

**SYLLABUS**  
**CEE:5154 ENVIRONMENTAL MICROBIOLOGY**

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<b>Lectures:</b>	• Mon/Wed/Fri	12:30 – 1:20 p.m.	2133 SC
<b>Labs:</b>	• Wednesdays	2:00-4:00/3:30-5:30	Water Plant
<b>Office Hours:</b>	• Tues/Thurs	2:00 – 3:30 p.m.	4112 SC
	• By Appointment or email (also when office door is open!)		
<b>Required Text:</b> (at IMU Bookstore)	• BROCK BIOLOGY OF MICROORGANISMS, 14 <sup>th</sup> Ed. by Madigan et al., Prentice Hall, 2014. (Abbreviation: B14) (Note: 13 <sup>th</sup> edition = B13)		
<b>Supplemental Texts:</b> (On reserve in Eng. Library)	• BIOCHEMISTRY, 4 <sup>th</sup> Ed. by Stryer, Freeman Press, 1995. (Abbreviation: S)		
	• MICROBIAL ECOLOGY: Fundamentals and Applications, 4 <sup>th</sup> Ed. by Atlas and Bartha, Benjamin Cummings, 1998. (Abbreviation: A)		
	• MICROBIOLOGY: An Evolving Science, 2 <sup>nd</sup> Ed. By Slonczewski and Foster, Norton Publishing, 2011 (Abbreviation: M2)		
<b>Course website:</b>	• Log onto Iowa Courses Online (ICON) @ <a href="http://www.uiowa.edu">www.uiowa.edu</a>		
<b>Grading:</b>	• 3 Exams (20% each)		60%
	• Quizzes/homeworks		15%
	• Group Lab Project (& presentation)		15%
	• Paper		10%
<b>Structure:</b>	• Unit I: Introductory biochemistry, molecular biology and microbiology		
	• Unit II: Central metabolism and metabolic diversity		
	• Unit III: Microbial ecology and environmental applications		

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

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 of your own interest, 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 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 (but not limited to) *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. Search for 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 through 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.

**CEE:5154**  
**ENVIRONMENTAL MICROBIOLOGY**  
**TENTATIVE SCHEDULE, Fall 2016**

<u>Date</u>		<u>Topic</u>	<u>Reading Assignment</u>	
			(Required)	(Supplement)
Mon.	Aug. 22	Introduction and course overview	<b>B14: Ch. 1</b>	<b>B13: Ch.1-2</b> M2: Ch. 1
Wed.	Aug. 24	Microbial cell structure and function – cell membranes	<b>B14:33-41</b>	<b>B13:48-58</b> M2:73-88 S:7-11,263-280
		<i>Lab 1. Microscopic examination of pure and mixed microbial cultures and serial dilution and spread plating of mixed microbial cultures</i>	<b>B14:26-32, 74-78, 155-157</b>	<b>B13:25-31, 129-131</b> M2:40-70
Fri.	Aug. 26	Microbial cell structure and function – cell walls	<b>B14:41-47</b>	<b>B13:58-64</b> M2:88-98
Mon.	Aug. 29	Microbial cell structure and function – other cellular structures	<b>B14:48-55</b>	<b>B13:64-73</b> M2:106-108
Wed.	Aug. 31	Microbial cell structure and function – cellular locomotion	<b>B14:58-63</b>	<b>B13:73-81</b> M2:108-110
		<i>Lab 2. Streak plating, microscopy and gram staining techniques</i>	<b>B14:28</b>	<b>B13:26-27, 90-92</b>
Fri.	Sept. 2	Molecular biology - DNA structure	<b>B14:107-115</b>	<b>B13:151-162</b> M2:221-232 S:Ch.4,94-112
		<i>Quiz 1</i>		
Mon.	Sept. 5	<b>NO CLASS (Labor Day)</b>		
Wed.	Sept. 7	Molecular biology - DNA structure	<b>B14:107-115</b>	<b>B13:151-162</b> M2:221-232 S:Ch.4,94-112
		<i>Lab 3. Handling of liquid cultures and monitoring microbial growth phases via spectrophotometry (+more streak plates)</i>	<b>B14:149-152, 157-158</b>	<b>B13:90-92, 123-126, 131-132</b>
Fri.	Sept. 9	DNA replication in the microbial cell	<b>B14:115-120</b>	<b>B13:162-168</b> M2:232-244 S: Ch. 31

Mon.	Sept. 12	Amplification and sequencing of DNA, Genomics	<b>B14:319-320, 184-188</b>	<b>B13:169-170, 314-317</b> M2:249-255
Wed.	Sept. 14	Finish sequencing, transcription of DNA into RNA	<b>B14:120-127</b>	<b>B13:170-174</b> M2:257-268 S:841-852
		<i>Lab 4. DNA extraction and gel electrophoresis demonstration</i>	<b>B14:317-318</b>	<b>B13:293</b>
Fri.	Sept. 16	The 16S rRNA gene as an evolutionary chronometer, introductory bioinformatics	<b>B14:355-359</b>	<b>B13:454-457</b> M2:638-641
		<i>Quiz 2</i>		
Mon.	Sept. 19	Bioinformatics of 16S rRNA genes – BLAST, Ribosomal Database Project, and phylogenetic trees	<b>B14:359-363</b>	<b>B13:457-462, 476-477</b> M2:641-650
Wed.	Sept. 21	Analyzing functional gene sequences, Protein structure and synthesis	<b>B14:127-128, 189-190</b>	<b>B13:317-318, 174-180</b> M2:268-297
		<i>Lab 5. Amplification and sequencing of 16S rRNA gene in isolates</i>		<b>B13:169-170, 314-317</b>
Fri.	Sept. 23	Analyzing functional gene sequences, Protein structure and synthesis	<b>B14:127-128, 189-190</b>	<b>B13:317-318, 174-180</b> M2:268-297
Mon.	Sept. 26	Translation of RNA into protein	<b>B14:128-138</b>	<b>B13: 180-181</b> S:875-903
Wed.	Sept. 28	Metabolic regulation	<b>B14:216-232</b>	<b>B13:210-225</b> S:Ch.36 M2: 341-351,374-377
		<i>Lab period: EXAM 1 REVIEW SESSION</i>		
Fri.	Sept. 30	<b>EXAM 1</b>		
Mon.	Oct. 3	Introduction to metabolism	<b>B14:79, 96</b>	<b>B13:106-108</b> M2:457-460
Wed.	Oct. 5	Bioenergetics, enzymes as catalysts	<b>B14:80-81</b>	<b>B13:92-94</b> M2:461-465 S:181-196, 443-452
		<b>**LAB PROJECT PROPOSAL DUE**</b>		
Fri.	Oct. 7	Oxidation-reduction reactions, electron carriers, high energy compounds	<b>B14:82-86</b>	<b>B13:94-98</b> M2:465-471

Mon.	Oct. 10	Central catabolic pathways	<b>B14:86-91</b>	<b>B13:98-101,105-106, 406-408</b> M2:471-493 S:Ch.19,20,21
Wed.	Oct. 12	Respiration and proton motive force	<b>B14:91-95</b>	<b>B13:101-108</b> M2:502-520
		<i>Lab period: Groups work on projects</i>		
Fri.	Oct. 14	Hydrocarbon oxidation	<b>B14:424-426</b>	
		<i>Quiz 3</i>		
Mon.	Oct. 17	Hydrocarbon oxidation ***PAPER TOPIC DUE***	<b>B14:459-461</b>	<b>B13:400-403, 486-488</b> M2:493-497
Wed.	Oct. 19	Hydrocarbon oxidation		
		<i>Lab period: Groups work on projects</i>		
Fri.	Oct. 21	Anaerobic respiration	<b>B14:410-423, 447-449, 461-462</b>	<b>B13:383-401,510-512,562-565</b> M2:521-524
Mon.	Oct. 24	Anaerobic respiration		
Wed.	Oct. 26	Chemolithotrophy	<b>B14:393-400, 449-452, 454-459</b>	<b>B13:353-363,481-486</b> M2:524-529
		<i>Lab period: Groups work on projects</i>		
Fri.	Oct. 28	Chemolithotrophy		
		<i>Quiz 4</i>		
Mon.	Oct. 31	Phototrophy: Anoxygenic and Oxygenic Photosynthesis	<b>B14:380-392, 435-443</b>	<b>B13:478-480, 341-352, 363-367, 532-545</b> M2:529-540
Wed.	Nov. 2	Introduction to microbial ecology (not included in Exam 2)	<b>B14:598-607</b>	<b>B13:670-678</b> A:174-196, Ch. 9, 375-379 M2: 790-791
		<i>Lab period: EXAM 2 REVIEW SESSION</i>		

Fri.	Nov. 4	<b>EXAM 2</b>		
Mon.	Nov. 7	Introduction to microbial ecology	<b>B14:Ch. 18</b>	<b>B13:643-662</b> <b>B13:295-310</b> M2:427-452
Wed.	Nov. 9	Methods in microbial ecology Part 1		
Fri.	Nov. 11	Microbial ecosystems – freshwater and terrestrial <b>**PROJECT PROGRESS REPORT **</b>	<b>B14:607-615</b>	<b>B13:678-695</b> M2:798-821 A: Ch. 10
Mon.	Nov. 14	Marine microbiology – coastal	<b>B14:615-622</b>	<b>B13:685-695</b> M2:798-810
Wed.	Nov. 16	Marine microbiology – pelagic	<b>B14:615-622</b>	<b>B13:685-695</b> M2:798-810
Fri.	Nov. 18	Marine microbiology –sediments and hydrothermal vents	<b>B14:622-628</b>	
		<i>Quiz 5</i>		
Mon.	Nov. 21	<b>NO CLASS</b>	<b>THANKSGIVING BREAK</b>	
Wed.	Nov. 23	<b>NO CLASS</b>		
Fri.	Nov. 25	<b>NO CLASS</b>		
Mon.	Nov. 28	Marine microbiology –sediments and hydrothermal vents	<b>B14:622-628</b>	
Wed.	Nov. 30	Methods in microbial ecology	<b>B14:Ch. 18</b>	<b>B13:643-662</b> <b>B13:295-310</b> M2:427-452
Fri.	Dec. 2	Methods in microbial ecology		
Mon.	Dec. 5	Biogeochemical cycles (carbon, oxygen, nitrogen, sulfur, iron)	<b>B14:632-642</b>	<b>B13:699-709</b> M2:829-855 A: Ch. 11
Wed.	Dec. 7	Review		
		<i>Lab: Project presentations</i>		
Fri.	Dec. 9	<b>Third exam</b>		
<b>Mon</b>	<b>Dec. 12</b>	<b>All papers due</b>		