***SYLLABUS:* 53:154**
ENVIRONMENTAL MICROBIOLOGY

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Lectures:	• Mon/Wed/Fri	12:30 – 1:20 p.m.	3026 SC
Labs:	• Wednesdays	3:30 – 5:30 p.m.	1246 SC
Office Hours:	• Tues/Thurs	2:00 – 3:30 p.m.	4112 SC
	• By Appointment or email (also when office door is open!)		
Required Text: (at IMU Bookstore)	• BROCK BIOLOGY OF MICROORGANISMS, 13th Ed. by Madigan et al., Prentice Hall, 2012. (Abbreviation: B13) (Note: 12th edition = B12)		
Supplemental Texts: (On reserve in Eng. Library)	• BIOCHEMISTRY, 4th Ed. by Stryer, Freeman Press, 1995. (Abbreviation: S)		
	• MICROBIAL ECOLOGY: Fundamentals and Applications, 4th Ed. by Atlas and Bartha, Benjamin Cummings, 1998. (Abbreviation: A)		
	• MICROBIOLOGY: An Evolving Science, 2nd Ed. By Slonczewski and Foster, Norton Publishing, 2011 (Abbreviation: M2)		
Course website:	• Log onto Iowa Courses Online (ICON) @ www.uiowa.edu		

Grading:	• 3 Exams (20% each)	60%
	• Quizzes/homeworks	15%
	• Group Lab Project (& presentation)	15%
	• Paper	10%

Structure:
- Unit I: Introductory biochemistry, molecular biology and microbiology
- Unit II: Central metabolism and metabolic diversity
- Unit III: Microbial ecology and environmental applications

Exams are closed book. Both sides of one page (8.5" x 11") containing any notes desired will be allowed. Duration: 60 minutes. More time will be allowed for third exam.

Quizzes are closed book. No notes will be allowed. Quizzes will cover lecture topics and reading assignments. Duration: 15 minutes. See schedule for quiz dates. Learning objectives for the quiz will be discussed in class.

Late homework policy: 1 day late -25%, 2 days late -50%, more than 2 days late -100%

Paper should review a particular microbial phenomenon, possibly related to your laboratory or MS project. The paper must be typed ***with a minimum length of 7 pages and a maximum length of 12 pages. It must also reference at least 5 journal articles from the peer-reviewed literature***. A list of past paper topics is attached. A brief paper proposal/abstract outlining the topics you will discuss and pertinent references must be submitted for approval (see schedule).

I suggest using Google and/or Google Scholar as starting points for finding out more about your paper topic. Initial searches will very likely lead you to articles in peer-reviewed scientific journals, such as *Science, Nature, Applied and Environmental Microbiology, Journal of Bacteriology* and *Environmental Science and Technology*. Literature reviews provide an overview of a particular topic and will also cite specific papers that deal with aspects of the topic in greater detail. Try to find articles that are part of the peer-reviewed literature, not the "gray" literature (e.g. technical reports and magazines like Discover and Scientific American). If you have questions about researching a particular topic or don't know how to distinguish peer-reviewed literature from other types of literature please see me.

General examples of past paper topics (can be used again!)
Microbial fuel cells
Bacterial resistance to Triclosan
Radiation resistance of *Deinococcus radiodurans*
Biogeochemical cycling of methylmercury
Biodegradation of polynuclear aromatic hydrocarbons (PAHs)
Aerobic and anaerobic bioremediation of chlorinated solvents
Rhizoremediation of polychlorinated biphenyls (PCBs)
Source tracking fecal coliforms in wastewater treatment

Laboratory project
Please refer to separate handout regarding the laboratory portion of this course. Be aware that laboratory attendance and participation are required, and will be taken into consideration in your final grade.

PURPOSE OF THE COURSE
To provide you with a fundamental understanding of concepts in microbiology, biochemistry and microbial ecology that are relevant in environmental engineering microbiology research as well as engineering practice. Specific applications of these fundamentals will be discussed as appropriate. The practical experience gained in the laboratory will enhance your understanding of microbiology in a manner not readily gained though the lectures or reading assignments. This experience will also highlight the limitations of current techniques. The majority of the course is based on the Brock textbook; however selected topics from other textbooks and the current scientific literature may supplement the book from time to time.

Other pertinent information:
This course is given by the College of Engineering. This means that class policies on matters such as requirements, grading, and sanctions for academic dishonesty are governed by the College of Engineering. Students wishing to add or drop this course after the official deadline must receive the approval of the Dean of the College of Engineering.

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ENVIRONMENTAL MICROBIOLOGY
TENTATIVE SCHEDULE, Fall 2011

Date		Topic	Reading Assignment	
			(Required)	(Supplement)
Mon.	Aug. 22	Introduction and course overview	**B12/B13: Ch.1-2**	M2: Ch. 1
Wed.	Aug. 24	Microbial cell structure and function – cell membranes	**B13:48-58 B12:51-57**	**B12:67-78** M2:73-88 S:7-11,263-280
		Lab 1. Microscopic examination of pure and mixed microbial cultures and serial dilution and spread plating of mixed microbial cultures	**B13:25-31, 129-131**	**B12:26-30, 153-156** M2:40-70
Fri.	Aug. 26	Microbial cell structure and function – cell walls	**B13:58-64**	**B12:78-86** M2:88-98
Mon.	Aug. 29	Microbial cell structure and function – other cellular structures	**B13:64-73**	**B12:86-95** M2:106-108
Wed.	Aug. 31	Microbial cell structure and function – cellular locomotion	**B13:73-81**	**B12: 91-95** M2:108-110
		Lab 2. Streak plating, microscopy and gram staining techniques	**B13:26-27, 90-92**	**B12:27-28, 113-114**
Fri.	Sept. 2	Molecular biology - DNA structure	**B13:151-157**	**B12:176-181** M2:221-232 S:Ch.4,94-112
		Quiz 1		
Mon.	Sept. 5	**NO CLASS (Labor Day)**		
Wed.	Sept. 7	Chromosomes and other genetic elements	**B13:157-162**	**B12:181-182**
		Lab 3. Handling of liquid cultures and monitoring microbial growth phases via spectrophotometry (+more streak plates)	**B13:90-92, 123-126, 131-132**	**B12:113-114, 147-152, 156-157**
Fri.	Sept. 9	DNA replication in the microbial cell	**B13:162-168**	**B12:182-189** M2:232-244 S: Ch. 31
Mon.	Sept. 12	Amplification and sequencing of DNA	**B13:169-170, 314-317**	**B12:320-327** M2:249-255 S:119-136
Wed.	Sept. 14	Finish sequencing, transcription of RNA	**B13:170-174**	**B12:189-194** M2:257-268 S:841-852

		Lab 4. DNA extraction and gel electrophoresis demonstration	**B13:293**	**B12:315**
Fri.	Sept. 16	The 16S rRNA gene as an evolutionary chronometer, introductory bioinformatics	**B13:454-457**	**B12:377-380** M2:638-641
		Quiz 2		
Mon.	Sept. 19	Bioinformatics of 16S rRNA genes – BLAST, Ribosomal Database Project, and phylogenetic trees	**B13:457-462, 476-477**	**B12:380-381, 389-390** M2:641-650
Wed.	Sept. 21	The genetic code and translation	**B13: 174-183**	**B12:194-201** M2:268-282 S:875-903
		Lab 5. Amplification and sequencing of 16S rRNA gene in isolates	**B13:169-170, 314-317**	**B12:320-327**
Fri.	Sept. 23	Analyzing functional gene sequences, genomics	**B13:317-318**	M2:292-297
Mon.	Sept. 26	Metabolic regulation	**B13:210-217**	**B12:225-231** M2:341-351 S:Ch.36
Wed.	Sept. 28	Metabolic regulation	**B13:218-225**	**B12:231-242** M2:374-377
		Lab period: EXAM 1 REVIEW SESSION		
Fri.	Sept. 30	**EXAM 1**		
Mon.	Oct. 3	Go over Exam 1, Introduction to metabolism	**B13:106-108**	M2:457-460
Wed.	Oct. 5	Bioenergetics, enzymes as catalysts	**B13:92-94**	**B12:114-118** M2:461-465 S:181-196, 443-452
		****LAB PROJECT PROPOSAL DUE****		
Fri.	Oct. 7	Oxidation-reduction reactions, electron carriers, high energy compounds	**B13:94-98**	**B12:118-122** M2:465-471
Mon.	Oct. 10	Central catabolic pathways	**B13:98-101,105-106, 406-408**	**B12:122-124,130-133, 648-649** M2:471-493 S:Ch.19,20,21
Wed.	Oct. 12	Respiration and proton motive force	**B13:101-108**	**B12:126-133** M2:502-520
		Lab period: Groups work on projects		

Fri.	Oct. 14	Hydrocarbon oxidation		
		Quiz 3		
Mon.	Oct. 17	Hydrocarbon oxidation *****PAPER TOPIC DUE*****	**B13:400-403, 486-488**	**B12: 641-644,410-412** M2:493-497
Wed.	Oct. 19	Hydrocarbon oxidation		
		Lab period: Groups work on projects		
Fri.	Oct. 21	Anaerobic respiration	**B13:383-401,510-512,562-565**	**B12:438-441,494-498, 624-641** M2:521-524
Mon.	Oct. 24	Anaerobic respiration		
Wed.	Oct. 26	Chemolithotrophy	**B13:353-363,481-486**	**B12:403-410, 595-605** M2:524-529
		Lab period: Groups work on projects		
Fri.	Oct. 28	Chemolithotrophy		
		Quiz 4		
Mon.	Oct. 31	Phototrophy and Anoxygenic Photosynthesis	**B13:478-480, 341-346, 543-545**	**B12:401-403, 474-476, 579-580,** M2:529-540
Wed.	Nov. 2	Oxygenic Photosynthesis	**B13:346-352, 532-537, 363-367**	**B12:463-466, 585-593,605-609** S:Ch. 26
		Lab period: EXAM 2 REVIEW SESSION		
Fri.	Nov. 4	**EXAM 2**		
Mon.	Nov. 7	Go over Exam 2/Intro to microbial ecology	**B13:670-678**	**B12:674-680** A:174-196, Ch. 9, 375-379 M2: 790-791
Wed.	Nov. 9	Introduction to microbial ecology		
Fri.	Nov. 11	Abiotic factors affecting ecosystems ****PROJECT PROGRESS REPORT ****	**B13:132-147**	**B12: 157-172** M2: 149-164,791-794

Mon.	Nov. 14	Microbial ecosystems - aquatic	**B13:683-695**	**B12: 680-681,687-691** M2:798-810
Wed.	Nov. 16	Microbial ecosystems - terrestrial	**B13:678-683**	**B12:682-686** M2:810-821
Fri.	Nov. 18	Biogeochemical cycles (carbon, oxygen)	**B13:699-710**	**B12:695-705** M2:829-855 A: Ch. 11
		Quiz 5		
Mon.	Nov. 21	**NO CLASS**	**THANKSGIVING BREAK**	
Wed.	Nov. 23	**NO CLASS**		
Fri.	Nov. 25	**NO CLASS**		
Mon.	Nov. 28	Nitrogen, sulfur, and iron cycles		
Wed.	Nov. 30	Wastewater treatment microbiology	**B13:1005-1010**	**B12:1028-1033**
Fri.	Dec. 2	Methods in microbial ecology	**B13:643-662**	**B12:653-671**
Mon.	Dec. 5	Methods in microbial ecology		
Wed.	Dec. 7	Methods in microbial ecology	**B13:295-310**	**B12:316-319** M2:427-452
		Lab: Poster presentations of lab project		
Fri.	Dec. 9	Methods in microbial ecology ****ALL PAPERS DUE****		
Thu.	**Dec. 15**	**EXAM 3 IN 3026 SC AT 12 PM**		