

## Bio 5530: Environmental Microbiology

Fall 2005

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**Course Overview.** Microorganisms inhabit virtually every environment on earth, form symbioses essential to many other organisms, and carry out activities that significantly influence the chemistry of our surface waters, soils, and atmosphere. In this course we will explore the profound impacts of microorganisms on the earth by learning about:

- evolution and diversity of microorganisms
- microbial physiology and population dynamics
- microbial functions in biogeochemical cycles from local to global scales
- microbial communities in natural environments, including interactions with each other and with other organisms
- interactions with environmental pollutants

Textbook readings will be complemented with selected papers from the literature, for more in-depth development of some topics. Students will write short critiques of five of these papers prior to discussion in class. A longer research paper will also be required, exploring in detail some aspect of environmental microbiology. Students will give a class presentation on their topic. There will be 3 exams during the semester and a comprehensive, take-home, final exam.

### Reading Material.

*Brock Biology of Microorganisms*, by Madigan and Martinko is the required textbook for this course.

Additional readings from *Biodiversity of Microbial Life*, by Staley and Reysenbach, and from *Environmental Microbiology* by Maier, Pepper, and Gerba are recommended.

Selected readings from the literature will be provided.

### Grading.

Exams	(100 points each * 3)	300
Final Exam		100
Paper critiques	(10 points each * 5)	50
Research Paper		100
Presentation		50
Total possible		600 points

Grades will be:	90-100%	A
	80 - 89%	B
	70 - 79%	C
	< 69%	F

<b>Microbial Diversity, Physiology and Population Dynamics</b>		
Aug 24	What is a microorganism? On being small in a big world	Brock 1-20, 21-26, 63-66; Maier 1-6
Aug 26	Microbial physiology	Brock 102-104, 110-129; Maier 19-42
Aug 29	Microbial physiology	Brock 130-134
Aug 31	Evolutionary history and diversity of microorganisms	Brock 26-36, 300-327; Staley 1-48
Sept 2	Phylogeny and diversity: Bacteria	Brock 331-417
Sept 5	Phylogeny and diversity: Archaea	Brock 420-446
Sept 7	Labor day	
Sept 9	Phylogeny and diversity: Eucarya	Brock 448-476
Sept 12	Microbial growth and population dynamics	Brock 136-151; Maier 43-60
Sept 14	Growth in nature and competitive interactions	Selected readings
Sept 16	Extreme environments	Brock 152-160
Sept 19	<b>Exam 1</b>	
<b>Biogeochemistry: Functions of Microbes in the Environment</b>		
Sept 21	Global carbon cycle	Brock 632-634
Sept 23	Carbon cycling: microbial photosynthesis and production	Brock 533-547; Staley 121-154
Sept 26	Carbon cycling: decomposition processes	Maier 319-330
Sept 28	Anaerobic C cycling	Brock 564-575; Selected readings
Sept 30	Nitrogen cycling	Brock 641-642, 555-559; Maier 331-339, 430-437
Oct 3	Sulfur cycling	Maier 340-345
Oct 5	Other elements	Selected readings
<b>Interactions Among Organisms in Natural Environments</b>		
Oct 7	Introduction to Microbial Ecology	Brock 613-623
Oct 10	Fall Break	
Oct 12	Aquatic environments	Maier 123-145
Oct 14	Microbial mats, biofilms	Maier 126-130; Staley 49-100
Oct 17	<b>Exam 2</b>	
Oct 19	The microbial loop	Selected readings
Oct 21	Hydrothermal vents and lithotrophic-based food chains	Brock 628-631
Oct 24	No Class	
Oct 26	Soil environments and the rhizosphere	Brock 655, 661-666; Maier 61-90,425-429
Oct 28	Plant-microbe interactions	
Oct 31	Mycorrhizae	Staley 258-287
Nov 2	Trophic interactions in soil	Selected readings
Nov 4	Plant pathogens	Brock 659, Maier 439-446
<b>Microorganisms and Anthropogenic Change</b>		
Nov 7	Biological control	
Nov 9	Mercury and other metals	Brock 648-650; Maier 403-424, 352-353
Nov 11	Biodegradation	Brock 647-655; Maier 363-389
Nov 14	Human pathogens and environmental change	Maier 447-485
Nov 16	<b>Exam 3</b>	
<b>Student Presentations</b>		
Nov 18	TBA	Selected readings
Nov 21	TBA	Selected readings
Nov 23	Thanksgiving	
Nov 25	Thanksgiving	
Nov 28	TBA	Selected readings
Nov 30	TBA	Selected readings
Dec 2	TBA	Selected readings
Dec 5	TBA	Selected readings