BIOL 487 (Fall 2018)

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BIOL/ENSCI/MICRO 487; EEOB 587 Microbial Ecology

Iowa State University

Fall Semester 2018

3 credits

Prerequisite coursework: 6 credits *in biology and 6 credits in chemistry.*

M, W, Fr 9-9:50 Lecture; Bessey 145

Instructor

Assistant Professor Elizabeth Swanner

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Office Hours: Thursdays 10-11 am or by appointment

Course Description

Catalog Description: Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

The emphasis of this course will be on the great diversity of microorganisms on Earth, the different environments they inhabit, and the functional roles they play in these environments. We will cover how microbes survive and make energy in diverse habitats, their role in complex biological systems, the physical and chemical limits to life on Earth, and the census of microbes on Earth.

Course Objectives

After completing BIOL/ENSCI/MICRO 487/EEOB 587 you will be able to:

- Recognize major metabolic classes of microbes and their role in biogeochemical cycling in the environment
- Identify controls on the distribution of microbes in different Earth environments
- Articulate the idea of microbial diversity, and the taxonomic and functional underpinnings of diversity

- Describe different scales of interactions between microbes or plants/animals/habitats and their impact on ecology and environmental processes
- Practice identifying key concepts in primary literature, and articulating complex scientific ideas is writing and speaking

Course Structure

This course consists of three meetings per week on Mondays, Wednesdays, and Fridays. Mondays and Wednesdays will generally be lectures by the instructor with in-class problem solving or group work. Most Fridays will be student-led discussions of primary literature.

Assignments and Assessment

Homework will be assigned weekly each Monday and will be due the following Monday via Canvas. Homework will be based on class material. The lowest individual homework grade will be dropped from the final grade.

Nearly every Friday we will discuss three papers relevant to the week's lectures from the primary literature. Each student will be assigned one of the weeks papers each week and asked to write a 1-page summary using the paper reading guidelines (**Paper_reading_guidelines.docx**). Students must post their paper summary either in the "Discussion" on Canvas prior to the beginning of Friday class, or turn in on paper following the class discussion. For the first half of class, we will form three groups, each composed of all the students who read the same paper. You will discuss the paper to improve your own understanding. Then we will form small groups of three people each, with one student in each group representing one of the three papers. You will be responsible for summarizing the main points of your reading to the group members who read the other papers, and vice versa. The lowest individual discussion grade will be dropped from the final grade.

A midterm and final exam consisting of short-answer questions (similar to homework problems) will assess learning in the course.

Both 487 and 587 students will submit a final term paper that reviews the primary literature on a topic in Microbial Ecology and provides an outlook for where research in this area is headed. This paper will be 4-5 single-spaced pages for 487 students (minimum 10 peer-reviewed references) and ~7-8 single-spaced pages for 587 students. Paper topics will be chosen in September, outlines due in October, and papers Friday, November 17. Additionally, 587 students will give a 10-15 minute presentation on their paper topics in the last 1-2 weeks of class.

487:

- Homework *20%*
- Primary literature discussions and summaries *20%*
- Midterm *20%*

- Final Exam *20%*
- Final paper *20%*

587:

- Homework *20%*
- Primary literature discussions and summaries *20%*
- Midterm *20%*
- Final Exam *20%*
- Final paper and presentation *20%*

Canvas

This course is an early adopter of the new learning management software Canvas. Homework assignments, Powerpoint lectures, readings, discussions, and any supplemental material will be available on Canvas.

Course Policies

Attendance

Attendance is expected, because much of the course content will be interactive. Absences will only be excused upon notification prior to the start of lecture, and only for university or research-related events. For any lectures that involve interactive work, there is no guaranteed make-up option for personal absences.

Assignments

Weekly homework assignments are available Mondays in Canvas, and due the following Monday by the start of class (9 am). Discussion summaries about weekly primary literature readings must be posted to Canvas prior to the start of Friday class, or handed in on paper at the end of the class discussion. Paper outlines and term papers are due at the beginning of the class period on the due dates, and should be submitted via Canvas. A 10% grade reduction will be applied for each day an assignment is late, and no assignments will be accepted or graded once the instructor has returned graded work to the rest of the class. The lowest individual homework grade will be dropped from the final grade. A small amount of extra credit points may be available at the discretion of the instructor.

Academic Misconduct

Each student is expected to produce his or her own original work. Academic misconduct includes using unauthorized resources on exams (e.g. phone data, neighbors, etc.), submitting someone else's work as your own, providing unauthorized access to materials to others, and plagiarism. We will prosecute academic

misconduct to the fullest extent allowed by ISU policy. Affected assignments or graded material will receive a zero, and may result in a failing course grade.

Disability Accommodation

Iowa State University complies with the American with Disabilities Act and Section 504 of the Rehabilitation Act. Any student who requires an accommodation based on disabilities should obtain a Student Academic Accommodation Request (SAAR) form from the Disability Resources (DR) office (515-294-7220). DR is located on the main floor of the Students Services Building, Room 1076. We are happy to help; please bring the SAAR to one of us to discuss privately within the first two weeks of class or as soon as you become aware of your needs. However, no retroactive accommodations will be provided in this class.

Student responsibilities

Students are expected to take an active part in classroom activities, discussions, and group work. **Please ask questions during class!!!** Students are responsible for knowing the due dates of homework and exams. Students should arrange to attend office hours or set up a meeting with the instructor if assistance is needed on homework.

In the event a student disrupts class in a way that compromises the safety and ability of other students to learn, the instructor will ask the student to leave.

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).

Furthermore, the Faculty Senate has unanimously passed this Resolution:
"Resolved: That the Faculty of the Iowa State University Senate stand united for the ideals of diversity and inclusion at our university. We welcome all students to learn to the best of their abilities on our campus in an environment free from racism, sexism, bigotry, harassment, and oppression. We uphold these ideals ourselves, and strongly encourage our colleagues across the university both to uphold these ideals, and to teach them when appropriate to our students as a way to move human society forward."

Textbooks:

Most of our readings in class will be from the primary literature (research articles and book chapters) and are posted to Canvas as pdf. Some chapters from textbooks posted as pdf will also be assigned as suggested reading.

Relevant chapters posted to Canvas:

Aquatic Geomicrobiology. Don E. Canfield and B. Thamdrup. Elsevier Academic Press: 2005; Vol. 48, p 640.

Introduction to Geomicrobiology. Konhauser, Kurt O. Blackwell Publishing: 2007; p. 425.

Optional supplemental textbook for purchase at bookstore and on library course reserve:

Microbial Ecology. Larry L. Barton and Diana E. Northrup. 2011. ISBN 978-0-470-04817-7

Supplementary or assigned readings: PDFs posted to Canvas.

Course Summary:

Date	Details	
Mon Aug 20, 2018	Syllabus; Fundamentals & Origins of Microbial Ecology (https://canvas.iastate.edu/calendar?event_id=142332&include_contexts=course_51690)	9am to 10am
Wed Aug 22, 2018	Origins & Characteristics of Microbial Life (https://canvas.iastate.edu/calendar?event_id=142333&include_contexts=course_51690)	9am to 10am
Fri Aug 24, 2018	The tree of life and microbial diversity (https://canvas.iastate.edu/calendar?event_id=142334&include_contexts=course_51690)	9am to 10am
	The Tree of Life and Microbial Diversity (https://canvas.iastate.edu/courses/51690/assignments/615133)	due by 9am
Mon Aug 27, 2018	Microbial Redox Reactions and Energy Generation (https://canvas.iastate.edu/calendar?event_id=142335&include_contexts=course_51690)	9am to 10am
	Metabolism Classification (https://canvas.iastate.edu/courses/51690/assignments/615157)	due by 9am
Wed Aug 29, 2018	Energetics of microbial life (https://canvas.iastate.edu/calendar?event_id=142329&include_contexts=course_51690)	9am to 10am
Fri Aug 31, 2018	Microbial Energy Generation (https://canvas.iastate.edu/calendar?event_id=142330&include_contexts=course_51690)	9am to 10am
	Microbial Energy Generation (https://canvas.iastate.edu/courses/51690/assignments/615134)	due by 9am
Mon Sep 3, 2018	No class (https://canvas.iastate.edu/calendar?event_id=142358&include_contexts=course_51690)	9am to 9:50am
Wed Sep 5, 2018	Microbial Habitats (https://canvas.iastate.edu/calendar?event_id=142328&include_contexts=course_51690)	12am

Date	Details	
	Microbial Redox Reactions & Thermodynamics (https://canvas.iastate.edu/courses/51690/assignments/615161)	due by 9am
Fri Sep 7, 2018	Extreme Environments (https://canvas.iastate.edu/calendar?event_id=142360&include_contexts=course_51690)	12am
	Extreme Environments (https://canvas.iastate.edu/courses/51690/assignments/615135)	due by 9am
	Final literature review paper topic due (https://canvas.iastate.edu/courses/51690/assignments/615155)	due by 9am
Mon Sep 10, 2018	Guest lecture by Nick Lambrecht on Microbial Redox Stratification in lakes (https://canvas.iastate.edu/calendar?event_id=142327&include_contexts=course_51690)	9am to 10am
	Winogradsky Column (https://canvas.iastate.edu/courses/51690/assignments/615163)	due by 9am
Wed Sep 12, 2018	Group work with Nick Lambrecht: sequencing data from stratified lakes (https://canvas.iastate.edu/calendar?event_id=142640&include_contexts=course_51690)	12am
Fri Sep 14, 2018	Group work with Nick Lambrecht: sequencing data from stratified lakes (https://canvas.iastate.edu/calendar?event_id=142642&include_contexts=course_51690)	9am to 10am
Mon Sep 17, 2018	Presentations on Functional Groups of stratified lakes (https://canvas.iastate.edu/calendar?event_id=142641&include_contexts=course_51690)	9am to 10am
	Presentation on Functional Groups from Stratified Lakes (https://canvas.iastate.edu/courses/51690/assignments/618561)	due by 9am
Wed Sep 19, 2018	Microbial Communities and Biofilms (https://canvas.iastate.edu/calendar?event_id=142349&include_contexts=course_51690)	9am to 10am
Fri Sep 21, 2018	Complex Microbial Communities (https://canvas.iastate.edu/calendar?event_id=142336&include_contexts=course_51690)	9am to 10am
	Complex Microbial Communities (https://canvas.iastate.edu/courses/51690/assignments/615129)	due by 9am
Mon Sep 24, 2018	Techniques in Microbial Ecology, part I (https://canvas.iastate.edu/calendar?event_id=142350&include_contexts=course_51690)	9am to 10am
	Microbes by Ecological Niche (https://canvas.iastate.edu/courses/51690/assignments/615158)	due by 9am

Date	Details	
Wed Sep 26, 2018	Techniques in Microbial Ecology, part 2 (https://canvas.iastate.edu/calendar?event_id=142367&include_contexts=course_51690)	9am to 10am
Fri Sep 28, 2018	Techniques in Microbial Ecology (https://canvas.iastate.edu/calendar?event_id=142331&include_contexts=course_51690)	9am to 10am
	Techniques in Microbial Ecology (https://canvas.iastate.edu/courses/51690/assignments/615130)	due by 9am
Mon Oct 1, 2018	Photosynthesis (https://canvas.iastate.edu/calendar?event_id=142351&include_contexts=course_51690)	9am to 10am
	Cell Count Protocol (https://canvas.iastate.edu/courses/51690/assignments/615145)	due by 11:59pm
Wed Oct 3, 2018	Oxygen & Carbon Cycling (https://canvas.iastate.edu/calendar?event_id=142352&include_contexts=course_51690)	9am to 10am
Fri Oct 5, 2018	Midterm (https://canvas.iastate.edu/calendar?event_id=142356&include_contexts=course_51690)	9am to 9:50am
Mon Oct 8, 2018	Fermentation & Methanogenesis/Methanotrophy (https://canvas.iastate.edu/calendar?event_id=142341&include_contexts=course_51690)	9am to 10am
Wed Oct 10, 2018	Nitrogen Cycling (https://canvas.iastate.edu/calendar?event_id=142353&include_contexts=course_51690)	9am to 10am
Fri Oct 12, 2018	New(ish) Metabolisms: Anaerobic Oxidation of Methane and Anammox (https://canvas.iastate.edu/calendar?event_id=142362&include_contexts=course_51690)	9am to 10am
	Final Literature Review Paper Outline (https://canvas.iastate.edu/courses/51690/assignments/615154)	due by 9am
	New(ish) Metabolisms: Anaerobic Oxidation of Methane and Anammox (https://canvas.iastate.edu/courses/51690/assignments/615131)	due by 9am
Mon Oct 15, 2018	Sulfur Cycling (https://canvas.iastate.edu/calendar?event_id=142342&include_contexts=course_51690)	9am to 10am
	Carbon Cycling (https://canvas.iastate.edu/courses/51690/assignments/615144)	due by 9am
Wed Oct 17, 2018	Microbiome guest lecture by Joel Maki (https://canvas.iastate.edu/calendar?event_id=146630&include_contexts=course_51690)	9am to 10am

Date	Details	
Fri Oct 19, 2018	Gut microbiome (https://canvas.iastate.edu/calendar?event_id=142361&include_contexts=course_51690)	9am to 10am
	Gut Microbiome (https://canvas.iastate.edu/courses/51690/assignments/615132)	due by 9am
Mon Oct 22, 2018	Iron & Manganese cycling (https://canvas.iastate.edu/calendar?event_id=142343&include_contexts=course_51690)	9am to 10am
	Elemental Cycles (https://canvas.iastate.edu/courses/51690/assignments/615146)	due by 9am
Wed Oct 24, 2018	Other metals, Phosphorus, & Hydrogen Cycling (https://canvas.iastate.edu/calendar?event_id=142344&include_contexts=course_51690)	9am to 10am
Fri Oct 26, 2018	Stable Isotopes in Microbial Ecology (https://canvas.iastate.edu/courses/51690/assignments/615137)	due by 9am
Mon Oct 29, 2018	Biomineralization (https://canvas.iastate.edu/calendar?event_id=142345&include_contexts=course_51690)	9am to 10am
	Microbial Pathways for Metals, Sulfur, & Other Elements (https://canvas.iastate.edu/courses/51690/assignments/615160)	due by 9am
Wed Oct 31, 2018	Microbial Weathering (https://canvas.iastate.edu/calendar?event_id=142346&include_contexts=course_51690)	9am to 10am
Fri Nov 2, 2018	Biomineralization & Lithification (https://canvas.iastate.edu/calendar?event_id=142338&include_contexts=course_51690)	9am to 10am
	Biomineralization & Lithification (https://canvas.iastate.edu/courses/51690/assignments/615139)	due by 9am
Mon Nov 5, 2018	Microbial Decomposition (https://canvas.iastate.edu/calendar?event_id=142363&include_contexts=course_51690)	9am to 10am
	Biomineralization & Microbial Weathering (https://canvas.iastate.edu/courses/51690/assignments/615143)	due by 9am
Wed Nov 7, 2018	Bioremediation: Guest Lecture by Dr. Jaejin Lee (https://canvas.iastate.edu/calendar?event_id=142364&include_contexts=course_51690)	9am to 10am
Fri Nov 9, 2018	Oil-degrading Bacteria in the Deepwater Horizon oil spill plume (https://canvas.iastate.edu/calendar?event_id=142337&include_contexts=course_51690)	9am to 10am

Date	Details	
	Oil-degrading Bacteria in the Deepwater Horizon oil spill plume (https://canvas.iastate.edu/courses/51690/assignments/615140)	due by 9am
Mon Nov 12, 2018	Microbial Origins & Evolution: Geological Perspectives (https://canvas.iastate.edu/calendar?event_id=142368&include_contexts=course_51690)	9am to 10am
	Microbial Degradation & Bioremediation (https://canvas.iastate.edu/courses/51690/assignments/615159)	due by 9am
Wed Nov 14, 2018	Microbial Drivers of Change in Earth's Surface Environment (https://canvas.iastate.edu/calendar?event_id=142347&include_contexts=course_51690)	9am to 10am
Fri Nov 16, 2018	Biomarkers in the Rock Record (https://canvas.iastate.edu/calendar?event_id=146208&include_contexts=course_51690)	9am to 10am
	Biomarkers in the rock record (https://canvas.iastate.edu/courses/51690/assignments/615138)	due by 9am
Mon Nov 26, 2018	Life in the Universe (https://canvas.iastate.edu/calendar?event_id=142348&include_contexts=course_51690)	9am to 10am
Wed Nov 28, 2018	Microbial Census (https://canvas.iastate.edu/calendar?event_id=142365&include_contexts=course_51690)	9am to 10am
	Course Evaluations (https://canvas.iastate.edu/calendar?event_id=142359&include_contexts=course_51690)	4pm to 4:30pm
Fri Nov 30, 2018	Winogradsky Column Dissection (https://canvas.iastate.edu/calendar?event_id=142366&include_contexts=course_51690)	9am to 10am
Mon Dec 3, 2018	Grad Student presentations (https://canvas.iastate.edu/calendar?event_id=142369&include_contexts=course_51690)	9am to 10am
Wed Dec 5, 2018	Grad Student presentations (https://canvas.iastate.edu/calendar?event_id=142370&include_contexts=course_51690)	9am to 10am
Fri Dec 7, 2018	Final Exam Review (https://canvas.iastate.edu/calendar?event_id=142355&include_contexts=course_51690)	9am to 10am
	Extra Credit - Microbial Census (https://canvas.iastate.edu/courses/51690/assignments/615147)	due by 11:59pm
Fri Dec 14, 2018	Final Exam (https://canvas.iastate.edu/calendar?event_id=142354&include_contexts=course_51690)	7:30am to 9:30am

Date	Details	
	Final Exam (https://canvas.iastate.edu/courses/51690/assignments/615152)	due by 9am
	Final Literature Review Paper (https://canvas.iastate.edu/courses/51690/assignments/615153)	due by 11:59pm
	587 Presentations (https://canvas.iastate.edu/courses/51690/assignments/615142)	
	Feedback on Grad Student Presentation (https://canvas.iastate.edu/courses/51690/assignments/615151)	
	Midterm (https://canvas.iastate.edu/courses/51690/assignments/615162)	