

Microbial Ecology and Diversity Laboratory 11:680:492

Description:

Microbial Ecology and Diversity Laboratory is a 3 credit laboratory course that meets once weekly for 5hrs 40min. Performing in-depth analyses of a microbial community from local ecosystems, students in this course will build upon the basic principles and skills gained in introductory courses. Laboratory exercises focus on microbial functions in ecosystems, examining the interactions between microbial communities and their environments and the impact of these relationships on global element cycles. The course will explore ecological principles as they apply to microorganisms, while emphasizing the molecular, biochemical and evolutionary diversity in the microbial world.

Availability:

This laboratory course is offered alternating spring semesters and is intended for upper-level undergraduate students in microbiology, biochemistry, biotechnology, environmental sciences, oceanography, and graduate students in the biosciences.

Prerequisites and Registration Restrictions:

Pre-requisites: Microbial Ecology and Diversity Lecture 11:680:491 or an equivalent course approved by course faculty.

Faculty:

Lecturer: Dr. Tamar Barkay: barkay@aesop.rutgers.edu

Lecturer: Dr. Andy Marinucci: andrew.marinucci@verizon.net

Teaching Assistant: Ashley Grosche: ashley.grosche@rutgers.edu

Learning Goals for Microbial Ecology and Diversity Lab:

Students will explore how the environment shapes microbial communities and how microbes affect the environment. Upon completion of the course, students will have acquired the basic skill set for participation in contemporary microbial ecology research. They will be capable of investigating microbial interactions using a multifaceted approach including culture-independent & culture-dependent analyses, bioinformatics, molecular biology, phylogeny, and ecosystem ecology. This skillset includes the ability to:

1. Analyze how environmental conditions drive community structure.
2. Assess the metabolic capabilities of microbial communities.
3. Synthesize community structure and metabolic capability data to predict microbial interactions with each other, with their environment, and/or their host.
4. Develop analytical skills by applying the scientific method; including experimental design, collection and analyses of data and synthesis of data to form conclusions.

Lab Manual:

Grosche, A. and Barkay, T. 2017. Microbial Ecology and Diversity Laboratory Exercises: 680:492, Department of Biochemistry and Microbiology.

Grading:

1. Pre-lab assignments (20%)
2. Post-lab notebook entries (20%)
3. Comprehensive paper in journal format based on semester project (30%)
4. Oral presentation of semester project (20%)
5. Class participation (10%)

Attendance:

Class attendance is mandatory. Make-up classes are not possible.

Skills Acquired:

Techniques employed will include:

Microbial respiration measurements

Carbon content estimation (Loss on ignition)

Enrichment culturing

DNA extraction

Gel electrophoresis

PCR & primer design

Clone library construction

Phylogenetic tree construction

Pyrotag analyses using Qiime pipeline

Computational use of BLAST, EzTaxon, Seaview, Qiime

Course Topics:

Experimental design and field sampling
Microbial diversity- exploring the resident community
Metabolic diversity- the role of microbes in biogeochemical cycling
Ecosystem diversity- principles of microbial wetland ecology
Next Generation Sequencing- methods and analyses
Methods in estimating microbial activity in the environment
The ecology of microorganisms in natural and engineered environments
Genomic, metagenomic and molecular advances in understanding of microbial interactions