BI 432/532 Introductory Mycology Fall 2013

Credits: 5

Prerequisites: BI 214, 253 or instructor's consent

Required textbook: Introduction to Fungi, 3rd Ed. J. Webster and R. S. Weber. Cambridge Univ. Press. 2007.
Lab manual: Mushrooms Demystified, 2nd Ed. D. Arora. Ten Speed Press. 1986.
Mushrooms of the Pacific Northwest, Trudell and Ammirati, Timber Press, 2009.

Additional reading supplements will be provided.
Reference materials on reserve:
Webster and Weber, Introduction to Fungi
Arora, Mushrooms Demystified
Spatafora, Hughes, Blackwell, A Phylogeny for Kingdom Fungi
Kendrick, The Fifth Kingdom, 3rd Ed.
Alexopoulos, Mims, and Blackwell, Introductory Mycology

Instructor: Jeff Stone, Office hours WF 10:30–11:30, 1600–1700 & by arrangement
stonej@science.oregonstate.edu
GTF: Dan Thomas, Office hours TBA
Lectures: WF 9:00 – 10:20,
Labs WF 13:00 – 15:50
Final Exam Wed. Dec 11, 10:15-12:00

Course objectives

An overview of the kingdom Fungi together with fungus-like organisms traditionally studied by mycologists. Students will learn the unique biological (life history, physiological, structural, ecological, reproductive) characteristics that distinguish Fungi (and fungus-like taxa) from other organisms. Ecological roles and interactions of the Fungi will be emphasized within the organizational framework of the most recent findings of molecular phylogenetics. Students will learn the defining biological characteristics of the phyla of kingdom Fungi, and of several of the most important taxa (classes, orders, genera) within these. The unique aspects of each taxonomic group as agents of plant, animal, and human disease, as partners in symbioses with various organisms, and as mediators of ecological processes will be considered. In the laboratory portion of the class, students will learn to identify distinctive diagnostic structures of fungi, learn to differentiate various fungal taxa, and how to identify genera and species of macro- and microfungi. Students will learn how to isolate and purify fungi from natural substrates and the use of selective media for isolation and cultivation of fungi. Working in groups, students will complete lab projects designed to illustrate fungal diversity and the unique aspects of fungal reproduction. In short, the objective is to learn as much about fungal biology as is possible in ten weeks.

Student Evaluation

BI 432 final grades will be based on two mid term exams (15% each), a final exam (30%), and lab projects as follows: culture collection and report (10%), specimen collection (10%), *Schizophyllum* mating experiment report (5%), soil diversity report (5%) lab final exam (10%).

For BI 532, grades will be based on all of the above, and in addition a class project consisting of either a short (~5-10 p) paper, informational webpage, or class presentation pertaining to an aspect of fungal biology of interest to the student. This will count as 5% of the final grade, with relative percentages of exams adjusted proportionally. The topic and format for the project must be approved by the instructor.

Late assignments, make-up exams. Make-up exams and late submission of assignments will be allowed only if A) student has made the instructor aware of a conflict at least 2 weeks before the scheduled exam/due date, or B) a compelling reason (my judgement) for not being able to make prior arrangements.

Final grades will be based on the cumulative percentages at the end of the term. Final grades will be assigned as follows: A, 90-100%; B, 80-89%; C, 70-79%, D, 60-69%; F, <60%.

Incompletes — A grade of "I" (incomplete) will be given only when there is a strong and compelling case for doing so. An incomplete can not be given unless the student has completed more than 70% of the course requirements, e.g. midterm exams 1 and 2, and at least 2 of 4 lab assignments. If an incomplete is requested, the student must make arrangements to remove the incomplete by the end of the next regular term following the term in which the incomplete was given.

Extra credit

No papers, projects or other supplementary student work, other than the exams and assignments, will be accepted for extra credit. Extra credit questions will be built into the mid term and final exams. Students who attend class regularly and participate actively and thoughtfully will be given favorable consideration for increasing a borderline grade to the next higher letter grade.

Field Trips

Field trips will be scheduled for at least 3 weekends during the term. Sites and dates TBA to allow for appropriate weather. Field trips will be for all day, i.e. depart about 9 am return 4-5 pm. Purpose of filed trips will be to collect/observe fungi in natural habitats.

Field trip 1. Tentatively scheduled for Oct 5
Field trip 2. Tentatively scheduled for Oct 19
Mt Pisgah mushroom show Oct 27
Field trip 3. Tentatively scheduled for Nov 2
Field trip 4. Tentatively scheduled for Nov 23

Statement concerning students with learning disabilities

The University of Oregon is working to create inclusive learning environments. Please notify us if there are aspects of the instruction or design of this course that result in barriers to your participation. You may also wish to contact the Accessible Education Center in 164 Oregon Hall at 346-1155 or uoaec@uoregon.edu

Class schedule, reading assignments, lecture topics, and exams				
Week	**Date**	**Lecture Topic**	**Lab Topic**	**Reading**
1	W Oct 2	Course overview, objectives Importance of fungi. Overview of fungi higher fungi, cellular structures, hyphal organization	Overview of lab, objectives Microscopes Fungal structures, spores, hyphae, sporocarps	**Webster Chapter 1, pp 1-39** Suppl.: Fisher et al. emerging fungal threats; Hawksworth, Fungal diversity; Schmitt and Mueller, Lower limit of fungal diversity; Mueller Global distribution Bartnicki-Garcia, Hyphal growth; Isaac, Dimorphism; Reyñaga-Pea, Spitzenkorper; Maheswari nuclear behavior; Galagan, fungal genomics; Weber, vacuoles;
1	F Oct 4	Fungal life cycles, evolution and phylogeny, fossil record, dating divergences	Agarics and polypores Ectomycorrhizae **Start Culture projects, collections**	Bridge, Molecular mycology Lutzoni, Fungal tree of life Suppl: Down, Fungal family trees; Blackwell, Deep Hypha Phylogeny
Field trip 1 tentatively scheduled for Sat. Oct 5, 9:00-4:00; Destination TBA				
2	W Oct	Basidiomycota overview, mating systems, spores	Agarics, polypores,	**Webster Chapter 18, pp 487-513**
2	F Oct 3	Basidiomycota – "Homobasidiomycetes" Agaricales Mycorrhizae—ECM physiology and function, mycotrophic plants	Basidiomycota-Hymenomycetes, Aphyllophorales, **start Schizophyllum mating**	**Webster Chapter 19, pp 514-576** Suppl.: van der Heijden and Horton, Mycorrhizal networks; Bruns, Molecular; Finlay, Mycorrhizal fungi; Leake, Parasitic plants; Taylor, Ectomycorrhizal symbiosis; Wilcox, Fungal parasitism; Mitchell, ericoid mycorrhizae; Maheswari plant-fungus marriages; Sagara, ammonia fungi; Tibbett and Carter forensic mycology;
3	W Oct 16	Basidiomycota – "Gasteromycetes" Gomphoid-Phalloid clade Agaricoid gasteromycetes; jelly fungi	gasteromycetes	**Webster Chapter 20, pp 577-592** Suppl: Money, Fungal dining; Tibbet, fungal forensic; Isaac, Fungal activity; Ritz, Interactions; Suppl.: Ingold, Spore liberation; Læssøe, Gasteromycetes
3	F Oct 18	Wood decay fungi in forest communties, decay pathogens Polyporoid clade Hymenochaetoid clade	**start soil diversity isolation experiment**	**Webster Chapter 21, pp 593-608** Suppl: Floudas et al. white rot; Anke, white rots; Herring, Luminous fungi; Rowe, Commercial harvesting; Weitz, Bioluminescent fungi; Maheswari largest and oldest; Blanchette, Phellinus, Grave guardians;

Field Trip 2 tentatively scheduled for Sat Oct 19, 9:00 - 4:00; Destination TBA				
4	W Oct 23	Basidiomycete-insect symbionts and predators Basidiomycota,	Rusts and smuts, jelly fungi Basidiomycete yeasts review for midterm 1	Currie ants fungi bacteria; Currie Attine symbiosis; Currie Black yeast; Fisher et al, Leaf cutting ants
4	F Oct 25	"Heterobasidiomycetes" rusts and smuts, jelly fungi Rhizoctonia	**Mid term 1** rusts, smuts, jelly fungi	**Webster Chapter 22, 23 pp 610-657** Suppl: Ingold, Ballistosporic basidia; Jong, Chondrostereum; Shattock, Transchel; Maheswari, scourge;
5	**Su Oct 27**	**Field Trip Mt. Pisgah Mushroom show**		
5	W Oct 30	Ascomycota overview, mating systems, reproductive structures; archiascomycetes	Asco yeasts, Conidial Fungi , Penicillium and Aspergillus, Eurotiales Onygenales Pezizomycetes	**Webster Chapters 8, 9 pp 226-249-260** Taylor et al fungal model organisms;
5	F Nov 1	Industrial mycology, pharmaceuticals Food mycology, mycotoxins mushroom toxins Asco yeasts	Hypocreales and Clavicipitales, Fusarium	Suppl: Bennet and Klich, Mycotoxins; Henderson, Discovery of penicillin; Sci news, I, mold; Isaac, mycotoxins; Isaac, Peanuts; Moss, Mycotoxin reviews; Moss, Fusarium; Isaac, Soya; Stormer, Ibutenic acid; Watling, Poisoning; Wiebe, Quorn; Tribe, Cyclosporin
Field Trip 3 tentatively scheduled for Sat Nov 2, 9:00 - 4:00; Destination TBA				
6	W Nov 6	Ascomycete human and animal pathogens, medical mycology	Discomycetes , Dothideomycetes	**Webster Chapters 10, 11 pp - 261-314** Suppl: Langley, Exploiting fungi; Odds, Antifungal agents; Isaac, Enzymes; Jarell, Kombucha; Nielson, Enzymes; Maheswari, cell factories; Latge, Aspergillus; Odds, Coccidiomycosis; Gow, Paracoccidioides; Hamilton, Cryptococcus; Hamilton, Penicillium marneffei; Isaac, Airbourne spores; Johnson, Dermatophytes; Wakefield, Pneumocystis;
6	F Nov 8	Ascomycete plant pathogens 1, "Discomycetes" and Erysiphales Ascomycete plant pathogens 2, Dothideomycetes,	Erysiphales, Diaporthales, Rhytismatales	**Webster Chapter 12 Sordariales pp 315-332 Hypocreales, Clavicipitales pp 337-364** **Erysiphales Chapter 13, pp 390-413, Leotiomycetes Chapter 15, pp 429-445 "Loculoascomycetes"**

				Chapter 17, pp 459-486 Suppl.: Ayres, Millardet; Isaac, Toxins;
6	**Sa Nov 3**	**Field Trip for Collections TBA**		
7	W Nov 13	Lichens	Lichens	**Webster Chapter 16, pp 446-458** Supp.: Grube, Lichenized ascomycetes; Isaac, Drought; Seymour, Sex in the extremes;
7	F Nov 15	Ascomycota-insect symbionts, parasites, Laboulbeniales Predaceous fungi, nematode trappers, rotifer trappers and parasites aquatic fungi **Schizophyllum reports due**	Lichens **Mid Term 2**	**Webster Chapter 25, pp 673-701** Suppl.: Pegler, Chinese caterpillar fungus; Shah, Sorosporella; Weir, Laboulbeniales; Suppl: Barron, Carnivorous mushrooms; Glockling, Endoparasites; Glockling, Haptocillium; Nordbring-Hertz, Arthrobotrys;
8	W Nov 20	Glomeromycota, AM fungi	AM mycorrhizae	**Webster Chapter 7.6 217-222, pp** Suppl.: Helgason, AM fungi; Bever et al., Arbuscular fungi
8	F Nov 22	Zygomycota overview, Mucorales Zygomycete-insect symbioses, Zoopagales, Entomophthorales	Zygomycetes, Pilobolus, Mucor **Schizopyllum mating reports due** **Soil diversity reports due**	**Webster Chapter 7, pp 165-200** Gooday, Trisporic acids; Moss, Mycobionts; **Webster Chapter 7 pp 200-217, 222-225**
9	W Nov 27	Chytridiomycota, Blastocladiomycota; rumen fungi, plant pathogens, Physoderma, Synchytrium	chytrids, aquatic fungi	**Webster Chapter 6, pp 127-164** Suppl: Carlile, Sirenin;
9	F Nov 29	no class		
10	W Dec 4	Oomycota, overview, pheromones, water molds, plant and animal pathogens Hyphochytridiomycetes, Labyrinthulids	Oomycetes	**Webster Chapters 4, 5, pp 67-126** Suppl: Appiah, Phytophthora ramorum; Ellison et al foundation species
10	F Dec 6	Myxomycetes and Plasmodiophoromycetes	**Lab final exam Collections due Isolations due**	**Webster Chapters 2, 3, pp 40-66**
10		**FINAL EXAM REVIEW TBA**		
11	**Dec 11**	**Final Exam**	**10:15 am**	

Bi 432/532 Fall 2012 Introductory Mycology Lab syllabus

1. Culture collection, isolation from natural substrate. Weeks 1-10, cultures and report due Dec 4, 2013

A. A collection of at least five fungi, identified to at least genus, isolated in axenic culture from a natural substrate. Natural substrates include: soil, dung, leaves, forest litter, aquatic substrates (submerged leaves etc), wood, rotting fungi, lichens and mosses, rotting vegetables, food, marine substrates, etc. Techniques for isolating from various substrates will be discussed in class.

B. Write a brief (ca 2-3 page) report on the general group of fungi you were attempting to isolate, the methods employed, and discuss in detail one of the fungi you isolated. This may include information on its taxonomic/nomenclatural history, aspects of its phylogenetic relationships, aspects of ecology, unusual or important metabolites, pathogenicity, or interesting, noteworthy characteristics and illustrations.

2. *Schizophyllum* mating weeks 2 – 6, Report due November 22, 2013

Obtain 8 – 10 single basidiospore isolates of *Schizophyllum commune* by suspending basidiocarps above agar surface and carefully excising isolated basidiospores onto agar medium in petri dishes. Allow isolates to grow for 1 week. When sufficient primary mycelium has developed, mate each isolates in all combinations by placing a small block of agar from two isolates on opposite sides of a petri dish. On the basis of mating reaction, characterize the mating type alleles for each isolate. Observe monokaryons and dikaryons in DAPI-stained material.

Write a brief (ca 2 page) report on the experiment. The report should briefly describe the methods and results, and include an interpretation of the results in relation to mating types.

3. Field collection weeks 1-10, due Dec 4, 2013

A collection of field collected specimens to include at least:

10 lichens*, representing a minimum of five families
10 basidiomycetes*, representing a minimum of five families
10 ascomycetes* or conidial anamorphs, representing a minimum of five orders

All specimens must be dried and identified to at least genus, only one specimen per genus is allowed, and at least five specimens of each group (basidiomycetes, ascomycetes, lichens) be identified to species. Each specimen must be labeled for curation with collection date, location, habitat, substrate (e.g. tree species, soil, carpet etc), collector, identifier, and reference used for identification. Students may share material but collector

must be identified. *one myxomycete may be substituted for one specimen of any of the three groups.

Collections must be accompanied by a printed list giving details and classification information for each specimen.

Example:

taxon	fungal group	location and date	habitat	collector	identifier	Reference
Peltigera neopolydactyla (Gyelnik) Gyelnik	lichen; Lecanoromycetes, Peltigerales, Peltigeraceae	Fall Creek, Lane Co., OR; 7 Nov. 2012	Old-growth Pseudotsuga/Tsuga forest. Growing on soil with moss.	H. J. Simpson	L. M. Simpson	McCune and Geiser, 2010, p 214.
Boletus zelleri (Murr.) Murrill	basidiomycete; Agaricomycetes, Agaricales, Boletaceae	Hardesty Mt Trail, Lane Co., OR; 14 Nov. 2012	Old-growth Pseudotsuga/Tsuga forest. On soil.	Neil Downe	Ben Dover	Bessette et al. 2000, p. 171
Lophodermella morbida Staley & Bynum	ascomycete; Leotiomycetes Rhytismatales, Rhytismataceae	Peavy Arboretum, Corvallis, Benton Co., OR 14 July 2011	On foliage of *Pinus ponderosa*	Woody de Caye	I. C. A. Fungus	Funk 1985, p. 66

4. Diversity of soil fungi weeks 4 – 8, report due Nov 22, 2013

Enumerate and compare fungal species diversity from soil samples from various habitats. You will use quantitative dilution techniques, selective culture media, and various statistical measures of biodiversity to compare soil fungi communities from different soil samples. The abundance of culturable fungi (cfu/g dry wt), the number of each species (species richness), and the relative abundance (evenness) of each species for each soil sample will be determined. Isolate and identify (genus or species) at least five fungi from the samples.

A written report (ca 2 page) summarizing the methods, results, analysis, and their interpretation (discussion) is required.

SPREAD SPORES