycete lichen?

Are there basidiomycete lichens?

What class of fungi accounts for the most lichens? How many species of lichens are there? What fraction of described ascomycetes are lichens? Why might this fraction be an over estimate?

Which symbiont, the fungus or the alga, carries the name of the lichen? What algal groups form lichens? What is a genus from each of these groups that is famous for lichen formation?

Is Trebouxia a green alga or a cyanobacterium?

Is Nostoc a green alga or a cyanobacterium?

When a single lichen has more than one alga in the thallus, what is the structure containing the uncommon alga called?

What does the fungus get from the alga? What does the alga get from the fungus? How do the hyphae and algal cells interact?

Hyphae make a number of structures that are specialized for nutrient transport between two mutualists or between a host and parasite. Draw and label them.

How are hautoria and arbuscules related? What is Hartig's net?

What evidence is there that lichens can grow where conditions are too extreme for all other plants?

It has been estimated that as much as 15% of the photosynthetic tissue in an old growth Douglas Fir forest is lichen? Remembering the microscope slide showing a cross section of a lichen thallus, might this fraction be an over estimate of the photosynthetic capacity of the lichens and, if so, why?

It is estimated that lichens account for 19% of the fixed nitrogen entering a forest by litter fall. How can a lichen contribute fixed nitrogen when fungi are unable to fix nitrogen?

What are the different thallus forms of lichens?

Tell three ways that lichens can reproduce asexually or vegetatively. What is the smallest asexual propagule with both the phycobiont and mycobiont?

How could you answer the question, "Do lichen ascospores start new lichens?"

Why is a Laboulbeniomycete hard to think of as a hyphal fungus?

Laboulbeniomycetes sometimes are known from only one body part of an insect, e.g., the head or even the left wing only. Can you think of two kinds of explanations for the specificity of Laboulbeniales on insects?

Deuteromycota

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How does the Deuteromycota differ from other divisions in terms of phylogenetic relationships?

Would you expect to be able to understand the phylogenetic relationships of the Deuteromycota independently of the Ascomycota and Basidiomycota?

Draw a life-cycle of a pleomorphic ascomycete, and label the parts of the life cycle that are sexual or asexual, mitosporic or meiosporic, anamorphic or teleomorphic, and holomorphic.

What technique is helping to make sense of the evolutionary relationships of Deuteromycota?

Basidiomycota

What features do basidiomycetes have in common with other true fungi?

What are there main subphylla (evolutionary lineages) in the Basidiomycota and what features characterize them?

Diagram the life cycle of *Coprinus*. Be sure to include nuclear condition and nuclear behavior.

What nuclear condition is dominant in the basidiomycetes? Compare this cycle to that of ascos.

What feature of some basidiomycete hyphae might remind you of croziers? Compare the two types of structures.

Describe the different types of basidia. Be sure to comment on septa formed following meiosis, the position of karyogamy and meiosis, and the features of basidiospore formation and discharge. Define the terms probasidium and metabasidium in the process.

Diagram balistospore discharge and explain what is known about the process. Is it unique to the Basidiomycota? and is it unique to basidiospores or do other spore types in the phylum use the same mechanism?

In what group or groups has this discharge mechanism been lost?

Which of the three classes of Basidiomycota contain yeasts? and where in the phylogenetic tree would most of yeasts be placed?

What are mirror yeasts?

Hymenomycetes - Jelly fungi, mushrooms, polypores and puffballs.

Mating behavior has been studied extensively in several Hymenomycetes, including Schizophyllum commune and Coprinus species. What is known about the loci and alleles controlling mating in these fungus? How many loci are there? How many alleles at each locus? Are the loci a single gene, or are they complex? How does their mating system compare to rusts or smuts .

Diagram and label mushroom development in *Amanita*. What features on the mature mushroom are derived from the universal veil? Which are from partial veil?

Diagram a longitutinal section of a typical gill and label the basidia, cystidia, and gill trama. How would this look different in a pored or toothed fungus?

What are cystidia? and what do they do?

Why do gills and tubes respond to gravity?

How would you recognize the following genera: *Amanita*, *Suillus*, *Ramaria*, *Russula*? To which orders do each of these belong?

Gastromycetes represent a convergent morpholgy, what types of selection has produced this convergence? and what, if any intermediate forms exist.

The gastromycetes have evolved many ways to disperse there spores. Give four examples of very different mechanisms, and for each provide an example of genus that uses that method.

How are spores dispersed in *Phallus*? What is it related to?

What types of basidiocarp morphologies are found in the following orders: Gomphales, Boletales, Agaricales (in the sense of the euagaric clade), Russulales.

What types of hyphae make polypores so hard and wood-like? and how do most polypores make their livings?

What is the difference between a white rot and a brown rot in terms of the wood components digested?

Are polypores a monophyletic group? If not what orders contain them?

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What is a seta (pl. setae) and where might you find one?

Diagram an ectomycorrhizal root and label the parts. What group or groups of the Basidiomycota are involved with ectomycorrhizal symbiosis? Are any ascomycetes or Zygomycetes also involved?

Compare ectomycorrhizal symbiosis to arbuscular mycorrhizal symbiosis in terms of the type of plants and fungi involved in each, and the morphological structures formed by each.

Describe the basidiocarp of *Tremella*, including the form and development of the basidia.

What type of septal pore structure would you expect to find in Tremella?

What does *Tremella* do in nature? When Tremella is haploid what does it look like?

What human pathogen is in the Tremellales? Where might you find it? and what does it look like?

Are most members of the Tremellales jelly fungi? If not what are they?

Diagram the basidia and basidiospores of Dacrymyces. Are these typical of the order, Dacrymycetales? What does Dacrymyces do in nature?

In the Auriculariales there are two types of phragmobasidia. Describe each type. What are the septal pore structures like in the order?

Describe three ways that basidiospores of *Auricularia* can germinate?

Where would you expect to find a member of the Sebacinales and what would it be doing?

Urediniomycetes - rusts

What famous group of plant pathogenic basidiomycetes are in the Pucciniomycotina?

Why is *Puccinia graminis* such a famous fungus?

Diagram and label the life cycle of *Puccinia graminis*, paying attention to the host, the spore states and nuclear behavior.

Which spore state is responsible for the rapid spread of wheat rust? Which spore is responsible for weathering bad conditions? Which spore infects barberry? Which sprores infect wheat? Which of these is produced on the barberry?

How are flies important to the life cycle of *Puccinia graminis*?

If a basidiospore doesn't land on its host what can it do?

What spore stages is Puccinia malvacearum lacking that P. graminis has? What would you call this type of lifecycle?

What do the terms heteroecious and autecious mean?

What is the mating system of heterothallic rusts?

Give three examples of short-cycled rusts.

Diagram a germinating teliospore and label the parts. How would one apply the terms probasidium and metabasidium to these structures

Name two other members of the Uredinomycetes that are not rusts and briefly describe how they make their livings. What features to these share in common with the rusts? Which spore states to they lack?

Where would you find *Tuberculina*? and what is unusual about its lifecycle?

Ustilaginomycetes -- smuts

Compare the life cycles of Ustilago nuda and Ustilago maydis paying attention to how the fungus infects the plant and how it keeps the infection going in an annual plant.

How is the basidium of Tilletia different from that of Ustilago? and how do the basidiospores of each behave?

One smut, *Microbotryum violaceum*, is not closely related to the Ustilaginales. Why is it called a smut? What does it infect? What does it do to the plant?

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Ustilago maydis has a two locus mating system with one locus having two alleles and the other having many. How does this mating system compare to tetrapolar mating systems of the Hymenomycetes?

When *Ustilago maydis* switches from haploid to a dikaryon after mating what morphological and physiological changes occur?

Smut basidiospores are not forcibly ejected from the metabasidium. How do smuts spread? What part of the life cycle is responsible for the spread?

Exobasidium has been a difficult genus to place within the classes of the Basidiomycota, but sequence data now place it in in the Ustilaginomycetes. What features of this genus are smut-like and which are not? Where would you find this in organism in nature?