

COURSE OVERVIEW AND LEARNING OBJECTIVES

Overview:

This course provides a basic foundation in laboratory skills that are used in diverse areas of microbiology including basic research, food production, and microbial quality control.

Learning objectives:

- **Be able to work safely in the lab.**
 - *Always read the lab exercise before coming to lab.*
 - *Follow protocols accurately.*
 - *Arrive early (at least 5 minutes before start) to put away your stuff, and put on your lab coat.*
 - *Know safe lab techniques and consistently practice them.*
- **Know how to make media and solutions.**
 - *Given a recipe or final concentrations, be able to make solutions.*
 - *Be able to use micropipettes and scales to accurately measure.*
 - *Understand the differences between different types of media used.*
- **Be able to exercise sterile technique.**
 - *Understand how the autoclave works.*
 - *Be able to keep solutions sterile, and start cultures that are not contaminated.*
- **Culture and enumerate microbes on solid and liquid media.**
 - *Be able to inoculate liquid and solid cultures.*
 - *Be able to streak for single colonies starting from liquid or solid cultures.*
 - *Be able to perform serial dilutions and plating.*
 - *Be able to determine the optical density of a liquid culture.*
 - *Be able to isolate a pure culture from a mixture of microbes.*
- **Be able to work safely with pathogens (risk group 2 organisms).**
 - *Know and consistently practice biosafety techniques (exercise 1).*
- **Be able to examine microbes using the microscope.**
 - *Be able to focus on a sample, using different microscope objectives.*
 - *Know when to use bright field or phase contrast microscopy.*
 - *Be able to accurately perform and interpret Gram stain results.*
 - *Be able to measure microbes using a stage and ocular micrometer.*
- **Be able to analyze microbial characteristics.**
 - *Calculate growth rate. Determine 16S rRNA gene sequence and compare to databases.*
 - *Select and interpret microbiology biochemical tests.*
- **Keep an accurate, complete, and up-to-date Lab Notebook.**
 - *Keep a written and current record of all procedures and results.*
 - *Perform data analysis, such as graphs, tables as appropriate.*

- *Write logical and well-founded conclusions and discussions.*
- **Design experiments.**
 - *Be able to state a question and hypothesis.*
 - *Design experiments to test the hypothesis.*
- **Work cooperatively with others..**
 - *Work with your partner to decide how to share the work.*
 - *Be respectful of your partners.*
- **Communicate science.**
 - *Prepare meaningful graphs and tables that present your results.*
 - *Prepare written lab reports that are clear, complete, with use of college level grammar.*
 - *Prepare clear presentations.*
- **Develop a working familiarity with the scientific literature.**
 - *Be able to search for keywords, title words, and authors on PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>), and download scientific papers.*
 - *Be able to read scientific papers and gather key information for discussions*

TEXT FOR THIS CLASS

There is no text for this class, instead we have written lab exercises with background information and specific protocols. These are on the CANVAS website in the Lab Exercises module. You need to print each and bring to class or have them available to you on a device during class. Note, these also describe the assignments for each class.

WHAT YOU NEED FOR THE LAB--bring each day

- A three ring binder with dividers for your lab notebook
- Binder paper (three hole punched), can be lined or graph-style.
- Printed or electronic copies of lab exercises
- Pencil or pen
- Any additional assigned handouts/reading material
- Long pants and close toed shoes

COURSE WORK AND GRADING

Work Expectation:

Students should expect to spend 15 hours a week on this course. Each week there will be three 3-hour lab sections. Additional time will be spent preparing for the labs and writing up the lab assignments . The specific assignments are in the List of Exercises document.

Each week students will have PreLabs and/or Lab WriteUps or Homework Assignments to turn in. In addition to these, there is one written Research Report, two Quizzes and a Midterm, 2 Paper Discussions, five Lab Skill Checks (these take place of the Lab Practical Exam) and one Final Presentation.

Grading is based on the following breakdown:

Grading Breakdown (#)	Possible Points	Weight
Prelabs (10)	20	7 %
Homework (3)	40	13 %
Lab Reports (4)	50	17 %
Assessments (3)	60	20 %
Paper Discussion Questions (2)	20	7 %
Lab Skill Checks (4)	40	13 %
Final Presentation	60	20 %
Attendance, Lab Skills, Lab Conduct	10	3 %
Total Possible Points	300	100 %

Grade Scale:

97-100	A+	76-79	C+
93-96	A	73-75	C
90-92	A-	70-72	C-
86-89	B+	67-69	D+
83-85	B	60-66	D
80-82	B-	0-59	F

Detailed Information about each component of the class

1. PRE-LABS

Before every lab class, you need to prepare a prelab before you can start. The prelab consists of the first part of each exercise being done that day, to become the first part of your Lab Notebook. The prelabs will be checked at the beginning of each lab class; to earn full points, the prelabs must be complete and done before class starts.

Prelabs will have:

- **Title** write the title of the exercise at the top.
- **Purpose** in your own words, state the goal for doing this experiment.
- **Flowchart of Method** make a simplified flowchart of the procedure
- **Date** on each page.
- **Page number** as in 1-1, 1-2 (for exercise 1 page 1 etc)

2. LAB NOTEBOOK

Your Lab Notebook will consist of the three ring binder and dividers that separate each lab exercise. Place a print-out of the exercise instructions at the beginning of each section in your binder. Then, follow that with your written description of what you did, using regular binder paper. *These sections are typically handwritten. Note that if your handwriting is illegible, points may be taken off.*

You will use your lab notebook to write the lab reports, do the homeworks, and prepare your oral presentation.

A list of Exercises, Prelabs and Assignments are available on the course website. Assignments/Lab Reports are generally due in one week following the end of that particular exercise at the start of the lab class. **Note that there are some exceptions. Exact due dates are listed in the "Course Schedule".**

3. LABORATORY REPORTS

Lab reports will follow the format of a typical scientific research article and will contain the following:

- **Introduction**
- **Materials and Methods:** For this section, you can simply say "Experiments were performed as described in the METX119L Lab Exercise instructions with the following changes" and then describe any changes you made
- **Results:** Present your results here, in the form of tables, figures and/or graphs with a paragraph or two to describe the data.
- **Conclusion:** Provide a discussion for your results. What can you conclude from your results?
- **Supporting Materials:** Graphs, tables, photos, and sketches can be included by taping them to a page. **All figures should be dated and labeled clearly.**

Lab reports **must be typed** and double-spaced. You should use 1 inch margins and Times New Roman 12 point font. Tables, figures and graphs must be computer generated and labeled completely. In other words, there should not be any hand-written sections/parts in the lab reports.

Specific guidelines will be provided in advance of the reports. Effective scientific writing is one of the most important skills that you can develop.

4. ASSIGNMENTS--HOMEWORK

The other type of post-lab assignments are homeworks. These consist of answers to the assigned questions at the end of the exercise, but do not require you to include all the other lab notebook sections.

5. QUIZZES

There will be three 20 point assessments. Questions will be based on the discussions in class, testing concepts behind the lab procedures and ability to perform calculations such as those done in the lab.

6. IN-LAB ASSESSMENTS

There will be four in-lab practical assessments. The weeks for these are indicated on the schedule. In these assessments, you will be asked to demonstrate your ability to do the following

- Inoculate a liquid culture
- Streak for single colonies
- Given a culture with a known amount of bacteria, perform a serial dilution and plate an amount that will give you countable single colonies.
- Focus the microscope on a phase contrast sample and Gram stain an unknown sample and identify

7. PAPER DISCUSSIONS

In this class, we will read two primary papers and discuss them. You may also be prompted to write about them. This exercise is designed to teach students how to read primary papers and to gain practice doing this. A specific paper will be assigned, along with questions to answer. During the lecture class, the instructor will lead the paper discussion.

8. FINAL PRESENTATIONS

In the last week of the course, student groups will give oral slide-based presentation on the microbes isolated from environmental samples. The date is indicated in the "Course Schedule". You will be graded on the quality of the slides, your oral presentation skills, and ability to answer questions. Details will be discussed during class, closer to the time of the presentation.

9. ATTENDANCE, LAB SKILLS AND LAB SAFETY

• WEEKLY DISCUSSIONS/LECTURE (attendance is mandatory)

The Labs will start with a discussion/lecture where we will go over theory and plan out the lab time. To prepare, you must read and understand the reading materials and lab exercises assigned for each exercise for that week.

For some discussion sessions, you may be asked to prepare assignments or information. These are indicated in the Lab Exercises and Course Schedule document. Additionally, students will be expected to participate in the discussion. You may be called on at random to answer questions about the weekly exercises.

• ATTENDANCE, LAB SKILLS, LAB SAFETY

You will receive points based on your performance in the lab class that will take into account the following:

- whether you come well prepared for the lab;
- whether you arrive on time;
- whether your behavior and questions demonstrate that you have a strong understanding of the lab exercises;
- whether you communicate well with your partners and clearly do a fair share of the work;
- whether you operate safely in the lab;
- whether you clean your area and properly dispose of materials.

Note on Lab Safety: *Proper use and disposal of hazardous reagents, live organisms, and equipment is mandatory. Instructions on how to safely handle materials used in this class will be provided daily. You are expected to follow all directions as indicated in the lab exercises and discussed in class. Students who repeatedly do not follow directions will be dropped from the course and reported to their college provost according to the Academic Misconduct Policy:*
https://www.ue.ucsc.edu/academic_misconduct

REFERENCES

Texts You should utilize your microbiology textbook from METX119 or METX100 as a reference, or if you don't have it anymore, use one of the recent editions of the following books (*Microbe*, *Brock Biology of Microorganisms*, *Microbial Life*), or the excellent on-line free text called Todars Microbiology, at <http://www.textbookofbacteriology.net>

Scientific literature Successful lab reports will require you to investigate more deeply the subjects presented in the course. This investigating will require library research and citation of scientific research collected from journal articles. PubMed is the primary literature database used by research scientists. We will go over some examples of how to effectively conduct a PubMed search in class. Google searching can get you some useful information but this information may not be accurate and should be avoided. Websites should be referenced with caution. Exceptions can be made when referencing Kenyon Micro Wiki, CDC, FDA, NIH, or EPA websites and publications.

POLICIES

Policy on missing class.

Because this is a lab class where we are doing experiments every class meeting, it's really difficult if you miss a class. So please try not to--e.g. do not arrange travel or other things so you will miss class. If you are ill, please stay home. In that case, let the Instructor know so we can evaluate how much you will miss and make arrangements.

If on quarantine, you will not be allowed to attend the lab. Again, please let the instructor know and we'll figure out a plan. We understand this might happen and we will work with you.

Policy on attendance

Prompt attendance of both the Discussion Session and Labs are required. Unexcused absences or arriving late will affect your grade.

Policy on late assignments/lab notebooks/lab report

Items turned in late will receive an automatic 10% deduction in points per day. Anything that is turned in more than 3 days late will be evaluated on a case by case basis and may not be accepted..

ALL assignments, lab write-ups, reports, exams, and presentations must be completed and turned in to receive credit for this course. No exceptions. It is the responsibility of the student to arrange for make-ups for missed work.

Policy on plagiarism

There's a zero tolerance policy for academic misconduct. This includes but is not limited to cheating, fabrication, plagiarism, or facilitating academic dishonesty (helping a friend) or as further specified in the Student Policies and Regulations Handbook Section 102.1. Any paper, test, report, notebook, or any other document that bears your name should be written by you in your own original words; should not be copied from any other source including the lab manual; and not be previously submitted in any other course by you or anyone else. In other words, the work you turn in is your own original work and is not copied, reworded, or closely paraphrased from someone else's paper, lab manual, website, scientific paper, book, or any other source.

Written work that you generate can have ideas and information that are not your own, however, you must properly cite the source of these in the correct format. Conveying ideas and information that is not your own without proper attribution is considered plagiarism. ***Re-wording or closely paraphrasing sources even with proper citation is still considered plagiarism. To help avoid inadvertent plagiarism, first read the source, then put the source away where you can't see it, and then make some notes on the ideas you just read. From your notes, craft your original words to describe the source. Be sure to properly cite the source too.*** It is expected that you follow these guidelines. If you do not follow the rules, your work will not be accepted and you risk disciplinary actions.

Lastly, you should remember as a UCSC student, you agreed to abide by the policies of the University Rules of Conduct. It is expected that you are familiar with the code of conduct and disciplinary actions that may result of academic misconduct.

If you have any questions about what constitutes unfair collaboration or plagiarism, please contact the instructor. These policies are found in the [Academic Misconduct Policy for Undergraduates](#):

Students who violate academic integrity policy (e.g. are caught cheating or plagiarizing will be reported to their college provost. Any plagiarized material will receive a score of 0; two cases of plagiarism will result in a failing grade.

DRC Accommodations:

The Disability Resources Center reduces barriers to inclusion and full participation for students with disabilities by providing support to individually determine reasonable academic accommodations. If you have questions or concerns about exam accommodations, or any other disability-related matter, please contact the DRC office, located in Hahn 125 or at 831-459-2089 or drc@ucsc.edu. Please provide Dr. Artun your DRC accommodations as soon as possible, and allow one week for your accommodations to be set up.

Title IX:

The university cherishes the free and open exchange of ideas and enlargement of knowledge. To maintain this freedom and openness requires objectivity, mutual trust, and confidence; it requires the absence of coercion, intimidation, or exploitation. The principal responsibility for maintaining these conditions must rest upon those members of the university community who exercise most authority and leadership: faculty, managers, and supervisors.

The university has therefore instituted a number of measures designed to protect its community from sex discrimination, sexual harassment, sexual violence, and other related prohibited conduct. [Information about the Title IX Office](#), the [online reporting link](#), applicable campus [resources](#), reporting responsibilities, the [UC Policy on Sexual Violence and Sexual Harassment](#) and the UC Santa Cruz Procedures for Reporting and Responding to Reports of Sexual Violence and Sexual Harassment can be found at titleix.ucsc.edu.

The Title IX/Sexual Harassment Office is located at 105 Kerr Hall. In addition to the [online reporting option](#), you can contact the Title IX Office by calling 831-459-2462.