

## Bi331: MICROBIOLOGY LAB SYLLABUS

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 9:30-10:30 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 2 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 8:00am-9:00pm, Monday through Friday, and 8:00am-6:00pm on Saturday and Sunday. A buddy-system will be mandatory for working in the lab after hours (6:00-9:00pm) and on the weekends (see description of the buddy-system under the "Lab care and safety" section). 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 lab exercises. We will do three types of exercises: general exercises (GEs), enrichments (ENs), and projects (Ps). 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; some 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, to be taken on canvas prior to your lab, on 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: one during lab lecture to be taken on canvas and one during your lab section in-person. 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 10<sup>th</sup> 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 4 when you receive your unknowns.

Summary (25 points). You will write a summary for one of two lab projects (P2: The nitrogen cycle in a biological filter or P3: Genetic analysis of prodigiosin biosynthesis). The text of summary must be typed and double-spaced, in 12 point font, 1-inch margins, 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. In the past, points have been deducted for absences or being late to lab. However, since Bi331 is entirely in-person this year during the pandemic and to help promote responsible behavior in regards to COVID, you will not be punished for missing labs. This only applies if you have been exposed to a known COVID-positive person or have tested positive yourself and need to quarantine. **YOU MUST NOTIFY YOUR INSTRUCTOR AT LEAST 2 HOURS PRIOR TO THE LAB SECTION(S) YOU WILL MISS.** Your instructor will work with you to ascertain a plan for making up the missed lab work. Since lectures, quizzes, and one of your exams are all done virtually through Canvas, you will still be responsible for attending these items (see Quizzes and Lab Exams above). If you do not notify your instructor of your absence as described above or are more than 10 minutes late for your lab, you will incur a penalty of 5 points and be counted as absent. If you are absent for more than 3 unexcused sessions you will receive a failing mark for the course.

## TENTATIVE SCHEDULE OF LAB ACTIVITIES

Week	Lab*	Exercise	Page <sup>†</sup>
1 3/29-4/1	1	GE1: Airborne microorganisms GE2: Simulated epidemic GE3: Streak dilution technique GE4: Intro to Microscope use	7 8-9 13-17 18-21
	2	GE4: Microscope use GE5: Serial dilution for bacterial enumeration	18-21 22-23
2 4/5-4/8	1	GE6: Constructing a growth curve for <i>E. coli</i> P1: Look up unknowns and work on key	27-28 75-78
	2	GE7: Staining methods (Gram) P2: The nitrogen cycle in wastewater treatment	31 81-84 Belser and Mays
3 4/12-4/15	1	GE8: Ultraviolet light-induced kill rate GE9: Identification of Gram-positive cocci	33-36 39-44
	2	EN1: Enrichment for denitrifying bacteria GE7: Staining methods (endospore)	69 32
4 4/19-4/22	1	P1: Receive unknowns P3: Genetic analysis of prodigiosin biosynthesis	75-78 85-88 Morrison
	2	GE7: Staining methods (capsule) GE10: Testing sensitivity to antibiotics	31-32 47-49
5 4/26-4/29	1	GE11: Membrane filter method for bacterial counts	53-55
	2	GE7: Staining methods (flagella)	32
6 5/3-5/6	1	P3: Complementation analysis of prodigiosin mutants	89-90
	2	EN2: Enrichment for Cyanobacteria EN3: Enrichment for Purple non-sulfur bacteria	70-71 72-73
7 5/10-5/13	1	GE12: Bacterial populations of the skin	59-60
	2	Continuation of existing exercises	
8 5/17-5/20	1	GE13: MPN method for coliform counts	63-66
	2	No new projects	
9 5/24-5/27	1	Lab clean up and <i>Microbial Jeopardy</i>	
	2	Exam 2 – in person during lab section	
10 5/31-6/3	1	Monday: Memorial Day – no lab Monday and Tuesday	
	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

<b>Week</b>	<b>Assignment</b>	<b>Date</b>
2	GE2 worksheet (Simulated epidemic)	Mon. 4/5 (M/W labs) Tues. 4/6 (T/Th labs)
2	GE5 worksheet (Serial dilution for bacterial enumeration)	Wed. 4/7 (M/W labs) Thurs. 4/8 (T/Th labs)
3	GE6 worksheet (Constructing a growth curve for <i>E. coli</i> )	Mon. 4/12 (M/W labs) Tues. 4/13 (T/Th labs)
4	GE8 worksheet (Ultraviolet light-induced kill rate) P1: Identification key for unknowns	Mon. 4/19 (M/W labs) Tues. 4/20 (T/Th labs)
5	Exam 1 (during lab lecture, through canvas)	Mon. 4/26
5	GE10 worksheet (Antibiotic testing)	Wed. 4/28 (M/W labs) Thurs. 4/29 (T/Th labs)
6	GE11 (Membrane filter method for bacterial counts)	Wed. 5/5 (M/W labs) Thurs. 5/6 (T/Th labs)
8	GE9 worksheet (Identification of Gram-positive cocci)	Wed. 5/19 (M/W labs) Thurs. 5/20 (T/Th labs)
9	Exam 2 (during lab section, in-person) GE12 (Bacterial populations of the skin) worksheet GE13 (MPN method for coliform counts) worksheet P1: Unknowns worksheet P2 or P3: Summaries (in lab lecture)	Wed. 5/26 (M/W labs) Thurs. 5/27 (T/Th labs)
10	Practical exams	Wed. 6/2 (W labs) Thurs. 6/3 (Th labs)

## CLASS SCHEDULE

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
<b>8:00 AM</b>					
<b>9:00 AM</b>					
	Bi331 LECTURE Zoom 9:30-10:30 AM	Bi331 LAB 1 SECTION III Klamath 33 9:30-11:30 AM		Bi331 LAB 2 SECTION III Klamath 33 9:30-11:30 AM	
<b>10:00 AM</b>			Bi330 LECTURE Zoom 10:15-11:45 AM		Bi330 LECTURE Zoom 10:15-11:45 AM
<b>11:00 AM</b>	OFFICE HOURS Kaye Shek Zoom 11:00-12:00 PM	OFFICE HOURS Molly Jud Kla 33/Zoom 11:30-12:30 PM	OFFICE HOURS Jana Prikryl - Zoom 11:45-12:15 PM		OFFICE HOURS Jana Prikryl - Zoom 11:45-12:15 PM
<b>12:00 PM</b>					
<b>1:00 PM</b>	Bi331 LAB 1 SECTION I Klamath 33 1:00-3:00 PM		Bi331 LAB 2 SECTION 1 Klamath 33 1:00-3:00 PM		
<b>2:00 PM</b>		Bi331 LAB 1 SECTION IV Klamath 33 2:00-4:00 PM		Bi331 LAB 2 SECTION IV Klamath 33 2:00-4:00 PM	Bi331 Lab Prep Klamath 33 2:00-3:30 PM Staff-only
<b>3:00 PM</b>					
<b>4:00 PM</b>	Bi331 LAB 1 SECTION II Klamath 33 4:00-6:00 PM	OFFICE HOURS Jonathan Kato Kla 33/Zoom 4:00-5:00 PM	Bi331 LAB 2 SECTION II Klamath 33 4:00-6:00 PM		
<b>5:00 PM</b>					
<b>6:00 PM</b>	OFFICE HOURS Abby Onos Kla 33/Zoom 6:00-7:00 PM				

You may work in the lab at any time, except when there is another class in session (ie-all gray boxed times are unavailable for out-of-class-time work).