

F'2017 ESM219/L: Microbial Processes in the Environment

Lecture: T/R 12:30 - 1:45 pm BH 1520 **Lab:** R 2 - 5 pm BH 2015

Instructor: Trish Holden **Office:** 3508 Bren Hall **Phone:** x3195 **email:** holden@bren.ucsb.edu

Office hours: Tuesdays 2 – 5 pm, or by email appointment, or drop-in

TA: Ying Wang ywang@bren.ucsb.edu Office Hour Wednesday 1 – 2 pm

Course Outline (approximate): See GauchoSpace (GS) for updates

Wk	Lecture Topic	Lab Exercise**	Due
1	Introduction to the course and microbial processes	E0: Introduction to the Lab (safety, and review of experiments)	
2	Environmental compartments, habitats, function	E1: Culture microbes (part a)	
3	Diversity: discovery, quantification	E1: Describe, count, subculture (part b); E2: EM demo	
4	Energetics, growth, metabolism	E1: Characterize cultures (part c); E2: EM demo	
5	Carbon cycle: greenhouse gas production and consumption; climate feedbacks	E3: DNA-based diversity (demo); E4: C mineralization setup	E1, E2
6	Nitrogen cycle: N ₂ fixation, ammonification, nitrification, denitrification	E4: Final measurements E5: N ₂ fixation study	E3
7	Biotransformation of inorganic and organic pollutants	E6: Toluene biodegradation, biostimulation, and bioaugmentation	E4; paper title /outline
8	Microbiological water quality	E7: Culture-based & molecular analysis of water quality (IDEXX / qPCR)	E5
9	Waste treatment	(Thanksgiving Holiday)	
10	Energy production	E7: Analysis of IDEXX data / DNA results overview	E6
11	Biotechnology and bioproducts; review	Lab review / practicum	E7
Final Paper Presentations: Friday, Dec. 8th, (8 am – 11 am)			paper

****NOTE:** Microbes are alive, and so some measurements must be made outside of normal class or lab hours. TA will arrange sampling times and lab access for all lab groups, to make interim measurements.

Assignments and Grading:

Lab reports / exercises: 50%, Written paper & presentation: (40%), Class participation: 10%

Textbook: Brock Biology of Microorganisms 15th ed. Madigan, Michael T et al. It can be “rented” for a reasonable price:

https://www.amazon.com/Brock-Biology-Microorganisms-Michael-Madigan-ebook/dp/B06WW12VVN/ref=mt_kindle?_encoding=UTF8&me= . earlier editions may be OK. Copies are in the Bren Reading Room. Purchasing yourself is not required.

Other reading: Consult GauchoSpace

Other references:

Environmental Microbiology by Raina M. Maier, Ian L. Pepper and Charles P. Gerba. 2000. Academic Press.

General Microbiology by Hans Schlegel

Microbial Ecology by Atlas & Bartha

Soil Microbiology and Biochemistry by Paul & Clark

Manual of Environmental Microbiology by ASM Press

Some Relevant Websites and Users Groups:

- Microscopy (Microbe Zoo): <http://commtechlab.msu.edu/sites/dlc-me/zoo/index.html>
- Biocatalysis / Biodegradation Database <http://eawag-bbd.ethz.ch/>
- American Society for Microbiology <http://www.asm.org/>
- Ribosomal Database Project II (RDP, at the Center for Microbial Ecology) <http://rdp.cme.msu.edu/>
- Center for Microbial Ecology (CME) at Michigan State: <http://www.cme.msu.edu/>
- National Center for Biotechnology Information (NCBI) <http://www.ncbi.nlm.nih.gov/>
- Bioremediation Discussion Group <http://www.bioremediationgroup.org/>

Course Goals

1. Learn about environmental microbiology / microbial ecology, with application to natural resource and pollution management
2. Focus on microbial processes: what microbes *do*
3. Tie knowledge to environmental problems including climate change, energy, pollution, and to public health
4. Learn how to find information, so that you can keep current
5. Learn the vocabulary: write, and present, using your knowledge gained in this course

Format:

This course is an integrated lecture and lab course. Weekly, there are 2 classroom meetings and 1 lab meeting. Lectures are for understanding for lab, and for aiding in interpreting results for lab report writing.

Read GS materials before lectures. Come prepared with questions, and to discuss.

Deliverables include lab reports with related exercises, a short term paper, and an oral presentation of the paper. Term paper topic suggestions are posted on GS. Consult instructor in selecting your topic. Submit outline with title at the Due Date.

Brock (optional textbook) is a good resource. First several chapters provide useful background. Other papers and materials uploaded to GS are for additional advanced reading / discussion.