Syllabus

ESM219: Microbial Processes in the Environment

Codes: 62398 (lecture), 62406 (lab)

Fall, 2021
Lecture: Bren Hall 1424: T/R, 12:30 – 1:45
Lab: Bren Hall 2015: R, 2 – 4:50

Instructors:
Patricia (Trish) Holden (Professor) / Natalie Dornan (TA)
Contact Info: holden@bren.ucsb.edu/nataliedornan@ucsb.edu

Office Hours:
Holden, Bren Hall 3508: Tuesdays 3 – 5, or Zoom https://ucsb.zoom.us/j/3067575343
Dornan, Marine Biotechnology Building 555: Wednesdays 10-12, or by appointment (in person or Zoom)

Course Description

Microbes are the most abundant organisms on Earth and control most biogeochemistry. Some are disease-causing. Who, and where, are they? What do they do, and how? This course provides a foundation applicable to environmental and natural resource management. The learning is experiential, through integrated lecture (twice weekly) and lab (once per week) meetings.

Deliverables include lab reports with related exercises, a short paper, and an oral presentation of the paper.
There is no required textbook, but “Brock Biology of Microorganisms” is an excellent resource. Other papers and materials uploaded to Gaucho Space are for additional advanced reading / discussion.

About Your Instructors

Trish is an engineer and environmental microbiologist who researches origins and fates of pollutants in soil, water and sediments to inform management including pollution prevention and remediation. My teaching style is organized, attentive to individuals, focusing on principles, and reinforces with quantitative content. I encourage classroom questions and discussion. I use writing and presentation assignments so that students employ the subject matter while pursuing topics of interest and building professional communication skills. As for “me”: I love students, and simple pleasures: good friends, cooking, exercising, writing, working, collaborating, nature, art, music, films, and my dog.

Natalie is a second year PhD student in the Interdepartmental Graduate Program in Marine Science here at UCSB. Currently, I investigate the biogeochemistry of kelp forests here along the Santa Barbara Channel, particularly relating to the cycling of elemental nitrogen. As a Bren MESM alumni (woop woop!) I am not only interested in novel scientific research, but how my work can help to Inform management goals and objectives. My personal teaching style is friendly, informative, and inclusive. I truly believe in the "learn by doing" philosophy, and absolutely love teaching laboratory classes and getting to know my students. Outside of work, I enjoy hanging out with my pets (Junior - horse and Otto - puppy), camping/backpacking/trail running, fishing,
and pressing algae. During COVID, I also started becoming an amateur cheese aficionado, Criminal Minds fan, and proud owner of a budding native plant garden.

**Student Learning Outcomes and Assessments**

1. Explain concepts in environmental microbiology and microbial ecology, with application to natural resource and pollution management
   a. *In class discussion, final presentation and paper*
2. Use in relationship to environmental problems including climate change, energy, pollution, and public health
   a. *Invocation of core concepts into laboratory exercises, final paper, and presentation*
3. Discover how to find information and resources, for this course and the future.
   a. *Selection of topic for paper and presentation*
   b. *Sourcing for lab reports*
4. Communicate the material; write, and present, using your knowledge gained in this course
   a. *Quality of written and oral assignment, based on rubric*

**Recommended materials**


- **Other reading:** Consult Gauchospace

- **Other references:**
  - General Microbiology by Hans Schlegel
  - Microbial Ecology by Atlas & Bartha
  - Soil Microbiology and Biochemistry by Paul & Clark
  - Manual of Environmental Microbiology by ASM Press

- **Some websites:**
  - Ribosomal Database Project II (RDP, at the Center for Microbial Ecology) [http://rdp.cme.msu.edu/](http://rdp.cme.msu.edu/)
  - Center for Microbial Ecology (CME) at Michigan State: [http://www.cme.msu.edu/](http://www.cme.msu.edu/)
**How to succeed in this course**

Attend lectures and labs, read, write down your questions, bring them to class and learn as much as you can. Participate in discussions and ask for help with concepts from Instructors. Make use of office hours or email when you need other options. Keep up with your lab reports. Start early in the course with picking your special topic, and work with the professor in making your choice.

**Grading Criteria**

Lab reports / exercises: 60%; Written paper & presentation: 30%; Class participation: 10%

**Course assignments**

Deliverables include lab reports with related exercises, a short paper, and an oral presentation of the paper. Guidance on the paper and presentation are posted to GS. Some paper topic suggestions will be posted on GS. Consult instructor in selecting your topic. Submit outline with title at the Due Date. We assess based on completeness and quality, plus relevance to the course material.

**University and Course Policies**

1. Compliance with the UC COVID-19 Vaccination Policy, including completing the daily symptom survey and weekly testing for non-vaccinated students;
2. Classroom masking: required
3. Classroom eating/drinking—not allowed owing to COVID-19 masking requirement
4. Ill students must not to attend class (lecture or lab). Consult with the TA or professor on how to keep up and/or catch up.
5. Course materials, including recordings, may not be distributed, or sold
6. Notify instructor if you do not want to be included in classroom recordings

- The schedule is subject to change depending on the progress of the course.
- Lab assignments turned in late will be penalized 10% per 24 hours after the deadline. If extenuating circumstances arise, coordinate with the teaching assistant before the assignment deadline to agree on alternative arrangements.
- In this course we’ll work and learn *together*. That means that you need to be here, in class (lecture or lab), for the learning to happen. We understand that you may encounter situations where you can’t attend; for this reason, you may miss two meetings without penalty. For each class you miss thereafter, your participation grade will decline by 5%. If you miss more than five classes, you will have missed most of the learning experiences in the course and will be unable to pass.

**Plagiarism and Academic Integrity**

Universities are places dedicated to the production of knowledge by people. This happens when people (like you!) bring your ideas together with others. It’s important, though, to observe the conventions (formal and informal rules) associated with knowledge production in this process. This is especially true when it comes to creating the kind of written work we’ll produce in this class. It’s critical to use sources honestly, to indicate when
you are drawing on materials from others. There are two concepts important to understand in conjunction with this idea.

First is plagiarism, which is a violation of academic integrity and UCSB policies. Plagiarism occurs when a writer deliberately passes off another's words or ideas without acknowledging their source. For example, turning another's work as your own is plagiarism. Plagiarized assignments (including copying of a friend's homework) will receive a grade of 0 and may result in additional disciplinary action. You can view the university’s policy on student conduct at http://www.sa.ucsb.edu/Regulations/student_conduct.aspx.

Second is misuse of sources, occasions when a writer does not properly cite a source, misuses quotations, includes too much of an original source in a paraphrase or summary, or commits similar unintentional violations of academic protocol. If you misuse sources, we will work together on appropriately incorporating and/or citing the sources. Note that some audiences/instructors will consider misuse of sources to be plagiarism; for this reason, it is extremely important for you to identify the conventions associated with source use and citations in any class.

Student Resources

- Information and links for applicable student resources
- Links to wellbeing and mental health resources
- Library resources: UCSB Library

Calendar  Course Outline (approximate): See GauchoSpace (GS) for updates

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<tr>
<th>Wk</th>
<th>Lecture Topic</th>
<th>Lab Exercise</th>
<th>Due</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>E0: Introduction to the Lab (safety, and review of experiments)</td>
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<td>2</td>
<td>Environmental compartments, habitats, function</td>
<td>E1: Culture microbes (part a)</td>
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<td>3</td>
<td>Diversity: discovery, quantification</td>
<td>E1: Describe, count, subculture (part b);</td>
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<td>4</td>
<td>Energetics, growth, metabolism</td>
<td>E1: Characterize cultures (part c);</td>
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<td>5</td>
<td>Carbon cycle: greenhouse gas production and consumption; climate feedbacks</td>
<td>E2: DNA-based diversity (demo); E3: C mineralization setup</td>
<td>E1</td>
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<td>6</td>
<td>Biotransformation of inorganic and organic pollutants</td>
<td>E3: Final measurements (TA) E4: Toluene biodegradation, biostimulation, and bioaugmentation</td>
<td>E2</td>
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<td>Week</td>
<td>Date</td>
<td>Topic</td>
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<td>7</td>
<td>11/2</td>
<td>Nitrogen cycle: N\textsubscript{2} fixation, ammonification, nitrification, denitrification</td>
<td>E5: N\textsubscript{2} fixation study</td>
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<td>8</td>
<td>11/9</td>
<td>Microbiological water quality Waste Treatment</td>
<td>E6: Culture-based &amp; molecular analysis of water quality (IDEXX / qPCR)</td>
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<td>9</td>
<td>11/16</td>
<td>Environmental pathogens; Antibiotic resistance</td>
<td>E6: Analysis of IDEXX data / DNA results overview</td>
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<td>10</td>
<td>11/23</td>
<td>Energy</td>
<td><em>No class on Thanksgiving Holiday</em></td>
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<td>11</td>
<td>11/30</td>
<td>Biotechnology / bioproducts Review</td>
<td>TA choice</td>
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<td><strong>Final Paper Presentations:</strong> Monday Dec. 6\textsuperscript{th}, (12 – 3 pm; Bren Hall 1424)</td>
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