

GENERAL INFORMATION

The purpose of this laboratory course is to introduce you to a sampling of the morphologically and physiologically diverse members of the Prokaryotes. The emphasis is on the enrichment, purification, and identification of organisms taken from natural habitats, but we will also explore genetic phenomena using model bacteria. The Bacteria and Archaea domains are so vast and diverse that you can study only a miniscule portion of the organisms and their isolation techniques in a one-term course. We will not study, fungi, algae, protozoans, slime molds, nor a number of other microbial groups. Each deserves its own course.

Format

Microbiology (Bi330) is a required pre- or co-requisite for *Microbiology Lab*. If a student withdraws from Bi330, they must withdraw from Bi331. Students failing to do so will be dropped from Bi331 upon our request to the Registrar.

A lecture for the laboratory is scheduled for 9:00-9:50 am on Mondays. In the lecture background information and technical suggestions will be given. Though attendance won't be taken, you are expected to attend these lectures so that you will be prepared when you arrive at your lab. The goal with the Monday lectures is to maximize your time working in the lab, and so introductions and overviews won't routinely be given in the lab. If you miss the lectures you will likely be unprepared to perform that weeks exercises.

Laboratories meet twice each week for up to 2½ hours each session. Many sessions will not last the full time, though during some weeks you will have additional lab work outside of your normal section time. The laboratory will be open 8-6, Monday through Friday. You may work in the lab at any time except when there is another class in session. However, you must attend your regularly scheduled lab section.

You will need a notebook in addition to this manual for this course. The notebook can be of any type that suits you. The idea is that you will take detailed notes about your results and observations throughout the term.

We will begin most sessions with a brief introduction about the work to be done that day, and then commence with the general exercises or enrichments. We will do three types of exercises: general exercises, enrichments, and projects. General exercises will be done by all students at the same time, and are designed to introduce you to some of the commonly used techniques in the many branches of microbiology. The enrichments are for the concentration or isolation of specific groups of microorganisms from mixed populations; all students will perform these, but once begun, the enrichments won't require coordinated efforts by the entire class. The projects are larger scale experiments that will take from 1 to 4 weeks each to complete; three of these are group (2-4 students) projects that, once begun, will require group members to coordinate daily or weekly tasks.

Assignments and grading

Grades will be assigned on points earned out of a possible 380 based upon the following criteria:

5-minute quizzes (50 points [5 points each]). There will be a short quiz at the beginning of 12 of the labs in which new exercises will be performed (except for the first lab). The questions will cover the procedures and background found for those exercises in the lab manual. The purpose of these quizzes is to motivate you to read the material before arriving in lab. The low score will be dropped.

Lab exams (100 points [50 points each]). There will be 2 exams during lab lecture. These are intended to test your knowledge of the techniques we use and of the physiological, ecological, and biochemical characteristics of the organisms that we study. No makeup exams will be given unless prior arrangements are made, or a valid medical or travel excuse is provided.

Lab practical final exam (70 points). During the 10th week you will take a lab practical exam. Grading will be based upon your ability to perform some of the standard microbiological techniques, and to analyze results from isolations and tests that were previously done in the lab.

Worksheets (85 points [10 points each; one at 5 points]). Short worksheets will be required for 9 of the general exercises. Due dates will be listed in the schedule. Sloppy work will be penalized; calculations must be clear, graphs must be constructed via computer programs or done on graph paper; mistakes must be erased; and, multiple pages must be stapled.

Identification of 2 unknowns (40 points [15 points each; 10 points for key]). You will be given a mixture of 2 species from bacterial groups that we will have studied, and your task will be to purify and identify them to the species level based upon an identification key of your design. You will submit a copy of your key during week 5 when you receive your unknowns.

Summary (25 points). You will write a summary for one of two lab projects (Genetic analysis of prodigiosin biosynthesis; The nitrogen cycle in a biological filter). The text of summary must be typed and double-spaced, in 12 point font, be no more than two pages, and must include:

- A statement of the goal of the experiment in the context of relevant background information.
- The methods, **without procedural details** (such as dilutions, reagents, standards, etc.), employed to address the question.
- A summary of the results you obtained. You should include a table, relevant figure, graph, and/or statistical analysis, but provide these on one separate page.
- Analysis of the results and conclusions that you can draw from the them

Discretionary (10 points). This will be based upon participation, group cooperation, workstation cleanup, punctuality, etc.

Attendance. You are expected to attend all labs. If you are more than 10 minutes late for your lab, you will be counted as absent. Each absence will incur a penalty of 10 points. If you are absent for more than 3 sessions you will receive a failing mark for the course.

Microbiology Lab, Spring 2019

Tentative schedule

Week	Lab*	Exercise	Page [†]
1 4/1-4/4	1	GE1: Airborne microbes GE2: Simulated epidemic GE3: Streak dilution technique GE4: Intro to Microscope use	5 6-7 9-13 14-17
	2	GE4: Microscope use GE8: Serial dilution for bacterial enumeration	14-17 22-26
2 4/8-4/11	1	Enrichment for <i>Caulobacter</i> Enrichment for aerobic N ₂ -fixing bacteria GE9: Constructing a growth curve for <i>E. coli</i>	65-66 78-79; handout 27-30
	2	GE6: Staining methods (Gram) The nitrogen cycle in a biological filter	73-76 20 Belser and Mays
3 4/15-4/18	1	GE14: Ultraviolet light-induced kill rate GE12: Identification of Gram-positive cocci	55-60 41-47
	2	Enrichment for denitrifying bacteria GE6: Staining methods (endospore)	77 21
4 4/22-4/25	1	Receive unknowns Genetic analysis of prodigiosin biosynthesis	85-89 67-70 Morrison
	2	GE6: Staining methods (capsule) GE13: Testing sensitivity to antibiotics	20-21 49-54
5 4/29-5/2	1	GE11: Membrane filter method for bacterial counts	37-40
	2	GE6: Staining methods (flagella)	21
6 5/6-5/9	1	Complementation analysis of prodigiosin mutants	71-72
	2	Enrichment for Cyanobacteria Enrichment for Purple non-sulfur bacteria	81-82 83-84
7 5/13-5/16	1	GE15: Bacterial populations of the skin	61-63
	2	TBA	
8 5/20-5/23	1	GE10: MPN method for coliform counts	31-36
	2	No new projects	
9 5/27-5/30	1	Monday: Memorial day—no lab; Tuesday: no required lab	
	2	Lab clean up and <i>Microbial Jeopardy</i>	
10 6/3-6/6	1	Lab Practical—no open lab	
	2	Lab Practical—no open lab	

* Lab 1 is on Monday and Tuesday; Lab 2 is on Wednesday and Thursday

[†] Page numbers are from the lab manual; authored articles are posted on Canvas.

Exam and Assignment Due Dates

Week	Assignment	Date
2	GE2 worksheet (Simulated epidemic)	Mon. 4/8 (M/W labs) Tues. 4/9 (T/Th labs)
2	GE8 worksheet (Serial dilution for bacterial enumeration)	Wed. 4/10 (M/W labs) Thurs. 4/11 (T/Th labs)
3	GE9 worksheet (Constructing a growth curve for <i>E. coli</i>)	Mon. 4/15 (M labs) Tues. 4/16 (T labs)
4	GE14 worksheet (Ultraviolet light-induced kill rate)	Mon. 4/22 (M labs) Tues. 4/23 (T labs)
5	Exam 1 (in lab lecture, 240A MCK)	Mon. 4/29
5	Identification key for unknowns	Mon. 4/29 (M/W labs) Tues. 4/30 (T/Th labs)
5	GE13 worksheet (Antimicrobial agents)	Wed. 5/1 (M/W labs) Thurs. 5/2 (T/Th labs)
6	GE11 (Membrane filter method for bacterial counts)	Wed. 5/8 (M/W labs) Thurs. 5/9 (T/Th labs)
8	GE12 (Identification of Gram-positive cocci) worksheet	Wed. 5/22 (M/W labs) Thurs. 5/23 (T/Th labs)
9	GE10 (MPN method for coliform counts) worksheet GE15 (Bacterial populations of the skin) worksheet Unknowns worksheet	Wed. 5/28 (M/W labs) Thurs. 5/30 (T/Th labs)
10	Exam 2 (in lab lecture, 240A MCK) Summaries (in lab lecture)	Mon. 6/3
10	Practical exams	Mon. 6/3 (M/W labs) Tues. 6/4 (T/Th labs) Wed. 6/5 (M/W labs) Thurs. 6/6 (T/Th labs)