

## **PMB/IB 110 Biology of the Fungi, 4 units, Fall 2022**

**Lectures** Mon, Wed 1-2 in Social Sciences 126

**Lab/discussion sections** Mon/Wed 9-12; Mon/Wed 2-5. All lab classes in 209 GPBB (above Pat Brown's Grill)

### Synopsis

This course surveys the biology of fungi and selected fungal-like eukaryotes through lectures, lab/discussions and student projects. Our goal is to help students develop a broad understanding of the diversity of fungi and fungal-like organisms, their basic biology, and the major roles fungi and fungal-like organisms play in our natural ecosystems, agriculture, medicine, and biotechnology.

Lectures will start promptly at 1:10 and end at 2:00. Please plan to arrive on time. Most of the material on exams will come from lectures, although some laboratory material will also be included. Quizzes will focus on lab material (see below).

### Lab sections

**Big picture:** In lab, you will examine material that the instructors give you; you will culture your own fungi for credit; and you will read, present on, and discuss primary research papers. Each aspect is critical for the course. We cover them in detail below.

**Lab housekeeping info:** Labs will start promptly at 9:10 AM and 2:10 PM. Please sign the attendance register at the front of the lab when you arrive, as **attendance is required**. With the exception of days when you are presenting a discussion paper, **you may miss a maximum of 2 labs without penalty or excuse**. The lab participation grade (5%) will be based on 1) your attendance, and 2) uploading of labeled images or videos from instructor-provided material lab to iNaturalist.

Labs will start with a short show and tell period, where students and instructors share observations with the class. This is a great time to bring in material to share, especially if you need help with identifying them. For microscopic fungi/fungal-like organisms, come with photos that you have posted to iNaturalist ([Inaturalist.org](https://www.inaturalist.org)) that can be projected for the class to see.

**Instructor-provided material in lab:** A first aspect of our lab is activities in which you inspect fungi and fungal-like organisms provided by the instructors. There will be live or preserved material. The purpose of this is to allow you to see these organisms and structures in person and to reinforce the information in lecture and discussions. Your job is thus to learn to identify key structures and species and **take good photos** that you will upload to iNaturalist ([Inaturalist.org](https://www.inaturalist.org)). A PDF handout for each lab will be available for download on the bCourses site in the Lab folder prior to the scheduled lab. This PDF will outline the goals of each lab and list the fungi/fungal-like organisms that we expect to see. Please download and read the PDF prior to coming to lab, and have it on hand during lab. Instructors are there to answer questions and help you wrangle your organisms, but you need to read the PDF first! Key structures and common organisms that you see in lab, lecture, or both are fair game for quizzes and tests.

**Culture/observations project:** Another key component of the lab is the culture/observations project. We cover the **details in a separate PDF on bCourses**. As a brief summary here, we note that the project involves each student finding and identifying a diverse set of fungi in their local environment and posting them to [Inaturalist.org](https://www.inaturalist.org). All class posts will be assembled so that everyone can see each other's observations, and collectively view the diversity of fungi in our environments. In addition to environmental samples (e.g. mushroom fruiting bodies), at least three pure culture isolates must be obtained as part of

your culture/observation project. You should set aside some time in each lab to work on obtaining these three cultures, identifying, photographing them and uploading information on these cultures to iNaturalist. These pure cultures will be useful to use DNA identification as part of your collection.

**Scientific paper presentation and discussion:** A third component of the lab is presentation and discussion of primary research papers from the fungal research literature. **The details are in a separate PDF on bCourses.** The essentials are that all students read each paper and submit Discussion Spark questions ahead of time; and a group of students stands up in front of the class giving an oral presentation on each paper. Click to sign up for your paper presentation topic and date for [morning](#) and [afternoon](#) lab.

## Textbook

No textbook is required for the course. However, there will be assigned readings that are part of the lab discussions. These are posted on bCourses, and we will post other unassigned readings to provide backgrounds in particular topics.

## Field trips

Field trips have always been a part of this course. We will carry on that tradition this year with two half-day field trips and one overnight/weekend field trip. The dates are listed on the schedule below. Transportation will be provided. The half-day field trips are free. The weekend field trip has an estimated cost of \$48 to cover two meals and overnight accommodations. If you cannot afford this, but want to go, contact Prof. Brem or Prof. Glass. All field trips are optional.

## Grades

This course has usually been ranked as difficult by students because of the amount of material covered. Nevertheless, roughly 2/3rds of the students usually receive As and Bs. To be in that subset, our advice is for you to **attend lecture and lab discussions**, take notes, stay current, and ask questions in class or office hours if you don't understand the material. Without a textbook, it is really important to attend lectures and remain engaged during lecture and laboratory presentations.

We will try to keep the grade book on bCourses reasonably current. But totals may not be precisely accurate because things like quizzes and participation grades may have different nominal points that will get scaled to the correct percentage later.

### Grade breakdown

		%	pts
Midterm		20%	100
Final		40%	175
Best five lab quizzes (of 7)		10%	50
Paper/discussion	group presentation	6%	26
	Discussion Spark questions and participation	4%	24
Personal observation project		15%	100

Lab participation		5%	25
Total		100%	500

**The midterm and final** will be biased toward material presented in lecture, but may also include information from all other parts of the course, including the lab material. Material that shows up in lecture and is repeated in labs or discussions has the highest probability of being tested. The final is cumulative but weighted toward material given after the midterm.

**7 lab quizzes** will be short (10-15 min) and given at the start of the lab period in which they are scheduled. They will cover material from lab, including morphology (what organisms look like) and aspects of the life cycle. The lowest two lab quiz scores will be dropped. Thus, you can skip up to two lab quizzes without penalty.

**Office hours** with instructors and GSIs will be by appointment and on zoom. Please contact us for an appointment if you have any questions on the lecture or laboratory material. We have an excellent student/instructor ratio - so take advantage of it!

## Instructors

### **Prof. Rachel Brem**

Office hours: by appointment; contact by email.

Email: [rbrem@berkeley.edu](mailto:rbrem@berkeley.edu)

### **Prof. N. Louise Glass**

Office hours: by appointment; contact by email.

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### **Dr. Monika Fischer**

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### **Alienor Baskevitch (GSI)**

Office hours: by appointment; contact by email.

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### **Anjali McNeil (GSI)**

Office hours: by appointment; contact by email.

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## Calendar

day	date		topic	lecturer
Wed	8/24/22	Lec	<b>Introduction to fungi and course</b>	<b>Brem</b>
Wed	8/24/22	Lab1	Kohler illumination and microscope use, making wet mounts, cell phone photomicroscopy	
Mon	8/29/22	Lec	<b>How do we tell one fungal species from another?</b>	<b>Brem</b>
Mon	8/29/22	Lab2	Isolation methods, PCR methods, how to do a BLAST search	
Wed	8/31/22	Lec	<b>Myxogastria: Acellular slime molds</b>	<b>Brem</b>
Wed	8/31/22	Lab3	Myxogastria: acellular slime molds	
Mon	9/05/22		<b>Labor Day</b>	
Wed	9/07/22	Lec	<b>Dictyostelia: Cellular slime molds</b>	<b>Brem</b>
Wed	9/07/22	Lab4	Lab quiz 1 Dictyoselia and relatives	
Fri	9/09/22	assign	<b>Deadline to sign up for an iNaturalist account (<a href="https://www.inaturalist.org">Inaturalist.org</a>)</b>	
Mon	9/12/22	Lec	<b>Oomycota - Peronosporales</b>	<b>Brem</b>
Mon	9/12/22	Lab5	Phytophthora and other Peronosporomycetes	
Wed	9/14/22	Lec	<b>Molecular evolution of Oomycota pathogens</b>	<b>Brem</b>
Wed	9/14/22	Lab6 assign	<i>Pythium</i> ; start water mold baiting from pond water; deadline to join iNaturalist PMB110 class project	
Fri	9/16/22	assign	<b>Deadline to make your first iNaturalist post</b>	
Sat	9/17/22	Fieldtrip	<b>UCB Botanical Gardens Field Trip</b>	
Mon	9/19/22	Lec	<b>Oomycota - Saprolegniales</b>	<b>Brem</b>
Mon	9/19/22	Lab7	Saprolegnia & Achlya - pick up dung jars	
Wed	9/21/22	Lec	<b>Emerging chytrid pathogens of amphibians</b>	<b>Brem</b>

Wed	9/21/22	Lab8 Reading	Lab quiz 2; Blastocladiomycota; baiting for chytrids BD:paper <a href="https://royalsocietypublishing.org/doi/10.1098/rspb.2019.0833">https://royalsocietypublishing.org/doi/10.1098/rspb.2019.0833</a>	
Mon	9/26/22	Lec	<b>Early diverging fungi</b>	<b>Glass</b>
Mon	9/26/22	Lab9	Chytridiomycota	
Wed	9/28/22	Lec	<b>Mucoromycota</b>	<b>Glass</b>
Wed	9/28/22	Lab10	Mucorales - mating structures, and light responsive dung fungi	
Mon	10/3/22	Lec	<b>AM and Ectomycorrhizae</b>	<b>Glass</b>
Mon	10/3/22	Lab11 Reading	Lab quiz 3; Mycorrhizal lab Reading: Massospora and cicadas: Boyce et al. <a href="https://www.sciencedirect.com/science/article/pii/S1754504819300352?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S1754504819300352?via%3Dihub</a>	
Wed	10/5/22	Lec	<b>Zoopagomycota</b>	<b>Glass</b>
Wed	10/5/22	Lab12	Mucorales - morphological diversity & Zoopagomycota, take home RBA plates for air sampling	
Mon	10/10/22	Lec	Midterm	
Mon	10/10/22	Lab13	Open lab to work on cultures	
Wed	10/12/22	Lec	<b>Ascomycota</b>	<b>Brem</b>
Wed	10/12/22	Lab14	Ascomycota Yeasts	
Wed	10/12/22	assign	<b>Turn in first axenic culture no later than today &amp; first deadline to submit samples for PCR amplification and DNA sequencing</b>	
Mon	10/17/22	Lec	<b>Saccharomycotina</b>	<b>Brem</b>
Mon	10/17/22	Lab15	"imperfect fungi" and fungi in your homes; bring RBA plate back	
Wed	10/19/22	Lec	<b>Ascomycota: Orbiliomycetes and Pezizomycetes</b>	<b>Glass</b>

Wed	10/19/22	Lab16 Reading	Lab quiz 4; Orbilomycetes, Pezizomycetes lab; Reading: Nematode trapping fungi and Nematode pheromone <a href="https://www.sciencedirect.com/science/article/pii/S0960982212013796?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S0960982212013796?via%3Dihub</a>	
Mon	10/24/22	Lec	<b>Ascomycota: Leotiomycetes and Sordariomycetes</b>	Glass
Mon	10/24/22	Lab17	Pezizomycetes, Leotiomycetes lab	
Wed	10/26/22	Lec	<b>Ascomycota: Lecanoromycetes</b>	Scharnagl
Wed	10/26/22	Lab18	Sordariomycetes lab	
Fri	10/28/22	assign	<b>Last day for first 50 pts of culture/observation project to be turned in</b>	
Fri	10/28/22	Fieldtrip	<b>Far West Fungi Field Trip</b>	
Mon	10/31/22	Lec	<b>Ascomycota_Dothidiomycetes</b>	Glass
Mon	10/31/22	Lab19	Lab quiz 5; Lichens and Dothidiomycetes	
Wed	11/2/22	Lec	<b>Ascomycota_Eurotiomycetes</b>	Glass
Wed	11/2/22	Lab20 Reading	Cheese and other edible fungal products tasting lab; Reading: <a href="https://sfamjournals.onlinelibrary.wiley.com/doi/full/10.1111/1462-2920.15223">https://sfamjournals.onlinelibrary.wiley.com/doi/full/10.1111/1462-2920.15223</a>	
Wed	11/2/22	assign	<b>Last day for 2nd culture to be turned in &amp; 2nd deadline to submit samples for PCR amplification and DNA sequencing</b>	
Mon	11/7/22	Lec	<b>Evolution of Drug Resistance: Aspergillus fumigatus</b>	Brem
Mon	11/7/22	Lab21	Eurotiales	
Wed	11/9/22	Lec	<b>Introduction to Basidiomycota</b>	Glass
Wed	11/9/22	Lab22	Mushroom construction and clamp connections	
Mon	11/14/22	Lec	<b>Agaricomycotina</b>	Glass
Mon	11/14/22	Lab23 Reading	Lab quiz 6; Jelly fungi Raudabaugh 2020: <a href="https://doi.org/10.1016/j.funeco.2019.100870">https://doi.org/10.1016/j.funeco.2019.100870</a>	
Wed	11/16/22	Lec	<b>Rusts and relatives: Pucciniomycotina</b>	Glass

Wed	11/16/22	Lab24	Rust fungi	
Sat-Sun	11/19-11/20	Fieldtrip	<b>Mendocino Mushroom Foray (overnight)</b>	
Mon	11/21/22	Lec	<b>Smut fungi Ustilaginomycotina</b>	<b>Glass</b>
Mon	11/21/22	Lab25 Assign	Mushroom display from foray; <b>final deadline to submit samples for PCR amplification and DNA sequencing</b>	
Wed	11/23/22		NO Class Thanksgiving break	
Mon	11/28/22	Lec	<b>Convergent morphologies and evolution in Basidiomycota</b>	<b>Glass</b>
Mon	11/28/22	Lab26 Reading	Lab quiz 7; Smut fungi /Reading: Rust Pseudoflowers Roy. <a href="https://www.nature.com/articles/362056a0">https://www.nature.com/articles/362056a0</a>	
Wed	11/30/22	Lec	<b>Evolution of virulence in fungal plant pathogens</b>	<b>Brem</b>
Wed	11/30/22	Lab27	Open lab to work on cultures	last day of formal classes
Wed	11/30/22	Assign	<b>Deadline for culture/observation project</b>	
Wed	12/15/22	Final	7-10:00 PM	