

CATALOG YEAR 2006-2007
(Please use separate form for each add/change)

COLLEGE/SCHOOL : Arts and Sciences

Current Catalog Page(s) Affected _____ 260 _____

Course: BIOL 5420 Add: X Delete: _____
(check all that apply) Change: Number _____ Title _____ SCH _____
Description _____ Prerequisite _____

If new, provide Course Prefix, Number, Title, SCH Value, Description, prerequisite, and lecture/lab hours if applicable. If in current catalog, copy and paste the text from the and indicate changes in red.

Biol 5420 Advanced Environmental Microbiology. Four semester hours.
An overview of the relationship between microbial metabolism, physiology, and the environment with a discussion of the primary literature. The application of modern microbiological concepts to address and solve current environmental problems is emphasized. Topics include air, water and soil microbiology, geochemical activities of microbes, biotransformations, pollution, and pollution abatement using microbes. Prerequisite: Graduate standing and permission of instructor. Laboratory fee: \$30.00. (Cross-listed with ENSC 4420/BIOL 4420)

Justification: New course for the Master of Science in Biology.

Approvals:	Signature	Date
Chair Department Curriculum Committee	_____	_____
Chair Department	_____	_____
Chair College Curriculum Committee	_____	_____
Dean	_____	_____

Course Title: Environmental Microbiology
Course Number: BIOL 5420
Term/Year: Spring 2005
Instructor: David L. Beck, BS, AM
Office Hours: Tues 2-4 pm, Wed 9-11 am, Thurs 2-4 pm
Office: Canseco Hall 302G
Office Phone: 956-326-2587
E-mail: dbeck@tamiu.edu
Home Phone: 956-722-0594 - (leave a message if I am not home)
Do not call after 9 pm.

WebCT Website: <http://www.tamiu.edu/login.html>

Text: Environmental Microbiology, by R.M. Maier, I.L. Pepper and C.P. Gerba,
Academic Press, 2000.

Environmental Microbiology Learning Outcome:

1. Students will be able to distinguish and classify microorganisms, from bacteria to viruses.
2. Students will be able to discuss the importance of microorganisms in the maintenance of an ecological balance on earth.
3. Students will be able to describe and explain the role of microorganisms in Soil, Water, Sewage Treatment, Bioremediation..
4. Students will demonstrate a knowledge environmental sample testing and quantitation of microorganisms.
5. Students will be able to discuss the basic principles of wastewater treatment.
6. Students will be able to write about and apply basic environmental microbiological concepts to everyday life and current scientific issues.

Course Synopsis: This course will focus on current knowledge of microbial activities in the soil and water environments. The participation of microbes in the natural oxidation - reduction cycles for C/N/S and metals, their role in the bioremediation of organic and inorganic pollutants in soil and water and sewage (wastewater biotreatment) and infectious disease transmission will also be discussed. Environmental sampling and cultural and non-cultural detection methods will be reviewed as it relates to the potential and limits of microbial interactions and metabolism in the environment. Special topics (as time permits) on the effects of global climate change on microbial activities, genomics and current microbial ecology research and the bioremediation of oil and fuel hydrocarbons in soil and ground water will be discussed.

Class Presentation (Literature Research Paper)

Purpose: The class presentation is an important learning experience which is useful in the development of critical thinking, data evaluation and instructional skills and as a model for real life presentations. "Remember, it is the questions we ask that are important, not necessarily the answers, in the quest for understanding and objectivity." Useful topics can be obtained from primary sources, i.e. research papers in any of the above cited journals.

Students will investigate a topic of interest in microbial ecology. **The topic should address a question eg. a)What are the consequences of bacterial biofilms in indwelling catheters, prostheses and other medical devices? b)What is the evidence that chlorinated compounds (TCE, PCE) are biodegraded by soil microbes?** They should gain a greater understanding of the research topic, experimental methods used, whether initial hypotheses/questions were answered and if new experiments are suggested for improving knowledge of the subject(s). Students are required to a)submit an abstract, copy of all slides and list of references (to the instructor), b)use visual aids(eg. Powerpoint, overheads) in a clear, concise and focussed presentation and c) answer questions from the class. The instructor is willing to pre-review and post-review the student's presentation.

Graduate Discussion - there will be ten graduate discussions during the semester. At each discussion current immunology research articles will be discussed.

Graduate students will participate in all discussions and present several times during the semester a primary research paper.

Grading

Test 1	100 points
Test 2	100 points
Final	200 points
Presentation	100 points
Homework	200 points
Graduate	100 points

Tests will consist of essays , calculations and definitions.

Lecture Schedule			
Date		Topic	Text chapt.
Jan. 19	W	Introduction	Not in text
21	F	Microbial ecology pioneers	Not in text
24	M	Bacterial growth	3
26	W	Bacterial growth	3
28	F	Soil environment	4
31	M	Soil environment	4
Feb. 2	W	Soil environment	4
4	F	Air environment	Not in text
7	M	Water environment	6
9	W	Water environment	6
11	F	Extremophiles	6
14	M	Microbial transport - soil	7
16	W	Microbial transport - soil	7
18	F	Environmental sampling	8
21	M	Test 1* (Chapters: not in text material and 3,4,6,7)	
23	W	Test answers review	
25	F	Culture methods of detection	10

Feb28-Mar.4	Mid-semester break - No classes	
Mar. 7	M Culture methods of detection	10
	9 W Culture methods of detection	10
	11 F Physiological(functional) methods of detection	11
	14 M Physiological(functional)methods of detection	11
	16 W Physiological(functional)methods of detection	11
	21 M Physiological(functional)methods of detection	11
	23 W Fluorescent techniques	12
	28 M Non-cultural methods of detection	13
	30 W Non-cultural methods of detection	13
Apr. 1	F Non-cultural methods of detection	13
	4 M Test 2* (Chapters 8-13 except 9)	
	6 W Biogeochemical cycles	14/15
	8 F Biogeochemical cycles	14/15
	11 M Microbes and organic pollutants	16
	13 W Microbes and organic pollutants	16
	15 F Microbes and metal pollutants	17
	18 M Microbes in agriculture	18
	20 W Domestic waste treatment	21
	22 F Domestic waste treatment	21
	25 F Class presentation	
	27 M Class presentation	
	29 W Class presentation	
May 2	M*** Special topic - Global climate change and infectious diseases	Refs.
May 4	W*** Special topic - TBA	Refs.

6-13 F-F **Final Exams* (Chapters 14,15,16,17,18&21 and special topics)**
(Date? ME Final Exam (12:00-2:30pm))

Useful Reference Textbooks in Microbial Ecology:

- 1)Atlas, R.M. and R. Bartha, "Microbial Ecology - Fundamentals and Applications," 4th ed., Addison, Wesley Longman, Inc., NY, 1999.
- 2)Staley, J.T and A-L.Reysenbach, eds., "Biodiversity of Microbial Life:Foundation of Earth's Biosphere", John wiley and Sons, NY, 2002.
- 3)Perry, J.T., J.T. Staley and S. Lory, "Microbial Life," Sinauer Associates, Publ., MA, 2002.
- 4)Hurst, C.J., G.R. Knudsen, M.J. McInerney, L.D. Stetzenbach and R.L.Crawford,eds., "Manual of Environmental Microbiology," Amer. Soc. for Microbiology, Wash., DC, 2001.
- 5)Encyclopedia of Environmental Microbiology, Vols. 1-6, John Wiley and Sons, NY, 2002.
- 6)Levin, M.A., R.J. Seidler and M. Rogul, "Microbial Ecology - Principles, Methods and Applications", Vols. 1 and 2, McGraw Hill Cos., 1992.
- 7)Amy, P.S. and D.L. Haldeman, eds., "Microbiology of the Terrestrial Deep Subsurface," CRC Publ., NY, 1997.

- 8) Pickup, R.W. and J.R. Saunders, eds., "Molecular Approaches to Environmental Microbiology," Ellis Horwood, London, 1996.
- 9) Horikoshi, K. and W.D. Grant, eds., "Extremophiles - Microbial life in Extreme Environments," Wiley-Liss, NY, 1998.
- 10) Morita, R.Y., "Bacteria in Oligotrophic Environments (Starvation and Survival Lifestyle)," Chapman and Hall, 1997
- 11) Friedman, E.I., ed., "Antarctic Microbiology," Wiley-Liss, NY, 1993.
- 12) Alexander, M. Biodegradation and Bioremediation, 2nd ed., Academic Press, 1999.

Useful Journals as Primary Sources of Current Topics in Microbial Ecology:

- 1) Applied and Environmental Microbiology
- 2) Microbial Ecology
- 3) Environmental Science and Technology
- 4) FEMS Microbial Ecology / FEMS Microbiology Reviews
- 5) Biodegradation
- 6) J. Molecular Microbiology Biotechnology
- 7) Archives of Microbiology
- 8) Microbiological Reviews
- 9) Advances in Microbial Ecology
- 10) Microbiology Today
- 11) Microbiology
- 12) Current Opinions in Biotechnology
- 13) Current Opinions in Microbiology
- 14) Nature
- 15) Science
- 16) Limnology and Oceanography
- 17) Soil Science

Useful Website

Digital Learning Center for Microbial Ecology:

www.commtechlab.msu.edu/CTLProjects/dlc-me