

Course: PLS566
Title: Soil Microbiology

Term: Spring 2024

Credit hours: 3

Meeting days/time/location: MWF 10:00 – 10:50, Agricultural Science Building Room A-06

Instructor Information

Name: Dr. Ernie Osburn

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Office building and room number: Agricultural Science Building N-122N

Office hours: MWF 11:00 – 12:00

Course Description

Microbes are the most abundant organisms on earth and contribute to the ecosystem processes that make human existence possible. For example, microbes regulate the global climate and are central to food, energy, and fiber production. This course will present core principles of the biology and ecology of microorganisms that live in the soil. Students will use the core principles to link the characteristics these organisms to the ecosystem services they provide. This course will also use primary scientific literature to develop critical thinking skills needed to analyze, interpret, and communicate scientific information.

This class will explore: (1) Soil as a microbial habitat, (2) Microbial taxa (e.g., viruses, bacteria, archaea, fungi), (3) Microbial ecology (diversity, community composition, spatial distribution, interactions), (4) Microbial metabolism and functional traits (5) Microbe-mediated biogeochemistry (soil C and N cycling) (6) Plant-soil-microbe interactions and (7) Methods in microbial research. Through discussion-based classes and readings, this course is designed to provide students with core concepts and skills that will allow students to apply their knowledge of soil microorganisms to real-world problems.

Required Materials

Readings from the literature will be made available on Canvas.

The **suggested** textbook we will follow is *Soil Microbiology, Ecology, and Biochemistry* (5th ed.) edited by Eldor Paul and Serita Frey (ISBN: 9780128229415). The text can be obtained in hardbound or electronic form. Older but comparable editions of this text (e.g., 4th ed.) are also in circulation.

Student Learning Outcomes

- Discuss core concepts of the biology, ecology, and ecosystem functions of soil microorganisms.
- Understand the importance of soil microbes' biology and ecology to biogeochemical cycles (e.g., the carbon and nitrogen cycles).
- Investigate and communicate the complexity of soil microbes in the soil environment using critical analysis of soil microbiology literature.

Course Details

Tentative Course Schedule

Week	Topic	Assignments
Week 1: 1/8/24 – 1/12/24	Intro to Soil Microbiology <i>Paul and Frey Ch. 1</i>	Paper Discussion 1 (1/12) Canvas Quiz 1
Week 2: 1/15/24 – 1/19/24	The Soil Habitat <i>Paul and Frey Ch. 2</i>	Paper Discussion 2 (1/19) Canvas Quiz 2
Week 3: 1/22/24 – 1/26/24	Bacteria and Archaea <i>Paul and Frey Ch. 3</i>	Paper Discussion 3 (1/26) Canvas Quiz 3
Week 4: 1/29/24 – 2/2/24	Fungi and “Protists” <i>Paul and Frey Ch. 4</i>	Paper Discussion 4 (2/2) Canvas Quiz 4
Week 5: 2/5/24 – 2/9/24	Microfauna and Viruses <i>Paul and Frey Ch. 5</i>	Paper Discussion 5 (2/9) Canvas Quiz 5
Week 6: 2/12/24 – 2/16/24	Microbial Ecology <i>Paul and Frey Ch. 8</i>	Paper Discussion 6 (2/16) Canvas Quiz 6
Week 7: 2/19/24 – 2/23/24	Microbial Ecology (cont.) <i>Paul and Frey Ch. 10</i>	Paper Discussion 7 (2/23) Canvas Quiz 7
Week 8: 2/26/24 – 3/1/24	Microbial Metabolism <i>Paul and Frey Ch. 9</i>	Paper Discussion 8 (3/1) Canvas Quiz 8
Week 9: 3/4/24 – 3/8/24	Microbial Functional Traits <i>Paul and Frey Ch. 9, 10</i>	Midterm Exam (Friday 3/8)
Week 10: 3/11/24 – 3/15/24	Spring Break	
Week 11: 3/18/24 – 3/22/24	The Carbon Cycle <i>Paul and Frey Ch. 12, 13</i>	Paper Discussion 9 (3/22) Canvas Quiz 9 Lit. Review Proposal Due (3/22)
Week 12: 3/25/24 – 3/29/24	The Nitrogen Cycle <i>Paul and Frey Ch 14, 15</i>	Paper Discussion 10 (1/26) Canvas Quiz 10
Week 13: 4/1/24 – 4/5/24	Plant-Soil-Microbe Interactions <i>Paul and Frey Ch. 11</i>	Literature Review Draft Due (4/5)
Week 14: 4/8/24 – 4/12/24	Molecular microbial methods <i>Paul and Frey Ch. 6</i>	Paper Discussion 11 (4/12) Canvas Quiz 11
Week 15: 4/15/24 – 4/19/24	Physiological microbial methods <i>Paul and Frey Ch. 7</i>	Final Literature Review Due (4/19)
Week 16: 4/22/24 and 4/24/24	Review and Summary	Prep Days, Reading Days
Week 17: 4/29/24	Final Exam	Monday 4/29 10:30 – 12:30 PM

Course Activities and Exams

Exams -	30%
Quizzes -	20%
Participation in lecture/discussion -	10%
Discussion Lead -	10%
Literature Review Proposal -	5%
Literature Review Draft -	10%
Final Literature Review -	15%

Exams: A midterm exam and final exam will be administered. The exams will contain a combination of multiple choice questions, short response prompts, and essay prompts. These questions are designed to provide opportunities for students to demonstrate mastery of the content at various cognitive levels ranging from basic knowledge comprehension to analysis, synthesis, and evaluation of content.

Quizzes: Short quizzes will be administered weekly on Canvas and are designed to provide ongoing feedback to students and the instructor regarding achievement of specific learning objectives. Quizzes should be completed individually, but course materials can be used. Each student's lowest quiz score will be dropped.

Participation in lecture and discussion: Learning experiences improve when all students contribute their unique perspectives and insights during class. I expect to make meaningful comments or ask meaningful questions during each class period. I will be asking numerous questions to help stimulate discussion during lectures. You and your classmates will be doing the same during paper discussions. Performance in this category also depends on attendance. It will be difficult to do well if you are frequently absent; your presence is necessary for you to contribute during class and paper discussions.

Discussion Lead: Students will work in pairs to lead one of the Friday paper discussions. Guidelines for leading a successful discussion will be provided during class. We will sign up for days/topics for leading the discussions during the first two weeks of class.

Literature Review: My goal is to facilitate students in developing the skills they will need to be successful in their academic careers. In this course, the skill we will focus on is critical analysis of the scientific literature. The assignment we will use to practice and assess that skill is the literature review assignment. For this assignment, students will choose a specific topic in soil microbiology that interests them, conduct a literature search for references that relate to their topic, and provide a written summary and analysis of the selected references. Full details on the guidelines and expectations for this assignment will be provided in class. This assignment will also differentiate between undergraduate and graduate expectations for the course (graduate students will include a larger number of references in their analysis).

Literature Review Proposal: The proposal assignment is a short, one paragraph description of the topic you want to investigate for your literature review. This will allow me to gauge the appropriateness of your topic of choice and provide some initial feedback. The paragraph should provide a few details on why you chose your specific topic and why you think it is important. It would also be helpful to provide a couple of examples of references you would include in the review. The more information you provide here, the better feedback I can provide.

Literature Review Draft: Your initial draft of the literature review is due two weeks before submitting the final draft. This will allow me to provide additional feedback before submission of the final assignment. At a minimum, the draft will be a complete outline of the content of your literature review. Alternatively, you can submit a fully written draft for feedback. Again, the more content you provide to me the better feedback I can give.

Grading Scale

Grading scale for undergraduate students:

90 – 100% = A
80 – 89% = B
70 – 79% = C
60 – 69% = D
Below 60% = E

Grading scale for graduate students:

90 – 100% = A
80 – 89% = B
70 – 79% = C
Below 70% = E

Midterm Grades

For undergraduates, midterm grades will be posted in myUK by the deadline established by the University Senate and published in the [Academic Calendar](https://registrar.uky.edu/academic-calendars/university). (<https://registrar.uky.edu/academic-calendars/university>)

Attendance Policy/Acceptable Documentation

If you have unexcused absences equal to 20% of class contact hours, you will not receive credit for the course and will receive a grade of 'E' if you do not withdraw. University Senate Rules state that students who accumulate excused absences equal to 20% of class contact hours can ask to withdraw from the course. To have your absence excused, you will need to provide official documentation within one week of returning to class. If you have a combination of excused and unexcused absences equal to 20% of class contact hours, your instructor may also encourage you to withdraw. Please see University Senate Rules <https://universitysenate.uky.edu/rules-and-elections/university-senate-rules> for an explanation of excused absences.

Assignment Policies

Assignment Submissions

Assignments for this course will be turned in on Canvas.

Late Assignments

Assignments turned in late due to absence from class will only be accepted if the absences were excused, as described in the University Senate Rules: <https://universitysenate.uky.edu/rules-and-elections/university-senate-rules>

Academic Policy Statements

All university policies regarding absences, make-up work, prep days, reading days, accommodations due to disability, and non-discrimination and title IX will be observed. Those policies are described at the following URL: <https://universitysenate.uky.edu/standard-academic-policy-statements>

Academic Offenses (Cheating, Plagiarism, and Falsification or Misuse of Academic Records)

Per University policy, students shall not plagiarize, cheat, or falsify or misuse academic records. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious

penalties, up to suspension from the University may be imposed. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty.

University Senate Rule 6.3.1 states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. For cases in which students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission. When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Complete information regarding the university's policies on plagiarism and other academic offences can be found at the following URL: <https://universitysenate.uky.edu/academic-offenses-rules-undergraduate-and-graduate-students>

In addition to plagiarism, the use of generative AI (GenAI) will be prohibited in this course. Because a major focus of this course is on developing your skills and understanding, you must complete assignments for this course entirely on your own. You may not copy from any online sites (e.g. Course Hero or Chegg) or utilize composition technologies (e.g. ChatGPT or other GenAI software). Work submitted by students will be generated by the students themselves. For the purposes of this course, any use of these sites or tools will be considered academic misconduct and consequences will follow University policies. If you have any questions or concerns about this policy, contact your instructor before submitting any assignments.

Diversity, Equity, and Inclusion

This course will uphold the university's policies on diversity, equity, and inclusion, as described here: <https://universitysenate.uky.edu/syllabus-statement-diversity-equity-and-inclusion-dei>

As such, it is my goal that students from all backgrounds and perspectives be served by this course and feel comfortable during class. I believe that the diversity that students bring to this class is a resource and strength that improves the quality of our interactions and achievement of learning outcomes. I aim to be respectful and inclusive of all backgrounds (gender, sexual orientation, disability, age, socioeconomic status, ethnicity, race, and culture) in all aspects of this course. Your suggestions about how to improve the course to be more inclusive and equitable are welcome. I'm looking forward to learning and growing with you.

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### **Student Resources**

*The University offers a variety of resources to students. Visit the University Senate's [Resources Available to Students](https://universitysenate.uky.edu/resources-available-students) to access that list (<https://universitysenate.uky.edu/resources-available-students>).*