

BIOL 4XX W
Environmental Microbiology

Instructor: Dr. Mary Beth Leigh

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Office hours: XXXXXXXX or by appointment

Class time and place

Tuesday and Thursday 9:45-11:15

Course overview

This course provides a comprehensive overview of the role of microorganisms in environmentally relevant processes including bioremediation of pollutants, biogeochemical cycling and wastewater treatment, and covers modern molecular methods for studying microbes in the environment. Upper level undergraduate students in Biology, Chemistry, Civil & Environmental Engineering or other disciplines will gain expertise in microbial processes with an emphasis on their application to environmental quality issues. The class is stacked and will meet concurrently with the graduate-level (BIOL 6XX) section (graduate student requirements are listed separately on the BIOL 6XX syllabus).

Prerequisites

Students should have taken ENGL 111X, ENGL 211X or 213X, BIOL 115/116 (Fundamentals of Biology), BIOL 342 (Microbiology) and CHEM 105/106 (General Chemistry) or equivalent. Exceptions may be made on an individual basis with permission of instructor.

Reading materials

- Many readings will be in the form of **scientific journal articles**, which are electronically available through UAF library and/or provided on Blackboard.
- There is no required text. A recommended text is *Brock Biology of Microorganisms* by Madigan and Martinko (11th, 12th or 13th Ed.). This and several other books are on reserve at the BioSciences library from which some reading assignments will be made, including:
 - *Environmental Microbiology*, by Maier, Pepper and Gerba
 - *Microbe*, by Schaechter, Ingraham and Neidhardt
 - *Microbiology*, by Bauman
 - *Biocatalysis and Biodegradation*, by Wackett and Hershberger

Course goals

- Provide a comprehensive overview of the role of microorganisms in environmentally relevant processes including bioremediation of pollutants, biogeochemical cycling and wastewater treatment
- Cover state-of-the-art research and molecular methods in microbial diversity, microbial function and the impacts of microbes in the environment
- Develop strong skills in scientific writing

Mary Beth Leigh 4/19/12 9:26 AM

Comment: This course will be stacked with a 600-level course. As requested, I have prepared a separate syllabus just for the 400-level W portion of the course to help facilitate its evaluation as a W course.

Mary Beth Leigh 4/19/12 9:35 AM

Comment: Lower level writing courses (ENGL) have been added as pre-requisites.

Student Learning Objectives

- Understand application of microbial processes to environmental remediation
- Appreciate contribution of microorganisms to geochemical cycling
- Become familiar with methods for studying microbes in the environment
- Develop skills in reading and criticism of primary scientific literature
- Develop literature research, writing and oral presentation skills

Course format: Lectures with supporting readings from textbooks and primary scientific literature will form the knowledge base of the course. Journal articles relevant to the current topic will be assigned for critical group discussion. Several individual conference times with instructor will also be held to discuss students' writing throughout the semester.

Assignments: The goals of these exercises are to help develop research, writing and oral presentation/teaching skills important to success in their postgraduate scientific careers.

- **Reading questions:** When journal articles are assigned for reading and discussion, reading questions (short answer, short essay) will also be assigned which should be completed before the beginning of the discussion class period.
- **Diagnostic writing assignment:** Early in the semester, students must complete a diagnostic writing assignment. Feedback will be provided by the instructor regarding aspects of the students' writing that need improvement, and the instructor will help the student improve these areas through the term paper project (below).
- **[B] Term paper and presentation:** All students will independently research an environmental microbiology topic of their choice, subject to instructor approval. Students will prepare a term paper in the form of a review article of 20 pages in length. Students will then deliver ~25 min oral presentations to the class near the end of the semester. Detailed instructions for papers and presentations will be provided in class. **[D]** An outline and first draft of the paper will be due prior to the final paper. **[C]** Feedback will be provided by instructor on the outline, first draft and final draft of the paper, in the form of detailed written comments and through individual conferences with the student following. See schedule below for relevant deadlines.

**Support for term paper:* Assistance with library research can be provided by Biosciences librarian Anne Christie (anne.christie@uaf.edu). For additional guidance with writing consult the Writing Center (8th floor, Gruening Bldg).

Exams: One in-class midterm and final exam will be given to all students, with questions in a variety of formats from multiple choice, fill-in-the-blank, short answer and essay.

Journal article discussions: Journal articles will be assigned in advance of discussions and made available on Blackboard. Reading questions will also be assigned at the same time. Written responses to these reading questions should be completed before the beginning of the discussion class period. I will assign 1-2 class members to lead the discussion.

Mary Beth Leigh 4/12/12 11:43 AM

Comment: Individual conferences with students to discuss writing have been added.

Mary Beth Leigh 4/19/12 8:53 AM

Comment: Reading questions are one form of written work that contributes to the points earned

Mary Beth Leigh 4/19/12 9:26 AM

Comment: Diagnostic writing assignment has been added, see schedule

Mary Beth Leigh 4/19/12 8:59 AM

Comment: Details added on the 3 stages of term paper that will receive feedback

Mary Beth Leigh 4/19/12 8:59 AM

Comment: Individual conferences added for student writing feedback

Mary Beth Leigh 4/19/12 9:27 AM

Comment: Typically at least half of the exam points are from written questions, so these have been calculated in to the point totals (see point calculations below).

Mary Beth Leigh 4/19/12 9:27 AM

Comment: Journal article reading questions are another component of the grade earned by written work. See point totals below.

Note on written assignments: Plagiarism will result in a failing grade. Be sure to acquaint yourself with the definition of plagiarism to avoid accidental errors at <http://www.uaf.edu/library/instruction/handouts/Plagiarism.html>

Course evaluations: I welcome your positive and negative comments at any time. Opportunities to provide anonymous evaluations will be provided at the middle and end of semester.

Students with disabilities

UAF is committed to equal opportunity for all students. Students with even minor disabilities, students who are the first in their families to attempt a four-year college degree, or students whose incomes are low, have opportunities for tutorial and other forms of support from the office of Disability Services or the office of Student Support Services. If you need classroom accommodations or other support, please meet with me during office hours as soon as possible to let me know; and please make an appointment with the Office of Disability Services and Student Support Services, to enlist the appropriate support. I will collaborate to provide the appropriate accommodations and supports or services to assist you in meeting the goals of the course.

Grading Scale

(% of total course points)

A+	97 - 100
A	94 - 96.99
A-	90 - 93.99
B+	87 - 89.99
B	84 - 86.99
B-	80 - 83.99
C+	77 - 79.99
C	74 - 76.99
C-	70 - 73.99
D	50 - 69.99
F	< 50

Late policy:

Assignments turned in after the deadline will have 5% of the total possible points deducted per day it is late. Exceptions may be made in the case of excused absences due to documented family/medical or other reasons or when arrangements have been made with instructor in advance. In general, when an absence is anticipated due to travel or other conflicts, work should be turned in ahead of time.

Activity	Number of assignments	Points per assignment	Total	Points from writing-intensive work	Percentage of total points from written work
UNDERGRADUATES					
Midterm	1	100	100	50	
Final	1	100	100	50	
Term paper					
Term paper outline	1	10	10	10	
Term paper draft	1	50	50	50	
Term paper final draft	1	100	100	100	
Oral presentation	1	30	30		
Reading questions	4	10	40	40	
Discussion participation	1	50	50		
		Total (Undergraduates)	480	300	63%

Mary Beth Leigh 4/19/12 9:09 AM

Comment: See highlighted columns above. Note that written work constitutes 63% of points earned in the class. This takes into consideration that at least 50% of exam questions are written (short answer, essay), plus there are points from journal reading questions, and all components of the term paper.

X

Environmental Microbiology- Tentative schedule. Subject to change. Additional reading assignments will be made during the semester from journal articles, material posted on blackboard or on reserve in the BioSciences library.

Day	Date	Lecture topic	Reading assignment	Assignments due
FUNDAMENTALS OF MICROBIOLOGY				
R	9/1/11	Syllabus, Introductions, Overview of Microbial Diversity	Brock (12th Ed) Chapter 1 Section I, Chapter 2 Section III	
T	9/6/11	Microbial Cell Structure and Function Review		
R	9/8/11	Microbial Species Concept, Identifying Microbes	Rosello-Mora 2001 FEMS Microbiology Reviews 25:39-67	
T	9/13/11	Fueling the microbial cell	Bauman p 125-150, Chapter 6 in <i>Microbe</i>	Diagnostic writing assignment due
BIOGEOCHEMICAL CYCLING				
R	9/15/11	Term paper guidelines, diagnostic writing assignment		
T	9/20/11	Carbon cycling	Brock Chapter 24 Section I	Deadline for term paper topic approval
R	9/22/11	Discussion	Journal articles TBA	Reading questions
T	9/27/11	N cycling	Brock 24 Section II, Journal articles TBA	
R	9/29/11	In-class small group assignment		Reading questions
T	10/4/11	Sulfur cycling, Geochemical cycles gone wild	Maier 14.4, Maier Chapter 15	
R	10/6/11	Winogradsky column exercise		Term paper outlines due
T	10/11/11	MIDTERM EXAM		
BIOREMEDIATION				
R	10/13/11	Organic contaminants, policy, evolution of biodegradative pathways	Chapter 16 Maier, Wackett Chapter 7	
T	10/18/11	Student conferences to discuss term paper outlines		
R	10/20/11	Aromatic pollutants, crude oil	Chapter 16 Maier, Wackett Chapter 7	
T	10/25/11	Methods for studying organic contaminant degraders		
R	10/27/11	Aerobic PCB degradation lecture/ paper discussion	Journal articles TBA	Reading questions
T	11/1/11	Anaerobic degradation of organic and halogenated contaminants		
R	11/3/11	Discussion with Alaska Dept. Environmental Conservation staff	Journal articles TBA	Reading questions
T	11/8/11	Metal transformations, Bioremediation of uranium	Maier Chapter 17, Wall and Krumholz. 2006. Annu. Rev. Microbiol.60:149-166	Term papers drafts due
R	11/10/11	Wastewater treatment	Brock Chapter 36	
WASTEWATER TREATMENT				
T	11/15/11	Student conferences to discuss term paper drafts		
R	11/17/11	Field trip to wastewater treatment plant		
SPECIAL TOPICS: STUDENT PRESENTATIONS				
T	11/22/11	Student term paper oral presentations		
R	11/24/11	NO CLASS - THANKSGIVING HOLIDAY		
T	11/29/11	Student term paper oral presentations		
R	12/1/11	Student term paper oral presentations		Final term papers due
T	12/6/11	Student term paper oral presentations		
R	12/8/11	Student conferences to discuss final term papers		
R	12/15/11	FINAL EXAM 8:00-10:00 am		

Mary Beth Leigh 4/19/12 9:21 AM

Comment: The class schedule has been revised to show (in bold) when all writing-intensive assignments are due (includes exams, reading questions and term paper outline, draft, final paper). ALSO individual conferences with students to discuss term paper components have been added to the schedule.