



Fungal Biology PLP 4653C/PLP 6656C

INSTRUCTOR: Dr. Matthew E. Smith

Office: 2517 Fifield Hall

Phone: 352-273-2837

Email: <trufflesmith@ufl.edu>

Office Hours: Mondays 9-10 am or by appointment

LABORATORY SUPPORT: Katy Lazarus

Email: <lazarusk@ufl.edu>

COURSE(S): PLP 4653C and PLP6656C are taught concurrently. Undergraduates are expected to enroll in PLP 4653C whereas graduate students should enroll in PLP6656C. Students enrolled in the graduate course will be responsible for additional writing assignments and will be held to a higher standard for the fungal collections project and for their participation in class discussions based on the primary literature.

PREREQUISITE: BSC 2010 and BSC 2011 *or* PLP3002C (or consent of instructor)

CREDITS: 4

Course Website: <https://lss.at.ufl.edu/> (e-Learning in Canvas)

CLASS TIMES & LOCATIONS:

Lectures: 2306 Fifield Hall, Monday and Friday, 12:50–1:40 pm (Period 6)

Laboratories: 2306 Fifield Hall, Monday and Friday, 1:55–3:50 pm (Period 7–8)

Final Exam: Wednesday, 16 December 2015 10:00 am–12:00 pm

BRIEF DESCRIPTION

Mycology is the study of fungal biology. Fungi are extremely diverse in terrestrial and aquatic ecosystems and they serve as the most important decomposers of organic materials. Fungi are also ecologically and economically important as symbionts and pathogens of a wide variety of plants and animals. The main objective of this course is to provide students with a broad overview of this group of organisms. Much of the class will focus on fungal ecology, fungal diversity, and fungal evolution. During the course, students will: 1) learn about fungi, their biology, and the important impacts they have on humans and natural ecosystems, 2) collect and identify a variety of different fungi from local habitats, and 3) use microscopy to examine the morphology of fungi in the laboratory. We will also read, discuss, and critique modern journal articles that address various aspects of fungal biology.

COURSE OBJECTIVES

By the end of this course, students will be able to:

1. Read, interpret, and critique scientific journal articles focused on fungal biology
2. Locate and use fungal biology resources to interpret fungal nomenclature and systematics
3. Identify major groups of fungi based on morphology (both in the field and in the lab)
4. Understand and explain the ecological roles and trophic modes of major fungal groups
5. Read and interpret a phylogenetic tree
6. Use a dichotomous key to identify local macrofungi to the genus level
7. Perform molecular and computational tasks necessary for DNA barcoding of fungi
8. Give a 10-minute presentation with appropriate visual aids
9. Provide constructive criticism during a peer review

TEXT: Introduction to Fungi. 3rd Edition (2007) Webster & Webster. Cambridge University Press.

ABSENCES AND MAKE-UP WORK: Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

ATTENDANCE: Attendance is mandatory. This is a highly experiential course - you are expected to participate in every class and laboratory. There will be occasional quizzes and activities that will contribute to your grade in the class. Missed activity grades, tests, and quizzes can be made up for excused absences. Activities in class require that you: 1) have done the readings or other appropriate preparation, 2) show up on time, and 3) actively participate in class.

LABORATORY: The laboratory will emphasize principles and concepts of mycology through demonstrations and hands-on exercises using living organisms and prepared specimens as well as short field trips. Labs will typically include an introduction to the exercise, work with demonstration or experimental materials, and sometimes an assignment to be handed in either at the end of the session or the beginning of the subsequent session. It is advised that you keep a lab notebook for all labs. Your lab notebook will not be graded, but a well-kept notebook will be highly beneficial to you in preparing lab assignments and studying for exams.

EXAMS AND GRADING: Grading is based on a total of 600 possible points for graduate students and 500 points for undergraduates. The grading will be based on a combination of participation in class discussions and laboratory activities, quizzes, a final exam, and several projects. For undergraduates there will be two projects: The Zygomycete EOL Project and the Fungal Collection Project (see below). Graduate students will have an additional project (the Famous Mycologist Wikipedia page project). These projects will be introduced toward the beginning of the term and students will have opportunities to work on their independent projects throughout the semester in lab. The quiz grade will be based a series of short quizzes that will be completed in class (students will be allowed to drop their lowest quiz score). The final exam will take place on **Wednesday, 16 December 2015 10:00 am–12:00 pm**.

COURSE PROJECTS: For the Zygomycete EOL project, students will select a target zygomycete fungus, research the biology of that fungus, and then summarize what is known about the fungus on a webpage for the Encyclopedia of Life (EOL). This project will also involve a peer-review process whereby fellow students will provide constructive feedback to improve the webpage. For the Fungal Collections Project students will collect, identify, and preserve **35 species of local macrofungi**. Students will have opportunities to learn basic fungi identification skills to help them with this project during labs and field trips throughout the semester. For the Famous Mycologist Wikipedia page graduate students will select a mycologist for which there is no Wikipedia page and they will create a page based on publically available resources.

Graduate Student Grading

Component	Points
Class & Lab Participation	100
Quizzes	100
Final Exam	150
Fungal Collection Project	100
Zygomycete EOL project	100
Famous Mycologist Wikipedia page	50

Total Number of Possible Points: 600

Undergraduate Student Grading

Component	Points
Class & Lab Participation	100
Zygomycete EOL project	100

Fungal Collection Project	100
Quizzes	100
Final Exam	100
Total Number of Possible Points:	500

GRADES AND GRADE POINTS:

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Grade points will be assigned as follows.

<u>Letter Grade</u>	<u>Percentage</u>
A	95 – 100
A-	90 – 94.9
B+	87 – 89.9
B	83 – 86.9
B-	80 – 82.9
C+	77 – 79.9
C	73 – 76.9
C-	70 – 72.9
D+	67 – 69.9
D	63 – 66.9
D-	60.1 – 62.9
E	60 or below
WF	NA
I	NA
NG	NA
S-U	NA

ACADEMIC HONESTY – As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/SCCR/honorcodes/honorcode.php>.

Students are expected to strictly follow these guidelines:

1. Complete their own independent work (unless the assignment has specifically been defined as a group project) and turn it on time.
2. Cite sources in their written assignments so that the veracity of their statements can be independently verified by the instructor.
3. Use quotations to designate text that was generated by another person.
4. Know the definition of the word “plagiarism” and ensure that their academic work does not plagiarise the work of others (**see www.plagiarism.org/**).

SOFTWARE USE – All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

CAMPUS HELPING RESOURCES – Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/*
 Counseling Services
 Groups and Workshops
 Outreach and Consultation
 Self-Help Library
 Training Programs
 Community Provider Database
- *Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/*

SERVICES FOR STUDENTS WITH DISABILITIES – The Disability Resource Center (0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/) coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation

Course Schedule

		Lecture	Lab
Mon	Aug. 24	Intro to Course	Microscope Use
Fri	Aug. 28	Fungi Intro 1	Macrofungi – macromorphology, basics of ID
Mon	Aug. 31	Fungi Intro 2	Agaricoid fungi
Fri	Sept. 4	Paper Discussion 1 [Quiz 1]	<i>Field Trip to NATL to collect fungi</i>
Mon	Sept. 7	Holiday	Holiday
Fri	Sept. 11	Basidiomycota 1	Dichotomous Key exercise with Basidio fungi
Mon	Sept. 14	Basidiomycota 2	‘gasteromycetes’ and shelf fungi
Fri	Sept. 18	Paper Discussion 2	<i>Field Trip to Split Rock to collect fungi</i>
Mon	Sept. 21	Basidiomycota 3 [Quiz 2]	Rusts, Smuts, and Jellies
Fri	Sept. 25	Basidiomycota 4	<i>Field Trip to Newnan’s Lake to collect fungi</i>
Mon	Sept. 28	Paper Discussion 3	Molecular Identification & Tree-building
Fri	Oct. 2	Ascomycota 1	Zygo EOL Peer review exercise
Mon	Oct. 5	Ascomycota 2 [Quiz 3]	Ascocarp morphology
Fri	Oct. 9	Ascomycota 3	Asexual states of Ascomycota
Mon	Oct. 12	Ascomycota 4	Zygo EOL Exercise & Presentations Due
Fri	Oct. 16	Lichens	Lichen Morphology Lab
Mon	Oct. 19	Paper Discussion 4 [Quiz 4]	<i>Lichen Demography Field Trip</i>
Fri	Oct. 23	Mycorrhizal Symbiosis	Mycorrhiza Lab (dung chambers set up)
Mon	Oct. 26	Zygomycota	Zygomycete Morphology

Fri	Oct. 30	Industrial Uses of Fungi	Nematode-Destroying Fungi
Mon	Nov. 2	Paper Discussion 5 [Quiz 5]	Dung Fungi Lab
Fri	Nov. 6	Holiday	Holiday
Mon	Nov. 9	Paper Discussion 6	Fungi Barcoding Lab
Fri	Nov. 13	Aquatic Fungi – the chytrids Paper	Aquatic Fungi Lab
Mon	Nov. 16	Paper Discussion 7	Complete Barcode + Nematode Fungi Labs
Fri	Nov. 20	Fungi - food & food production	<i>Local Fungi Business Field Trip</i>
Mon	Nov. 23	Paper Discussion 8 [Quiz 6]	Mycophagy Lab (Wikipedia page due for graduate students)
Fri	Nov. 27	Holiday	Holiday
Mon	Nov. 30	Oomycota	Oomycota Lab
Fri	Dec. 4	Slime molds	Slime Mold Lab
Mon	Dec. 7	Final Review	Fungi Collections Due
Wed	Dec. 16	Final Exam 10-12 am	Final Exam 10-12 am

Outline of major topics to be covered in the course:

- Overview of fungal tree of life
- Basics of light microscopy
- History of mycology
- Macrofungi: basic field identification
- Lineage-specific activities for microscopic identification of fungi
- Species- and lineage-level diversity based on morphology and environmental sampling
- Basic concepts in molecular phylogenetics
- Specimen preservation and herbarium curation
- Emerging fungal diseases of plants and animals
- Encyclopedia of fungi exercise and peer review
- Identifying unknown fungi with DNA barcoding and phylogenetic analysis
- Insect and nematode associated fungi – ecology and systematics
- Species concepts and cryptic species in fungal biology
- Lichen biology and morphology
- Mycorrhizal ecology and evolution
- Fungi as medicines, toxins, and food products
- Fungal sexuality and reproduction
- Fungal endophytes of plants, bacterial endophytes of fungi
- Aquatic fungi – the biology and diversity of the “chytrids”
- Fungi-like organisms: Oomycota and Slime Molds

Assigned readings for Paper Discussions

Discussion 1 – Species-level and Deep-level Phylogenetic Diversity

- Blackwell (2011) The Fungi: 1, 2, 3 ... 5.1 million species? *American Journal of Botany*. 98: 426–438
- James et al. (2006) Reconstructing the early evolution of Fungi using a six-gene phylogeny. *Nature*. 443: 818

Discussion 2 – Speciation and Species Boundaries

- Taylor et al. (2000) Phylogenetic species recognition and species concepts in fungi. *Fungal Genetics and Biology*. 31: 21–32.
- Cai et al. (2014) Multi-locus phylogeny of lethal amanitas: Implications for species diversity and historical biogeography. *BMC Evolutionary Biology*. 14: 143.

Discussion 3 – Genomics Tools in Fungal Biology

- Branco et al. (2015) Genetic isolation between two recently diverged populations of a symbiotic fungus. *Molecular Ecology*. 24: 2747-2758.
- Floudas et al. (2012) The Paleozoic origin of enzymatic lignin decomposition reconstructed from 31 fungal genomes. *Science*. 336: 1715-1719.

Discussion 4 – Animal pathogenic fungi

- Leopardi et al. (2015) White-Nose Syndrome fungus introduced from Europe to North America. *Current Biology*. 25: R217-219
- Farrer et al. (2011) Multiple emergences of genetically diverse amphibian infecting chytrids include a globalized hypervirulent recombinant lineage. *PNAS*. 107:13777–13782

Discussion 5 – Plant pathogenic fungi

- Jousimo et al (2015) Ecological and evolutionary effects of fragmentation on infectious disease dynamics. *Science*. 344:1289-1293.
- Ma et al. (2013). Comparative genomics reveals mobile pathogenicity chromosomes in *Fusarium*. *Nature*. 464: 367-373.

Discussion 6 – Fungal Symbiosis

- Ruiz-Herrera et al. (2003) A novel intracellular nitrogen-fixing symbiosis made by *Ustilago maydis* and *Bacillus* spp. *New Phytologist*. 207: 769-777.
- Hom & Murray (2014) Niche engineering demonstrates a latent capacity for fungal-algal mutualism. *Science*. 345: 94-97.

Discussion 7 – Using fungal systems to test large-scale ecological theories

- Peay et al. (2007) A strong species–area relationship for eukaryotic soil microbes: island size matters for ectomycorrhizal fungi. *Ecology Letters* 10: 470-480.
- Peay et al. (2012) Measuring ectomycorrhizal fungal dispersal: macroecological patterns driven by microscopic propagules. *Molecular Ecology*. 21: 4122-4136

Discussion 8 –

- Bennet JW (2015) Silver linings: a personal memoir about Hurricane Katrina and fungal volatiles. *Frontiers in Microbiology*. <http://dx.doi.org/10.3389/fmicb.2015.00206>
- Liggenstoffer et al (2010) Phylogenetic diversity and community structure of anaerobic gut fungi (phylum Neocallimastigomycota) in ruminant and non-ruminant herbivores. *The ISME Journal* (2010) 4, 1225–1235