Microbial Ecology
(BIOL 521)
Spring 2011
Tue. & Thu. 9:25-10:40am

Instructor: Dr. Vladislav Gulis
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Office Hours: Mon. 9:30-1:30pm, Tue. and Thu. 11:00-1:30pm or contact me for an appointment.

Textbook: Atlas R.M. and Bartha R. 1998. Microbial Ecology: Fundamentals and Applications, 4th ed. Benjamin/ Cummings Science Publishing. (see also other reference materials on p. 2)

Note: A new *Microbial Ecology* textbook by Jones and Bartlett Publishers may be used if published in 2011. I was invited to review several chapters from this new textbook last year (2009) and found them to be of excellent quality.

Blackboard: Blackboard will be used for this class. A copy of the syllabus, lecture notes and other pertinent information will be posted. Check it regularly.

Course description: This course is designed to introduce students to the vital roles that microorganisms play in various environments and in sustaining life on Earth. Some topics that will be covered include: microbial metabolic diversity; the role of microorganisms in biogeochemical cycles; microbial diversity, activity and importance in the functioning of aquatic and terrestrial ecosystems; microbial bioremediation.

Course objectives: To ensure that students:

- understand major topics and principles in microbial ecology
- understand and explain the critical importance of microorganisms in sustaining life on Earth
- master analytical skills by analyzing microbiological data from scientific literature
- have sufficient background in microbial ecology to take more advanced courses as a graduate student or apply for relevant positions in the governmental agencies, industry or academia.

Student learning outcomes: By the end of the semester, the student will be able to:

- demonstrate a general understanding of major methodological approaches to analyses of microbial communities
- describe and differentiate symbiotic relationships among microorganism and their interactions with plants and animals along the continuum from parasitism to mutualism
- discuss the metabolic adaptations and ecological importance of chemolithotrophs and microorganisms capable of anaerobic respiration in aquatic and subsurface environments
- describe the role of microorganisms in biogeochemical cycles of carbon, nitrogen and sulfur

- discuss the crucial role of microorganisms in the functioning of aquatic and terrestrial ecosystems
- describe the processes involved in microbial degradation of solid waste, wastewater treatment and some aspects of bioremediation

Assessment and grading: The student's performance in this course will be assessed *via* a series of quizzes, three exams during the semester as well as a cumulative final exam. Quizzes will be given, unannounced, every few classes, usually at the beginning of a class. Exams will include discussion type questions only and will require a greater degree of analysis and synthesis than exams for undergraduate students. In addition, each graduate student will make 15-20 minute presentation to the class on an assigned topic. I will assist and advise graduate students with preparation of the presentation. Also, each graduate student will write a paper based on analysis of scientific literature on any subject of microbial ecology (specific guidelines and suggested topics will be provided). Grades will be assigned on the basis of the percentage of 650 points as follows:

Point distribution

Assignment	**Points**
Exam 1	100
Exam 2	100
Exam 3	100
Final exam	150
Quizzes (4)	100
Class presentation	50
Paper	50
Total	**650**

Grading scale

Grade	**%**
A	90-100
B+	85-90
B	80-85
C+	75-80
C	70-75
D+	65-70
D	60-65
F	0-60

Confirmed cheating or plagiarism on an exam or assignment will result in a grade of "F" for that assignment, the entire course and/or reporting to the university. In general, academic misconduct will not be tolerated. See CCU Student Code of Conduct for details.

Attendance: Attendance is expected and will be monitored *via* a sign-off sheet, which will be passed around at the beginning of each lecture. I will follow the CCU catalog policy that "An instructor is permitted to impose a penalty, including assigning the grade of F, for unexcused absences in excess of 25% of the regularly scheduled class meetings". If you are absent or late, you may miss unannounced quizzes that would affect your grade. Make-up exams are only given for university-excused absences. See current CCU catalog for details.

Cell phones: Use of cell phones, PDAs, etc. during the class is both disruptive and disrespectful to your colleagues. You will be asked to leave the class after the second offense.

Disabilities: Students with disabilities should see me at the beginning of semester so special arrangements can be made, if necessary. Also, please contact Office of Disability Services.

Other reference materials: The text chosen for this class is one of the few available in microbial ecology. As you can see from the course outline, I will not follow the organization of the text during the semester. Therefore, I will be somewhat selective as to the topics covered. For some areas, the text gives good coverage, in other areas, I have found better coverage from other sources. Consequently, I have indicated some of these sources under the appropriate topic. Copies of some material may be made available in electronic form through Blackboard and will be mentioned in class. Commonly used sources include:

Madigan M.T. & Martinko J.M. 2006. Brock Biology of Microorganisms, 11th Edition, Pearson Prentice Hall.

Hurst C.J., Knudsen G.R., McInerney M.J., Stetzenbach L.D., Walter M.V. (Eds.) 1997. Manual of Environmental Microbiology. ASM Press.

Kirchman D.L. (Ed.). 2000. Microbial Ecology of the Oceans. Wiley-Liss.

Staley J.T. and Reysenbach A.L. 2002. Biodiversity of Microbial Life: Foundation of Earth's Biosphere. Wiley-Liss.

Kemp P.F., Cole J.J., Sherr B.F., Sherr E.B. 1993. Handbook of Methods in Aquatic Microbial Ecology. Lewis Publishers.

Ford T.E. (Ed.). 1993. Aquatic Microbiology: An Ecological Approach. Blackwell Science.

Some useful web resources:
The Center for Microbial Ecology (Michigan State U) - http://www.cme.msu.edu
The Microbial Zoo - http://commtechlab.msu.edu/sites/dlc-me/index.html
Indices to web resources in Environmental Microbiology
http://www.microbes.info/resources/Environmental_Microbiology/
http://www.biol.uni.torun.pl/~henroz/links.html

TENTATIVE SCHEDULE

Date	Week	Lecture Topic and Assigned Readings*
Tue, Jan. 11 Thu, Jan. 13	1	Introduction and overview of microorganisms. Roles and significance of microorganisms in ecosystem level processes. Text: Chapter 1 & 2, Madigan and Martinko: Chapter 1 & 2.
Tue, Jan. 18 Thu, Jan. 20	2	Methods for examining microorganisms in the environment. Text: Chapter 7, Madigan and Martinko: Chapter 18.
Tue, Jan. 25 Thu, Jan. 27	3	Methods in microbial ecology, continued.
Tue, Feb. 1 Thu, Feb. 3	4	**Exam 1** Interactions among microorganisms. Microbial loop. Biofilms. Lichens. Text: Chapter 3.
Tue, Feb. 8 Thu, Feb. 10	5	Interactions among microorganisms, continued. **Feb. 10 - Celebration of Inquiry**

Tue, Feb. 15 Thu, Feb. 17	6	Interactions between microorganisms and animals. Nutrition, gut flora, rumen, mycophagy. Text: Chapter 5; Madigan and Martinko: Chapter 19.10-19.11.
Tue, Feb. 22 Thu, Feb. 24	7	Interactions between microorganisms and plants. Rhizosphere, mycorrhizae, symbiotic nitrogen fixation. Text: Chapter 4. Chapter 19.19-19.22.
Tue, Mar. 1 Thu, Mar. 3	8	**Exam 2** Graduate presentations.
Tue, Mar. 8 Thu, Mar. 10	9	Graduate presentations. Microbial metabolic diversity, Madigan and Martinko: Chapter 17
Tue, Mar. 15 Thu, Mar. 17	10	**Spring Break**
Tue, Mar. 22 Thu, Mar. 24	11	Microbial metabolic diversity, continued Biogeochemical cycles. Carbon cycle. Text: Chapter 10; Madigan and Martinko: Chapter 19.9. **Mar. 24 is the last day to drop with a "W".**
Tue, Mar. 29 Thu, Apr. 31	12	Carbon cycle, continued. Nitrogen cycle. Text: Chapter 11; Madigan and Martinko: Chapter 19.12.
Tue, Apr. 5 Thu, Apr. 7	13	Nitrogen cycle, continued. Phosphorus cycle. Sulfur cycle. Text: Chapter 11; Madigan and Martinko: Chapter 19.13-19.14. **Exam 3**
Tue, Apr. 12 Thu, Apr. 14	14	Aquatic microbiology. Freshwater, estuarine, marine environments. Hydrothermal vents. Text: Chapter 9; Madigan and Martinko: Chapter 19.5-19.8.
Tue, Apr. 19 Thu, Apr. 21	15	Soil microbiology. Atmospheric microbiology. Text: Chapter 9; Madigan and Martinko: Chapter 19.4. Bioremediation. Solid waste treatment. Wastewater treatment. Text: Chapter 12-14. Madigan and Martinko: Chapter 19.15-19.18, 28.2.
Tue, Apr. 26	16	Bioremediation, continued.
Tue, May 3		**Final Exam**

*The schedule is tentative and subject to change at the discretion of the instructor