

MICR 3900 – Applied and Environmental Microbiology

Dr. Tina Salmassi

Office Location:	La Kretz Hall ASC-Wing A 315
Regular Office Hours:	T/R 10:00 AM – 10:45 AM
Office Hours by Appt:	T 2:00 – 3:00 PM (call Biological Sciences Office)
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Lecture:	MICR 3900 Sec 01 T/R 1:00 – 1:50 PM, SH C243
Moodle:	SPRING 2016 MICR 370-01
Laboratory:	MICR 3900 Sec 02 T 2:10 PM– 4:40 PM, ASCL 242 MICR 3900 Sec 03 R 2:10 PM– 4:40 PM, ASCL 242 MICR 3900 Sec 04 R 2:00 PM– 4:30 PM, ASCL 242

Course Description:

Interactions of microorganisms with their environment and the application of microorganisms in food and biotech industries, agriculture, and bioremediation. Emphasis on microbial diversity, distribution and microbial function within ecosystems. *Prerequisites:* MICR 300B with a grade of C or higher, or instructor consent. Lecture 3 hours, laboratory 3 hours including a required field trip.

Course Objectives:

Upon completion of this course, students will be able to:

- Discuss the ubiquity of microorganisms in our environment;
- Discuss the diversity of microorganisms;
- Properly sample, transport and process environmental samples containing microorganisms;
- Describe the different environments in which microorganisms are found;
- Distinguish between molecular and culture-based methods of microbial characterizations;
- Describe the major biogeochemical cycles in the environment;
- Describe the application of microorganisms to industrial processes;
- Culture microbes from environmental samples;
- Quantify microbes from samples such as water, soil or food;
- Identify microorganisms based on 16S rRNA.

Course Materials

Moodle: (or "Modular Object-Oriented Dynamic Learning Environment") is an open source learning management system providing faculty and students an online presence for their courses. Visit the Moodle website and become familiar with the interface. You can access Moodle from the myCSULA portal using your CSULA login and password.

Readings: All materials including lecture readings and laboratory exercises will be available via Moodle or the Internet. Readings will be announced via Moodle or in class.

Course Policies:

Drop Policy: Please see the schedule of classes for information. No exceptions will be made to the established University deadlines.

Academic Honesty: Students are expected to read and abide by the University's Academic Honesty Policy, which can be found at www.calstatela.edu/academic/senate/handbook/ch5a.htm. Students who violate this policy will be subject to disciplinary action, and may receive a failing grade in the course for a single violation.

ADA Policy: Reasonable accommodation will be provided to any student who is registered with the Office of Students with Disabilities and requests needed accommodation.

Course Requirements:

Attendance: Regular attendance and participation are required for both lecture and laboratory sessions.

Exams: There will be no make-up exams or assignments. Please inform your instructor should any special circumstances arise.

Projects:

Project #1 – Sourdough Bread Home Kitchen Lab

Project #2 – Survey of Microbial Diversity Presentation and Study Guide

Project #3 – Bioinformatics Data Analysis Project

Project #4 – Applied and Environmental Microbiology in the News Presentation

Laboratory Requirements: Students must provide their own laboratory coat and permanent marker. These items can be purchased at the student bookstore. Laboratory attendance is required. Experiments build on prior experiments so when you miss class you not only miss the content from that class but you put yourself at a disadvantage for other classes. Laboratory reports will be announced in lab upon completion of the experiments.

Grading

Project #1	100 points
Class Activities	50 points
Project #2	100 points
Project #3	100 points
Project #4	100 points
Lecture Final	150 points
Lab Reports	200 points
Lab Midterm	100 points
Lab Final	100 points
TOTAL	1000 points

Final Course Grade:

Percent of Total	Point Total	Letter Grade
91-100	>910	A
90-90.9	900-909	A-
89-89.9	890-899	B+
82-88.9	820-889	B
80-81.9	800-819	B-
76-79.9	760-799	C+
65-75.9	650-759	C
60-64.9	600-649	C-
55-59.9	550-599	D
Below 55	<550	F

Lecture Schedule:

Week	Date	Topic
1	1/24	General Course Information
	1/26	Introduction to Environmental Microbiology, Part I Project #1 Introduced 1. <i>Prokaryotes the Unseen Majority</i> (Whitman 1998) 2. <i>Epistemology of Environmental Microbiology</i> (Madsen 1998)
2	1/31	Introduction to Environmental Microbiology, Part II 1. <i>Neighborhoods and Community Involvement, no Microbe is an Island</i> (Hurst 2007) Project #2 Introduced
	2/02	Chemistry of the Cell Biofilms 1. Chapter 14 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) 2. <i>The Biofilm Matrix</i> (Flemming & Wingender 2010)
3	2/07	The Environments Extreme Environments 1. Chapter 5 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) 2. <i>Life in Extreme Environments</i> (Rothschild & Mancinelli 2001)
	2/09	Methods of Environmental Sampling & Microbiology 1. <i>Neighborhoods and Community Involvement, no Microbe is an Island</i> (Hurst 2007) 2. <i>Microbial Evolution, Diversity, and Ecology: A Decade of Ribosomal RNA Analysis of Uncultivated Microorganisms</i> (Head et al. 1998)
4	2/14	Diversity, Species Concept, & Phylogeny 1. <i>Prokaryotic Diversity: Form, Ecophysiology, and Habitat</i> (Colwell and Leadbetter 2007) 2. <i>The Species Concept for Prokaryotes</i> (Rossello-Mora & Amann 2001)
	2/16	Bioinformatics Project #3 Introduced Reading TBA
5	2/21	Biogeochemical Cycling Global Issues 1. Chapter 22 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) 2. <i>The Microbial Engines That Drive Earth's Biogeochemical Cycles</i> (Falkowski et al. 2008)
	2/23	Microbial Groups 1. Chapter 18 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) 2. Chapter 19 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) 3. Chapter 20 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) Project #2 (student presentation) Survey of Microbial Diversity/Microbial Groups
6	2/28	Project #2 (student presentation) Survey of Microbial Diversity/Microbial Groups
	3/02	Microbial Metabolism in the Environment Microbial Ecology 1. Chapter 21 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>)

7	3/07	Project #2 (student presentation) Survey of Microbial Diversity/Microbial Groups Growth and Adaptation Interactions <ol style="list-style-type: none"> 1.—<i>A Squid That Glows in the Night: Development of an Animal-Bacterial Mutualism</i> (Ruby & McFall-Ngai 1992) 2.—<i>Termite Guts: the World's Smallest Bioreactors</i> (Brune 1998) Project #4 Introduced
	3/09	Water & Wastewater, Part I <ol style="list-style-type: none"> 1. Chapter 22 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) 2. <i>Detection and Enumeration of Coliforms in Drinking Water: Current Methods and Emerging Approaches</i> (Rompre et al. 2002)
8	3/14	Water & Wastewater, Part II Biogeochemical Cycling Global Issues Microbial Metabolism in the Environment <ol style="list-style-type: none"> 1. Chapter 22 (<i>Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition</i>) <i>The Microbial Engines That Drive Earth's Biogeochemical Cycles</i> (Falkowski et al. 2008)
	3/16	Bioaerosols <ol style="list-style-type: none"> 1. <i>Introduction to Aerobiology</i> (Stetzenbach 2007) Growth and Adaptation (HOMEWORK ASSIGNMENT ONLY) Interactions <ol style="list-style-type: none"> 1. <i>A Squid That Glows in the Night: Development of an Animal-Bacterial Mutualism</i> (Ruby & McFall-Ngai 1992) 2. <i>Termite Guts: the World's Smallest Bioreactors</i> (Brune 1998) Microbial Ecology <i>Chapter 21 (Microbiology and Evolving Science - Slonczewski and Foster 3rd Edition)</i>
9	3/21	Food Microbiology <ol style="list-style-type: none"> 1. <i>The Microbes We Eat: Abundance and Taxonomy of Microbes Consumed in a Day's Worth of Meals for Three Diet Types</i> (Lang et al. 2014)
	3/23	Bioremediation & Metals <ol style="list-style-type: none"> 1. <i>Bioremediation of Metal Contamination</i> (Lovley & Coates 1997) 2. <i>Anaerobes to the Rescue</i> (Lovley 2001)
	3/28	Spring Break
10	4/04	Geomicrobiology Reading TBA
	4/06	Industrial Microbiology <ol style="list-style-type: none"> 1. <i>Ileal-lymphoid-nodular Hyperplasia, Non-Specific Colitis, and Pervasive Developmental Disorder in Children</i> (Wakefield et al. 1998) 2. <i>Autism and Measles, Mumps, and Rubella Vaccine: No Epidemiological Evidence for a Causal Association</i> (Taylor et al. 1999) 3. <i>Recent Trends in Industrial Microbiology</i> (Beloqui et al. 2008)
11	4/11	Astrobiology Reading TBA
	4/13	Project #4, Student Presentations
12	4/18	Project #4, Student Presentations
	4/20	Project #4, Student Presentations

13	4/25	Project #4, Student Presentations
	4/27	Project #4, Student Presentations
14	5/02	Project #4, Student Presentations
	5/04	Project #4, Student Presentations
15	5/09	Project #4, Student Presentations
	5/12	Review
Finals	5/16	Cumulative Final Exam (1:30-3:30 PM)

Readings

1. Beloqui, Ana, et al. "Recent trends in industrial microbiology." *Current opinion in microbiology* 11.3 (2008): 240-248.
2. Brune, Andreas. "Termite guts: the world's smallest bioreactors." *Trends in Biotechnology* 16.1 (1998): 16-21.
3. Colwell, F. S., et al. "Prokaryotic diversity: form, ecophysiology, and habitat." *Manual of environmental microbiology* Ed. 3 (2007): 20-34.
4. Falkowski, Paul G., Tom Fenchel, and Edward F. Delong. "The microbial engines that drive Earth's biogeochemical cycles." *science* 320.5879 (2008): 1034-1039.
5. Flemming, Hans-Curt, and Jost Wingender. "The biofilm matrix." *Nature Reviews Microbiology* 8.9 (2010): 623-633.
6. Franche, Claudine, Kristina Lindström, and Claudine Elmerich. "Nitrogen-fixing bacteria associated with leguminous and non-leguminous plants." *Plant and soil* 321.1-2 (2009): 35-59.
7. Head, I. M., J. R. Saunders, and R. W. Pickup. "Microbial evolution, diversity, and ecology: a decade of ribosomal RNA analysis of uncultivated microorganisms." *Microbial ecology* 35.1 (1998): 1-21.
8. Hurst, C. J., et al. "Neighborhoods and community involvement: no microbe is an island." *Manual of environmental microbiology* Ed. 3 (2007): 6-19.
9. Lang, J.M., et al. "The microbes we eat: abundance and taxonomy of microbes consumed in a day's worth of meals for three diet types." *PeerJ* (2014).
10. Lovley, Derek R. "Anaerobes to the rescue." *Science* 293.5534 (2001): 1444-1446.
11. Lovley, Derek R., and John D. Coates. "Bioremediation of metal contamination." *Current Opinion in Biotechnology* 8.3 (1997): 285-289.
12. Madsen, Eugene L. "Epistemology of environmental microbiology." *Environmental science & technology* 32.4 (1998): 429-439.
13. Pace, Norman R. "A molecular view of microbial diversity and the biosphere." *Science* 276.5313 (1997): 734-740.
14. Rompré, Annie, et al. "Detection and enumeration of coliforms in drinking water: current methods and emerging approaches." *Journal of microbiological methods* 49.1 (2002): 31-54.

15. Rossello-Mora, Ramon, and Rudolf Amann. "The species concept for prokaryotes." *FEMS microbiology reviews* 25.1 (2001): 39-67.
16. Rothschild, Lynn J., and Rocco L. Mancinelli. "Life in extreme environments." *Nature* 409.6823 (2001): 1092-1101.
17. Ruby, E. G., and M. J. McFall-Ngai. "A squid that glows in the night: development of an animal-bacterial mutualism." *Journal of bacteriology* 174.15 (1992): 4865.
18. Smith-Palmer, A., J. Stewart, and Lorna Fyfe. "The potential application of plant essential oils as natural food preservatives in soft cheese." *Food Microbiology* 18.4 (2001): 463-470.
19. Stetzenbach, L. D., et al. "Introduction to aerobiology." *Manual of environmental microbiology* Ed. 3 (2007): 925-938.
20. Taylor, Brent, et al. "Autism and measles, mumps, and rubella vaccine: no epidemiological evidence for a causal association." *The Lancet* 353.9169 (1999): 2026-2029.
21. Wakefield, Andrew J., et al. "RETRACTED: Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children." *The Lancet* 351.9103 (1998): 637-641.
22. Whitman, William B., David C. Coleman, and William J. Wiebe. "Prokaryotes: the unseen majority." *Proceedings of the National Academy of Sciences* 95.12 (1998): 6578-6583.

Lab Schedule:

Week	Date	Lab Exercises
1	1/24	Check in and Safety
2	1/31	Lab 1: Serial Dilutions
3	2/07	Lab 2: Soil Sampling Lab 1: Serial Dilutions Cont'd
4	2/14	Lab 3: Contact Slide
5	2/21	Lab 4: Soil Enumeration Lab 3: Contact Slide Cont'd
6	2/28	Lab 5: Aerobiology Lab 4: Soil Enumeration Cont'd
7	3/07	Lab 6: Bacterial Examination of Water Lab 5: Aerobiology Cont'd
8	3/14	Lab 6: Bacterial Examination of Water Cont'd
9	3/21	Midterm Home Kitchen Lab & Bread Baking
	3/28	Spring Break
10	4/04	Lab 7: Food Microbiology
11	4/11	Lab 7: Food Microbiology Cont'd

12	4/18	Lab 8: Soil DNA Extraction
13	4/25	Lab 9: 16S of Soil DNA
14	5/02	Lab 10: Bioremediation
15	5/09	Cumulative Final Exam