ENST 422 (Introductory) and 622 (Advanced)
Soil Biochemistry and Microbial Ecology

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Time 9:30-10:45 TR
Room 1104 HJ Patterson Hall [An additional hour discussion for 622 students each week]
Office Hours TBA or by appointment

Text Sylvia, D.M., et al. 2005. Principles and Applications of Soil Microbiology (2nd Edition) Prentice-Hall, Upper Saddle River, New Jersey. ISBN-10: 0130941174

Course Description

The soil is a heterogeneous, non-equilibrium system of gases, water, and solids that is open to the atmosphere; and in which chemical, biochemical, and microbial processes maintain a steady state governed by myriad unknown reactions and microorganisms growing in bulk soil and in the rhizosphere. Given this complexity and mystery surrounding what we call "the soil," many perspectives and disciplinary backgrounds are keys to synthesizing an accurate understanding of soil processes and properties.

This course is designed for upper division undergraduates and beginning graduate students who have taken: ENST 200 (or equivalent introductory soils), a microbiology course, OR a biochemistry course. Most of you may have a strength in one of these areas, but likely do not feel versed in all three. We will take an interdisciplinary approach to understand how the soil biota interacts with the mineral matrix resulting in numerous microbial-mediated processes. We will rely on each other's unique backgrounds to understand how microorganisms affect and are affected by the soil ecosystem, and investigate the role of microorganisms in sustainable agriculture.

Pre-requisites
ENST 200, a microbiology course, or a biochemistry course

Grading

Midterm I	100 pts.
Midterm II	100 pts.
Final Exam	150 pts.
Paper topic/Annotated Bibliography	20 pts.
In class participation/activities	30 pts.
Term paper	100 pts.
TOTAL	500 pts

Grades will be assigned according to the percentage of the total possible points obtained: 95-100%, A; 91-94%, A-; 87-90%, B+; 83-86%, B; 79-82%, B-; 75-78%, C+, 71-74%, C; 67-70%, C-; 63-66%, D+; 59-62%, D; 55-58%, D-; less than 55%, fail. To take into account variation in the difficulty of exams, 100% will be defined as the average of the highest three scores obtained (This scale will be calculated separately for ENST 422 and ENST 622). Makeup exams will be available to those with documented medical excuses or other documented emergencies.

ENST 622
There will an additional weekly session held at a separate time (TBA) for ENST 622 students. Graduate students will discuss recent papers in soil biochemistry and terrestrial microbial ecology (Students registered for ENST 422 are welcome to attend, but are not required). We will meet starting Week 2. Each student will be required to pick a paper at least one week in advance, make it available to be post on Blackboard for everyone to read, prepare for the discussion, and facilitate the meeting. A computer and projector will be available if you choose to create power

point slides for visual aids, but this is not required. Attendance is required. If you need to miss a week, you will be required to submit a two-page summary of the article that was discussed that week.

University and Departmental Policies

Academic Accommodations: If you have a documented disability, you should contact Disability Support Services 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to DSS for accommodation request forms which you can provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site at http://www.counseling.umd.edu/DSS/receiving_serv.html.

Religious Observances: The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs. They shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. The student should inform the instructor in advance of any intended absences for religious observances. Notice should be provided as soon as possible, but no later than the end of the schedule adjustment period. Prior notification is especially important in connection with final exams, since failure to reschedule a final exam before the conclusion of the final examination period may result in loss of credits during the semester. The problem is especially likely to arise when final exams are scheduled on Saturdays.

Inclement Weather: Official closures and delays are announced on the campus website at umd.edu and snow phone line (301-405-SNOW), as well as on local radio and TV stations. If inclement weather conditions force a faculty member to cancel a class even though the University is open, a notice to this effect will be posted to the ELMS website and the ENST office will be notified and if possible a representative will come to the classroom to notify students.

Academic Integrity: The University of Maryland has a nationally recognized code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.studenthonorcouncil.umd.edu/whatis.html. The University of Maryland is one of a small number of universities with a student-administered Honors Code and an Honors Pledge. The code prohibits students from cheating on exams, plagiarizing papers, submitting the same paper for credit in two courses without authorization, buying papers, submitting fraudulent documents, and forging signatures.

Early Warning Grades: Early warning grades should be submitted for undergraduate students who are newly enrolled at the University. Instructors who have such students will be prompted via email to submit early warning grades. These grades are an important component of retention efforts, as they provide timely feedback to those students who are unfamiliar with our academic expectations. Faculty may submit a letter grade or satisfactory/ unsatisfactory (S/U) marks.

Online Course Evaluations: Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the tenure and promotion process. CourseEvalUM will be open for you to complete your evaluations for fall semester courses after Thanksgiving until final exams begin. You can go directly to the website (www.courseevalum.umd.edu) to complete your evaluations then. By completing all of your evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.

Learning Outcomes (422)

Acquire and retain basic knowledge about the procedures used to identify and study microorganisms in soil. Understand the variety of microbial mediated processes that occur in soils and identify key process in the fundamental nutrient cycles. Demonstrate ability to analyze problems that involve concepts such as microbial energetics and xenobiotic compound degradation. Analyze and synthesize an original research paper from the field and communicate scientific concepts clearly and concisely in writing.

Learning Outcomes (622)

In addition to the above learning outcomes, students are expected to display a comprehension of advanced concepts that are exemplified in scientific literature assigned as reading. Comprehension is displayed by written answers to problems that require an understanding of experimental results and theories and their application to new situations.

Tentative* Lecture Schedule and Reading List

Week	Date	Topic	Reading (From Silvia et al.)	Notes
1	Aug 30	Introduction		
2	Sept. 4	Historical perspectives/current trends	Chapter 1	
	Sept. 6	Soil as a habitat	Chapter 2	
3	Sept. 11	Environmental limits to microbial activity	Chapter 2	
	Sept. 13	Microbial metabolism: growth and energetics	Chapter 3	
4	Sept. 18	Growth and energetic calculations	Supplemental	
	Sept. 20	Microbial metabolism: metabolic diversity	Chapter 3	
5	Sept. 25	Measurement of soil microbial diversity	Chapter 4 / 10 (235-238)	
	Sept. 27	**Midterm I (in class)**		
6	Oct. 2	Bacteria and archaea	Chapter 5	
	Oct. 4	Fungi	Chapter 6	
7	Oct. 9	Cyanobacteria and algae	Chapter 7	
	Oct. 11	Soil animals and viruses	Chapter 8/9	**Paper topic due by noon**
8	Oct. 16	Microbial interactions	Chapter 10	
	Oct. 18	Plant/microbe interactions: the rhizosphere	Chapter 11	
9	Oct. 23	**No Class (SSSA meeting)**		
	Oct. 25	**No Class (SSSA meeting)**		
10	Oct. 30	Plant/microbe interactions: mycorrhizae	Chapter 12	
	Nov. 1	Microbes in organic agriculture (Guest lecture)		
11	Nov. 6	Biocontrol and Biotechnology	Chapter 22	
	Nov. 8	**Midterm II (in class)**		
12	Nov. 13	Nitrogen cycling: fixation	Chapter 15/16	
	Nov. 15	Nitrogen cycling: mineralization/immobilization	Chapter 14	
13	Nov. 20	Nitrogen cycling: denitrification/anammox	Chapter 14	
	Nov. 22	Soil organic matter composition	Supplemental	
14	Nov. 27	Decomposition and carbon mineralization	Chapter 13	
	Nov. 29	*No Class (Thanksgiving)*		
15	Dec. 4	Trace gases	Chapter 19	**Term Paper due by 5 pm**
	Dec. 6	Sulfur cycle	Chapter 17	
16	Dec. 11	Phosphorus cycle	Chapter 18	
	Final Exam			

***Note:** The lecture schedule may change if more time is needed to explore particular topics. Exam days will not be changed.