

## Syllabus for Environmental Microbiology CE 5552

**Lab Meeting Times and Locations:** room 677, CE Building, Thursday (starting 9/14): 2:30-4:30 p.m.

**Instructor:** Dr. Paige Novak; Office: room 148; Phone: 626-9846; email: novak010@tc.umn.edu

**Instructor's Office Hours:** By appointment (email me)

**Laboratory T.A.:** TBA

**Required Text:** Brock's Biology of Microorganisms, 11<sup>th</sup> Edition (10<sup>th</sup> is fine but pages for reading will change), by Madigan, Martinko, and Parker; Prentice Hall, 2006.

This course will provide instruction in basic laboratory techniques for the culture, isolation, and identification of microbes (culture-based) and also some instruction on non-culture based techniques for microbial identification.

**In this course, CE 5551, you will meet the following ABET Criterion 3 Program Outcomes:**

- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
  - (g) an ability to communicate effectively
  - (j) a knowledge of contemporary issues
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**Grading will be based on the following scale:** 100-93 is an A; 92-90 is an A-; 89-87 is a B+; 86-83 is a B; 82-80 is a B-; 79-77 is a C+; 76-73 is a C; 72-70 is a C-; 69-67 is a D+; 66-60 is a D; scores less than a 60 will result in a grade of F. There will not be a curve.

**Course grades will be based on the following:**

Laboratory grades:	50%
<u>Lab project/paper:</u>	<u>50%</u>
Total	100%

Lab project: see description on the following pages.

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Cheating is not allowed in the course and will not be tolerated. Anyone found cheating will receive a grade of zero on that assignment. If such behavior occurs more than once, the student will receive an F in the class.

**Plagiarism is cheating.** Harassment and disruptive and disturbing behavior will not be tolerated; students will be asked to leave immediately if such behavior occurs. Such behavior is defined in the Student Conduct Code. All acts of academic dishonesty will be reported to the Office for Student Conduct and Academic Integrity.

Persons with disabilities that require reasonable accommodations will be assisted on an individual basis. Please contact the instructor at the beginning of class to arrange for such accommodations.

**CE 5552**  
**Environmental Microbiology**  
**Lab Schedule**

- Lab # 1 (9/14): **NOTE: MEET IN THE “L” (ROOM 654) THIS DAY**—Introduction; cultivation vs. cultivation-independent techniques; discussion of the lab projects (including my project—we’ll all do this one).
- Lab # 2 (9/21): Media preparation
- Lab # 3 (9/28): Introduction to the microscope and staining
- Lab # 4 (10/5): Plating, transferring, and isolating organisms
- Lab # 5 (10/12): Enumeration of organisms
- Lab # 6 (10/19): Use of polymerase chain reaction to detect target “non-culturables” (*as part of Paige’s project*)
- Lab # 7 (10/26): Make and run gel for PCR results; fix sample for use in lab #8 (*as part of Paige’s project*)
- Lab # 8 (11/2): Perform fluorescent *in situ* hybridization of samples; look at them under the microscope (**NOTE: this lab will take longer than 2 hours**) (*as part of Paige’s project*)
- Lab # 9 (11/9): Presentation of your lab project to the class (**IN THE “L”**)
- Lab # 10 (11/16): Your lab project
- Lab # 11 (11/23): **NO LAB (THANKSGIVING)** (you can still work earlier this week if you need to)
- Lab # 13 (11/30): Your lab project
- Lab # 14 (12/7): Presentation and discussion of your results (continued from class period) and wrap-up of the course (**IN THE “L”**)

Notes: The TA and I will be available as resources throughout the lab. We do, however, expect you to perform the research on your organism on your own.

*Attendance is required.*

## Environmental Microbiology Laboratory

**Purpose:** to familiarize you with basic microbiology techniques, including cultivation-based and cultivation-independent techniques

### Why?

These different techniques are used to answer various questions about why things work the way they do, why problems are being observed in a particular process, which bacteria are present and at what quantity, etc.

### Why cultivation-based AND cultivation-independent?

Some problems are better solved by using cultivation, three examples are:

- You can learn more about a particular organism's abilities when you have it in culture (example from Paige's research on polychlorinated biphenyl (PCB) degradation)
- Some traits that you are interested in studying are easiest to determine through cultivation (example from Tim's research on antibiotic resistance)
- Sometimes the organisms that you are interested in are easy to grow, such as *E. coli* (a surrogate for public health issues)

Many organisms (99%+) cannot be cultivated, therefore you must use cultivation-independent techniques, two examples are:

- You want to know something about a natural community (different populations present, numbers of those different populations) and if you try to culture organisms in this community, you change the community and get only a small fraction (and often irrelevant portion) of the community!
- *Dehalococcoides*-like organisms are very difficult to culture, yet they are a very important group of organisms that appear to degrade a huge variety of chlorinated compounds. What is their natural diversity, population size, and niche?

Cultivation-based techniques include growing and isolating organisms on various media and identifying them based on morphology, metabolism, and other traits that can be observed through growth-based tests (motility, etc.). The biochemistry and genetics of isolated organisms can also be studied.

Cultivation-independent techniques include amplification of particular genes, separation and/or sequencing of these genes, visualization after hybridization with fluorescent probes, etc. **(READ pgs 600-611 in Brock for a nice overview)**

Visualization using microscopes is used in combination with cultivation and cultivation-independent techniques

## LAB PROJECT/PAPER

The lab project/paper is meant to be independent and creative (and fun!!!). It should take at least 40 hours of time in and out of class. You are to pick a particular microbial phenomenon or topic; it may be related, but not identical to your graduate thesis topic. You will develop a laboratory project related to the topic that can be completed in 3 weeks of lab time (see the next page for some ideas/examples). The basic idea should be developed **by 11<sup>th</sup> of October**. You will need to make an appointment to talk to me about your project idea **before the 18<sup>th</sup> of October**. After discussing it with me it will be either refined/alterd, or you will begin to write a lab protocol for your project. **I will need a supply list by October 25<sup>th</sup> to ensure that all supplies are available for your project (earlier is better)**. You will present your plan to the class in a brief (10 minute) presentation (powerpoint) on **11/1**. Upon completion of the project you will need to turn in a paper/lab write-up **by December 11<sup>th</sup> at 5 pm**. The paper/write-up must be typed, 1½-spaced, and must include a 5-6 page introduction of the microbial phenomenon/problem of interest, the lab protocol (similar in style to the protocols that I give you in class), a description of the results of your project (including graphs, photos, etc. as appropriate), conclusions, and recommendations. The introduction portion must contain references to at least 5 journal articles (i.e., not web sites). A final powerpoint presentation on your project (10-15 min.) is required at the end of class to enhance your communication skills.

NOTE: I reserve the right to reject your project ideas if too many people are working on them, if they are dangerous, etc.

### Important dates:

- 10/11: Have idea for project
- 10/18: By this date you must have talked with me about your project idea, receiving feedback
- 10/25: Supply list due
- 11/1: Presentation to the class during the lab period on your proposed project (7 min powerpoint)
- 12/11: Paper/write-up due by 5 pm
- 12/6-12/11: Presentations to the class during the class period and the lab period (12 min + 3 min for questions) on your project