



Fungal Biology PLP 4653C/PLP 6656C

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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: **15 December 2022 at 12:30 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 presentation with appropriate visual aids
9. Provide constructive criticism during a peer review

TEXTS (Suggested):

- Introduction to Fungi. 3rd Edition (2007) Webster & Webster. Cambridge University Press.
- Bessette, A. E., Bessette, A. F., & Lewis, D. P. (2019). Mushrooms of the Gulf Coast States: A Field Guide to Texas, Louisiana, Mississippi, Alabama, and Florida. University of Texas 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>.

A Special Note on Health and Safety During the COVID19 Pandemic – As you are well aware, we are still dealing with a pandemic of the viral pathogen COVID19.

(During the unusual times of the COVID19 pandemic, I recognize that life may be disrupted more than usual. I will be flexible and work with you if there are disruptions due to COVID19. Please contact me directly via email for any issues or problems that arise.)

In order to reduce the risk of COVID19 on the UF campus, the first course of action is for all eligible students to get vaccinated. If you have not already been vaccinated, you can find details on the best way to get vaccinated [here](#). For the safety and well-being of your classmates, I ask that you please refrain from attending class activities, labs, or field trips if you have COVID19 or have symptoms of COVID19 and have not received a negative test result. If you have any questions or concerns, please feel free to contact Dr. Smith directly via email or come talk with him in person regarding any issues related to COVID19.

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. *If you have to miss class for any reason, please contact me to ensure that we can provide any information that you missed if at all possible.*

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 (but not required) 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 550 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 Fungi EOL/Wikipedia 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 **15 December 2022 at 12:30 pm**.

COURSE PROJECTS:

For the **Fungi EOL/Wiki project**, students will select a target fungus of their choice (preferably from a designated list of nominated fungi) research the biology of that fungus, and then summarize what is known about the fungus on a webpage for the Encyclopedia of Life (EOL) or Wikipedia. This project will also involve a peer-review process whereby fellow students will provide constructive feedback to improve the webpage. Students will also give a brief presentation to introduce their fungus to the class.

For the **Fungal Collections Project** students will collect, identify, and preserve local macrofungi to be deposited in the Florida Museum of Natural History. Students will have opportunities to learn basic fungi identification skills to help them with this project during labs and field trips throughout the semester. We will go over this assignment in great detail before you start.

For the **Famous Mycologist Wikipedia Project (graduate students only!)**, students will select a mycologist for which there is no Wikipedia page (or a highly limited one) and they will create a page based on available resources.

The course **participation grade** is compiled based on attendance, participation in lecture and lab activities, and active participation during field trips and paper discussions.

Graduate Student Grading

Component	Points
Class & Lab Participation	50
Quizzes	100
Final Exam	100
Fungal Collection Project	200
Fungi EOL/Wiki project	100
Famous Mycologist Wikipedia page	50

Total Number of Possible Points: 600

Undergraduate Student Grading

Component	Points
Class & Lab Participation	50
Quizzes	100
Final Exam	100
Fungal Collection Project	200
Fungi EOL/Wiki project	100

Total Number of Possible Points: 550

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 FEEDBACK – Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens they and can complete evaluations through the email they

receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

COURSE RECORDING – Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor. Publication without permission of the instructor is prohibited. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party services. A student who publishes a recording without written consent may be subject to a civil action or disciplined by the University.

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 techniques 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
- Identifying unknown fungi with DNA barcoding and phylogenetic analysis
- Basic ecology and systematics of insect-associated and nematode-associated fungi
- 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

Course Schedule

		Date	Lecture	Lab	Assignment
1	Fri.	Aug. 26	Intro to fungi & the course	Microscope Use	
2	Mon.	Aug. 29	Fungi Intro - Nomenclature & Species Concepts	Macrofungi – macromorphology, basics of ID, Agaricoid fungi	
3	Fri.	Sept. 2	Agaricomycetes and mycological terms	'Gasteromycetes' lab	<i>Fungi Collections Handout</i>
–	Mon.	Sept. 5	Holiday	Holiday	
4	Fri.	Sept. 9	Paper Discussion 1 [Quiz 1]	<i>Field Trip to NATL**</i>	
5	Mon.	Sept. 12	Basidiomycota 1	Dichotomous Key exercise	<i>Dichotomous Key</i>
6	Fri.	Sept. 16	Basidiomycota 2	Paper Discussion 2, Dung Fungi (Intro & setup)	
7	Mon.	Sept. 19	Wood Decay Fungi ¹ [Quiz 2]	Polypore lab ¹	
8	Fri.	Sept. 23	Basidiomycota 3	Rusts, Smuts, and Jellies	<i>Fungi EOL/Wiki Handout</i>
9	Mon.	Sept. 26	Ascomycota 1	<i>Field Trip to Lake Alice**</i>	
10	Fri.	Sept. 30	Ascomycota 2	Ascocarp morphology	<i>Famous Mycologist handout (grads only)</i>
11	Mon.	Oct. 3	Ascomycota 3	DNA Barcoding (part 1) Culturing Dung Fungi	
12	Fri.	Oct. 7	Paper Discussion 3 [Quiz 3]		
13	Mon.	Oct. 10	Ascomycota 4	Culturing Dung Fungi, Fungi ID – bring your fungi!	Draft Fungi EOL/Wiki due
14	Fri.	Oct. 14	Fungi Secondary Compounds	Asexual states of Ascomycota	
15	Mon.	Oct. 17	Lichens ²	Lichen Morphology Lab ²	
16	Fri.	Oct. 21	Ascomycota 5 – Pezizales and Orbiliales ³	DNA Barcoding (part 2), Molecular Identification & Tree-building ³	
17	Mon.	Oct. 24	Fungal-Animal Symbioses	<i>Lichen Scavenger Hunt Field Trip**</i>	Fungi EOL/Wiki peer review due
18	Fri.	Oct. 28	Mycorrhizal Symbiosis [Quiz 4]	Mycorrhiza Lab	
19	Mon.	Oct. 31	'Zygomycetes'	'Zygomycete' Morphology Lab	<i>Famous Mycologist due (grads only)</i>
20	Fri.	Nov. 4	Paper Discussion 4	Fungi ID – bring your fungi!	
21	Mon.	Nov. 7	[Quiz 5]	Fungi EOL/Wiki Assignment Due + Presentations	Fungi Presentations
–	Fri.	Nov. 11	Holiday	Holiday	
22	Mon.	Nov. 14	Chytrids	Paper Discussion 5	
23	Fri.	Nov. 18	Paper Discussion 6	<i>Local Fungi Business Field Trip</i>	
24	Mon.	Nov. 21	Fungi for food & food production	Mycophagy Lab	
–	Fri.	Nov. 25	Holiday	Holiday	
25	Mon.	Nov. 28	Oomycota [Quiz 6]	Oomycota Lab Fungi ID – bring your fungi!	
26	Fri.	Dec. 2	Slime molds	Slime Mold Lab Fungi ID – bring your fungi!	
27	Mon.	Dec. 5	Final Review	Fungal Collections Due	
	THURS	Dec 15	FINAL EXAM (12:30-2:30)		

**Field trips are outside activities. Please wear appropriate clothes & shoes. Prepare to be outside!

¹Special Guest Lecture and Lab with Dr. Nattapol Kraistudomsook and Ph.D. candidate Claudia Paez.

²Special Guest Lecture and Lab with lichen expert Laurel Kaminsky.

³Special Guest Lecture and Lab set with Dr. Rosanne Healy and Ph.D. candidate Ben Lemmond.

Assigned readings for Paper Discussions

Discussion 1 – Phylogenies and Phylogenetic Diversity

- Spatafora et al. (2017) The Fungal Tree of Life: from Molecular Systematics to Genome-Scale Phylogenies. *Microbiology Spectrum*. 5(5)
- Sánchez-García et al. (2020). Fruiting body form, not nutritional mode, is the major driver of diversification in mushroom-forming fungi. *Proceedings of the National Academy of Sciences (PNAS)*. 117: 32528-32534.

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.
- Sepúlveda et al. (2017). Genome sequences reveal cryptic speciation in the human pathogen *Histoplasma capsulatum*. *MBio*, 8(6), e01339-17.

Discussion 3 – DNA Barcoding and Sequence-based Classification

- Gazis et al (2011) Species delimitation in fungal endophyte diversity studies and its implications in ecological and biogeographic inferences. *Molecular Ecology*. 20: 3001-3013
- Xu J (2016) Fungal DNA Barcoding. *Genome*. 59 (11): 913-932.

Discussion 4 – Fungal Symbioses

- Peay et al. (2007) A strong species–area relationship for eukaryotic soil microbes: island size matters for ectomycorrhizal fungi. *Ecology Letters* 10: 470-480.
- Koch et al. (2021) Symbiotic nitrogen fixation in the reproductive structures of a basidiomycete fungus. *Current Biology*. 31: 3905-3914.

Discussion 5 – Using molecular data to discover fungi in the environment

- Baldrian et al. (2022) High-throughput sequencing view on the magnitude of global fungal Diversity. *Fungal Diversity*. 114: 539-547.
- Torres-Cruz et al. 2017. *Bifiguratus adelaidae*, gen. et sp. nov., a new member of Mucoromycotina in endophytic and soil-dwelling habitats. *Mycologia* 109(3):363-78
- James TY, Seifert KA. 2017. Description of *Bifiguratus adelaidae*: The hunt ends for one of the “Top 50 Most Wanted Fungi.” *Mycologia* 109(3): 361-362 (A short commentary on Torres-Cruz et al. 2017)

Discussion 6 – Animal Pathogenic Fungi

- Palmer et al. 2014. Molecular characterization of a heterothallic mating system in *Pseudogymnoascus destructans*, the fungus causing white-nose syndrome of bats. *G3: Genes, Genomes, Genetics*. 4(9):1755-63.
- Scheele et al. 2020. Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity. *Science* 363: 1450-1463