

Biology 487, Fall 2014

Microbial Ecology

Course Description: This course explores microbial evolution and population, community, and ecosystem ecology of microorganisms. This course is designed to introduce students to the vital roles that microorganisms play in sustaining life on Earth. We are only beginning to understand the great diversity of microbes and their functions. We are literally surrounded and covered by microorganisms that play an important role in earth's habitability and our own survival; microbial ecology and environmental microbiology attempt to document and understand the diversity and activities of microbial communities and populations. This course emphasizes the roles of microorganisms in ecosystems, including, microbial physiology, nutrient cycles, methods of microbial analysis, and the functional roles of microorganisms. Instruction will be primarily through lecture and weekly discussions based upon current primary research literature or topics in the news. Comprehensive treatment of how microorganisms dominate our lives and environment is the underlying theme.

Course Objectives:

- Study the ecology of microorganisms at population, community and ecosystem levels.
- Gain an appreciation of microbial evolution and diversity.
- Understand the role of microorganisms in global biogeochemical cycling of elements.
- Gain familiarity with modern approaches and questions in microbial ecology.
- Practice critical analysis through speaking and writing.

Course Structure: Material presented in lectures and assigned readings will be critically analyzed through in-class discussions and written reviews. Tentative course set-up/schedule: Students will read and discuss papers on the ecology of microbial communities including topics such as microbial diversity and biogeography. I aim to keep this course interactive. Since the study of microbial ecology requires knowledge of several disciplines including microbiology, environmental science, chemistry, biology, and ecology, it is likely that all students will not share similar background knowledge. Therefore, we will discuss at a pace that the class finds comfortable.

Grading: Assignments, participation in discussion, and class attendance will be considered together as evidence of your active involvement in the course.

Grading scale:

- A 100-90%
- B 89-80%
- C 79-70%
- D 69-60%

Grades will be straight scale, meaning there will be no adjustment of the final grade.

Initial Bibliography Due Tuesday 9/2 - This is a short list (3-5) of potential papers you would like to read this semester. We are looking for prominent papers that have contributed to the way we think about microbial ecology. Choose a subject that you are passionate about. Papers should relate to the lecture topics. You should READ the papers before recommending them for class discussion. Please post suggestions to the discussion board "Potential Papers for Discussion" along with a url for the pdf. The reading list survey is due 9/4 (details on blackboard).

Weekly questions: Everyone should read the papers BEFORE class, and think about them critically. You will each be responsible for forming one question (< 1 paragraph) and posting the question on Bb each week. These questions will be used during the class discussion.

Discussion Leader: gives context for the paper and provides questions to lead the discussion. The leader should explain how the paper fits into the field, why this paper was chosen, and the impact of this paper on the field of microbial ecology. Additional information about the research group, cited papers or papers that have cited the article may be included if relevant. To lead a discussion, you should ask questions of your classmates and provide help so as to walk us through the purpose, methods, results and interpretations found in each paper. The discussion leader will monitor the discussion to keep all class members involved.

Quality class participation: Student participation in class discussions will be graded. Attendance may affect your participation grade.

Oral presentation: An oral presentation is required for this course. Each student must prepare an abstract, outline, bibliography and meet with me prior to final approval of the oral presentation topic. The deadline for submitting an oral presentation topic is September 25. Your presentation should be prepared by November 11 for peer review. The PowerPoint presentation, abstract, outline and bibliography must be submitted to me via email on the day of oral presentation. Please post these files to Bb via the Message tool with the file named using your first initial and last name in the file name (e.g. BChristner_MicroEcolOralPresentation.doc). Each presentation should be 15 minutes in length, allowing 5 additional minutes for questions.

POSSIBLE PROJECT TOPICS

Diversity of Microbes

Biogeography of Microorganisms throughout terrestrial, extreme, or marine environments

Distribution of functional guilds in terrestrial or aquatic systems

The Role of Oceanic Plankton in the Global Carbon Cycle

Microbes and the Greenhouse Gas Effect

Application of macroscale ecological theory to microbial communities

Plant-microbe interactions

Non-Discrimination Policy: Iowa State University is “dedicated to fostering an environment in which differences in people such as nationality, race, gender, religion, cultural background, physical ability, and sexual orientation, are respected and mutual understanding is promoted.” (from the ISU Bulletin)

Disabilities Statement: If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me as soon as possible. Please request that a Disability Resources staff send a SAAR form verifying your disability and specifying the accommodation you will need. For further information or assistance, contact the Disability Resources (DR) office. DR is located on the main floor of the Student Services Building, Room 1076; their phone is 515-294-6624.

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Class Schedule

26-Aug	Introductions
28-Aug	Microbial Evolution
2-Sep	Discuss first paper posted by Hofmockel; Bibliography Due
4-Sep	Choose papers & dates for leading discussions; Survey Due
9-Sep	Species concept
11-Sep	Discussion
16-Sep	Microbial Diversity
18-Sep	Discussion
23-Sep	Biogeography/Niche
25-Sep	Discussion Presentation/Paper Topics Due
30-Sep	Fungal Ecology
2-Oct	Discussion
7-Oct	Human microbiome
9-Oct	Discussion
14-Oct	Ecology of Antibiotics
16-Oct	Discussion
21-Oct	Microbial Communication
23-Oct	Special Seminar
28-Oct	Biogeochemical cycling N
30-Oct	Discussion
4-Nov	Biogeochemical cycling C and Climate Change
6-Nov	Discussion
11-Nov	Ecosystem Ecology – Presentation / Papers Due
13-Nov	Discussion
18-Nov	Presentation/paper workshop; Peer Reviews Due
20-Nov	Current Ideas in Microbial Ecology Discussion
25-Nov	Thanksgiving Break
27-Nov	Thanksgiving Break
2-Dec	Presentations and Discussion; Papers Due
4-Dec	Presentations and Discussion
9-Dec	Presentations and Discussion
11-Dec	Last day of class – Finish Presentations, Final Remarks