

## SOIL MICROBIOLOGY

SOCR 455

MWF, 9:00-9:50 am

Plant Sciences W212

Fall 2018

### Course Description and Objectives:

Students will gain an understanding of soil microbiology and microbial ecology, including the types of organisms living in soil, growth and survival strategies, biogeochemical functions, and environmental issues and applications involving soil microorganisms.

After completion of the course, students will be able to:

- 1) Describe soil organisms and microbial habitats of soil environments.
- 2) Understand the environmental influences which control microbial distribution, growth, and activity in soil ecosystems.
- 3) Describe critical functional roles of soil microorganisms and processes and interactions affecting ecosystem productivity and environmental quality.
- 4) Apply knowledge of soil microorganisms and their activities to address global issues within environmental quality and agricultural sustainability.
- 5) Understand and interpret data in the context of soil microbiology.
- 6) Communicate science and relevance of soil microbiology in written and spoken forms

### Instructor:

Yamina Pressler

Office: A105 Natural Resource & Environmental Science Building (NESB)

Email: Yamina.Pressler@colostate.edu

Office hours: Wednesdays 10-11 am or by appointment

### Textbooks:

*Soil microbiology, ecology and biochemistry 4<sup>th</sup> ed.*

By E.A. Paul (eds), Academic Press, 2014

(SMEB on course schedule; chapter pdfs available on Canvas)

### Other readings:

Relevant literature on syllabus, assigned in class, and posted on Canvas

### Prerequisites:

SOCR 240 (Introductory Soil Science) *or* MIP 300 (General Microbiology)

### Grading structure:

Component	Quantity	Points	Percentage of course total
Midterm exams	3	150 (50 each)	30 %
Final exam	1	100	20 %
Quizzes	5	75 (15 each)	15 %
Paper	1	75	15 %
Homework	2	50 (25 each)	10 %
Presentation	1	25	5 %
Participation	NA	25	5 %
<b>TOTAL</b>		<b>500</b>	

## Course Components:

### *Exams*

The course includes three (3) in class written midterm exams covering material from Part I, II and III of the course. The written final exam will be cumulative including material from Part IV.

### *Quizzes*

The course includes five (5) short in class quizzes. Quizzes will recover material from readings and lectures. Quiz weeks are denoted with an asterisk (\*) on course schedule.

### *Homework*

The course includes two (2) homework assignments. Homework 1 will be given during Part I of the course; Homework 2 will be given during Part III of the course. You will be given at least one (1) week to complete each homework assignment. Homework assignments are due on canvas by 5pm on the due date (see course schedule).

### *Presentation*

During Part I of the course, you will give an ignite style presentation (5 minutes, 20 slides, 15 seconds per slide, slides auto-advance) on a soil organism of your choice. The goals of the soil biota ignite presentations are to (1) gain experience searching and synthesizing the soil microbiology scientific literature, (2) share a quick but in-depth look at your chosen soil organism and (3) provide an opportunity for you to practice and refine your public speaking skills in the short, distilled format common in scientific settings.

### *Paper*

During the course, you will write a short popular science style essay on the societal relevance of soil microorganisms. The essay includes a draft (35 points) and a final (40 points). Further information on the paper will be provided during the course.

### *Synthesis Discussions*

Parts II, III, and IV will each end with a synthesis discussion. We will review and synthesize the content presented in that part and discuss a paper from the literature that you will be assigned to read earlier that week. You are expected to come to each synthesis discussion prepared to discuss the material presented during that part of the course as well as the assigned paper. Preparing for and participating in synthesis discussions will help you prepare for the midterm and final exams and will count towards your participation grade.

### *Participation*

Your participation grade will be based on your participation in course discussions, in class activities, and synthesis discussions. Successful students will come to class prepared to discuss the readings and previous lecture material.

### Statement Regarding Academic Integrity:

(modified from SPCM 201 Fall 2011 Syllabus of Professor Greg Dickinson)

Academic integrity means that no one will use another's work as their own. One part of academic integrity is avoiding plagiarism. Plagiarism is the unauthorized or unacknowledged use of another person's academic or scholarly work. It is a theft of intellectual property and a violation of an ironclad rule demanding "credit be given where credit is due."

**Source:** (Writing Guides: Understanding Plagiarism.

<http://writing.colostate.edu/guides/researchsources/understandingplagiarism/plagiarismoverview.cfm>).

If you plagiarize in your work you could lose credit for the plagiarized work, fail the assignment, or fail the course. Plagiarism could result in expulsion from the university. Each instance of plagiarism, classroom cheating, and other types of academic dishonesty will be addressed according to the principles published in the CSU General Catalog (see page seven, column two: <http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf>).

Academic integrity means **more** than just avoiding plagiarism. It also involves doing your own reading and studying. It includes *regular class attendance, careful consideration of all class materials, and engagement with the class and your fellow students*. Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, I will ask to you sign the CSU Honor Pledge as part of completing all major assignments. While you will not be required to sign the honor pledge, I will ask each of you to write and sign the following statement on your exams:

*"I have not given, received, or used any unauthorized assistance."*

### Inclusive Excellence & Respect for Diversity:

(Modified from CSU Vice President for Diversity Office <http://diversity.colostate.edu/principles-of-community/>)

As part of the CSU community, we recognize that a collaborative, and vibrant community is a foundation for learning, critical inquiry, and discovery. It is my goal that this course well serves students from diverse backgrounds and perspectives and that the perspectives we bring to the course are seen as a positive benefit to our learning. We have a responsibility to uphold the Principles of Community when engaging with one another and acting on behalf of the University. **INCLUSION:** We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents, and contributions. **INTEGRITY:** We are accountable for our actions and will act ethically and honestly in all our interactions. **RESPECT:** We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge. **SERVICE:** We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other

and the development of our local, regional, and global communities. **SOCIAL JUSTICE:** We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

Mental Health Resources:

CSU is a community that cares for you. If you are struggling with drugs or alcohol, and/or experiencing depression, anxiety, overwhelming stress, or thoughts of hurting yourself or others, please know there is help available. Counseling Services has trained professionals who can help. Contact 970-491-6053 or go to <http://health.colostate.edu>. If you are concerned about a friend or peer, tell someone by calling 970-491-1350 to discuss your concerns with a professional who can discreetly connect the distressed individual with the proper resources (<http://supportandsafety.colostate.edu/tellsomeone>). Rams take care of Rams. Reach out and ask for help if you or someone you know is having a difficult time.

**2018 Lecture Outline and Tentative Schedule**  
 Schedule, readings, and due dates subject to change

\* in week column indicates quiz week

Week	Date	Lecture Topic	Readings	Assignments & Exams
<b>Part I: Biodiversity Belowground</b>				
1	Aug 20	Introduction to course & soil biodiversity	Bardgett & van der Putten 2014 SMEB Ch. 1	
	Aug 22	The soil habitat	SMEB Ch. 2	
	Aug 24	Bacteria & Archaea I	SMEB Ch. 3	Assign soil biota presentation topics
2*	Aug 27	Bacteria & Archaea II	SMEB Ch. 3	
	Aug 29	Fungi I: saprotrophs	SMEB Ch. 4	
	Aug 31	Fungi II: mycorrhizae	SMEB Ch. 11	Homework 1 available
3	Sept 3	No class ( <i>Labor Day</i> )		
	Sept 5	Soil Fauna	Brussaard 1998 SMEB Ch. 5	
	Sept 7	Soil Food Webs	Hunt et al. 1987	
4	Sept 10	Class cancelled – work on soil biota presentations & HW 1		<b>Homework 1 due by 5pm</b>
	Sept 12	Soil Biota Presentations I		
	Sept 14	Soil Biota Presentations II		
5	Sept 17	Soil Viruses	Williamson et al. 2017	
	Sept 19	<b>Part I Exam</b>		
<b>Part II: Microbial Life in Soil</b>				
5	Sept 21	Microbial growth and distribution	SMEB Ch. 9	
6*	Sept 24	Survival strategies I	Schimel et al. 2007 SMEB Ch. 9	
	Sept 26	Survival strategies II	SMEB Ch. 9	
	Sept 28	Survival strategies III	SMEB Ch. 9	

7	Oct 1	Microbial metabolism I	SMEB Ch. 9	Assign synthesis discussion paper
	Oct 3	Microbial metabolism II	SMEB Ch. 9	
	Oct 5	Microbial metabolism III: group activity	SMEB Ch. 9	
8	Oct 8	Part II synthesis discussion	Synthesis discussion paper TBA	
	Oct 10	<b>Part II Exam</b>		
<b>Part III: Soil Microorganisms &amp; Biogeochemistry</b>				
8	Oct 12	Carbon transformations	SMEB Ch. 12	
9*	Oct 15	Litter Decomposition <i>(Dr. Cotrufo)</i>	Schmidt et al. 2011 SMEB Ch. 12	Homework 2 available
	Oct 17	SOM Formation & Stabilization <i>(Dr. Cotrufo)</i>	Cotrufo et al. 2013 SMEB Ch. 12	
	Oct 19	Nitrogen cycle I: N <sub>2</sub> fixation	SMEB Ch. 15	
10	Oct 22	Nitrogen cycle II: mineralization	SMEB Ch. 14	<b>Homework 2 due by 5pm</b>
	Oct 24	Nitrogen cycle III: immobilization	SMEB Ch. 14	
	Oct 26	Nitrogen cycle IV: nitrification	SMEB Ch. 14	
11*	Oct 29	Nitrogen cycle V: denitrification	SMEB Ch. 14	Assign synthesis discussion paper
	Oct 31	Phosphorous cycle	SMEB Ch. 16	
	Nov 2	Sulfur cycle	SMEB Ch. 16	Paper outline due (optional)
12	Nov 5	Metal Transformations	SMEB Ch. 16	
	Nov 7	Part III synthesis discussion	Synthesis discussion paper TBA	
	Nov 9	<b>Part III Exam</b>		
<b>Part IV: Applications of Soil Microbiology</b>				
13	Nov 12	Agricultural Applications I	SMEB Ch. 18 Other readings TBA	
	Nov 14	Agricultural Applications II		<b>Draft paper due</b>

	Nov 16	Global Change I	Readings TBA	
14	Nov 19-23	No class ( <i>Fall Break</i> )		
15*	Nov 26	Global Change II		
	Nov 28	Xenobiotic compounds in soils I	Readings TBA	
	Nov 30	Xenobiotic compounds in soils II		Assign synthesis discussion paper – Fierer 2017
16	Dec 3	Bioremediation case studies I	Readings TBA	
	Dec 5	Bioremediation case studies II		
	Dec 7	Course synthesis discussion	Fierer 2017	<b>Final paper due</b>
17	Dec 13	<b>Final Exam: Thursday 4:10 – 6:10pm</b>		