

Topics covered since Exam 2 in BOT 4723/5723 – Fall 2007
Exam date: 12/11/07; *final version* of review sheet posted 12/5/07

Lecture 17 (10/31): Plant pathology

- Introduction and history
 - Fungi cause plant disease, but there are many beneficial fungi as well
 - Golden age of plant pathology: deBary, Koch, Millardet
 - What are Koch's postulates? and why are they useful?
- Types and symptoms of diseases
 - where fungi attack plants
 - obligate biotrophs, necrotrophs, facultative parasites
- Development of plant diseases
 - weapons fungi use to enter and invade plants
 - preexisting and induced defenses in plants
- Control of plant diseases
 - the disease triangle
 - the four principles of disease control
 - integrated pest management
- Famous diseases: understand the life cycles of each of these plant pathogens (see also lec 18)
 - Dutch elm disease, caused by *Ophiostoma ulmi*
 - Wheat rust, caused by *Puccinia graminis*
 - Wheat bunt (smut), caused by *Ustilago maydis*

Lecture 18 (11/5): Finish plant pathology; fungus-animal interactions

- Finish plant pathology
 - Characteristics of rusts
 - Characteristics of smuts
- Fungus-animal relationships
 - Fungi eat insects (remember the *Cordyceps* film clip?), parasitize vertebrates (see lecture 24), pass harmlessly through the digestive tracts of herbivores (see your projects), trap nematodes in soil, and digest grass in the rumens of ruminants
 - Leaf-cutter ants as fungus farmers

Lecture 19 (11/7): Focus on Scientific Literature #3

- How did the researchers test the hypothesis that endophytes defend cacao plants against pathogens?
- Function of the results section of a paper
 - when is it correct to use a bar graph and a line graph?
 - statistical hypotheses (null and alternative)

Lecture 20 (11/12): Symbioses (mycorrhizae and lichens)

- Mycorrhizae
 - Introduction to mycorrhizae
 - who are the partners in a mycorrhizal relationship?
 - what does each partner do for the other?
 - Ectomycorrhizae
 - describe the physical interaction between the partners
 - which fungi and plants form this type of mycorrhiza

- Arbuscular mycorrhizae
 - describe the physical interaction between the partners
 - which fungi and plants form this type of mycorrhiza
- Mycorrhizae in agriculture
 - potential agricultural benefits of mycorrhizal fungi
 - why farmers don't routinely inoculate with mycorrhizal fungi
- Lichens
 - who are the partners in a lichen?
 - what does each partner do for the other?
 - describe the physical interaction between the partners
 - how lichens are classified and how they reproduce
 - ecological and practical importance of lichens
 - I also showed a movie clip showing how resistant lichens are to desiccation

Lecture 21 (11/14): Open lab (owing to Statehood Day)

Lecture 22 (11/19): Focus on Scientific Literature #4

- How did the researchers test the hypothesis that the *gliP* gene is required for virulence in *Aspergillus fumigatus*?
- Functions of the discussion section of a paper

Lecture 23 (11/26): Open lab (owing to Thanksgiving Holiday)

Lecture 24 (11/28): Medical mycology (guest lecturer: Joy Pelfrey from Immunomycologies)

- Why learn about medical mycology? Which people are most vulnerable to fungal infections?
- Medically important fungi that are widespread (how is each acquired?)
 - *Candida*
 - *Cryptococcus* (infection with this fungus DEFINES the onset of AIDS)
 - *Aspergillus*
- Medically important fungi that are endemic to particular regions (where in the world is each endemic, and how is each acquired?)
 - *Blastomyces*
 - *Histoplasma*
 - *Coccidioides*
- Methods for diagnosing fungal pathogens: culture from body, examine infected tissues, and/or detect antibodies or antigens in body fluids

Lecture 25 (12/3): Graduate student lectures

- Matt Jones: Yeast phylogeny
 - Social history of yeasts
 - Fermentation/model organism
 - History of fermentation includes “physicalists” vs. “vitalists,” a dilemma resolved by Buchner (demonstrated fermentation by cell free yeast extract)
 - Taxonomic history: ascomycete yeasts
 - Not recognized as ascomycetes until late 19th century
 - Initially considered monophyletic
 - Preponderance of artificial classification systems, organized for ease of identification
 - Phylogenetic classification (morph./biochem/physiology)

- Molecular phylogenetics places ascomycete yeasts into 3 classes, with the genera poorly circumscribed
 - Taxonomic history: basidiomycete yeasts
 - Not recognized as basidios until 1925
 - No teleomorphs until 1960s
 - Molecular systematics places basidiomycete yeasts into three classes, those shared with rusts, smuts and jellies. Again, genera are poorly delimited
 - Evolution of the yeast growth form: too little knowledge to investigate yet
 - Taxonomy as a dynamic field
 - Taxa assignments are hypotheses, can change with new data
 - Learn to deal with systematic rearrangements like any other scientific discovery
- Josh Cooper: The influence of chytrids on phytoplankton
 - Aquatic fungi
 - Fungi on leaves transfer energy from an inedible source to one usable by consumers
 - Older food webs studies have ignored parasites interactions in trophic cascades.
 - Chytrids
 - Chytrids infect almost every algal group and contribute to algal succession
 - Inedible and edible algae in phytoplankton effect this succession
 - Chytrids transfer energy from inedible hosts to higher trophic levels.
 - Chytrids reduce the numbers of host cells thus controlling abundance
 - Food-web implications: incorporation of parasites like chytrids into food-webs is critical for understanding how aquatic ecosystems function.

Lecture 26 (12/5): Fungi as/in food (lecture posted on Learn; we will use Wednesday to look at prepared slides in preparation for the final exam)

- Food spoilage by fungi
 - How to prevent food spoilage
 - Why it matters
- Mycotoxins in food and animal feed
 - What are mycotoxins and secondary metabolites?
 - Example: ergot alkaloids
 - Example: aflatoxins
- Edible, poisonous, and hallucinogenic mushrooms
 - Fungi are very useful in food processing, and some fleshy fungi are edible
 - Deadly poisonous toxins that cause extensive cell death: amatoxins bind to RNA polymerase, gyromitrin turns to jet fuel and inhibits neurotransmitter synthesis, orellanine causes kidney failure by unknown mechanism
 - Non-deadly toxins that affect nervous system (often causing hallucinations): coprine blocks metabolism of ethanol, ibotenic acid binds to GABA receptors, psilocybin stimulates serotonin receptors