

BIBC 103: Biochemical Techniques

Fall 2022

(last updated 9/20/2022)

Instructor: Sinem Beyhan, Ph.D. (sbeyhan@ucsd.edu)

Office Hours: Mondays 2:00-3:00 pm over Zoom (Canvas link); also available by appointment

Instructional Assistants: Aishwarya Ravisankar (aravisan@ucsd.edu)

Vaishali Harimani (vharimani@ucsd.edu)

Lectures: M/W/F 9:00-9:50 am in SEQUO 147. You are strongly encouraged to attend lectures. While it is not mandatory, in the lecture we will discuss the background to the labs and strategies for approaching the lab work and assignments. The lectures will be recorded for the video podcast, but attending live gives you the opportunity to ask questions.

Labs: W/F 10:00 am- 1:50 pm in YORK 3306/3406

Course Objectives:

This course will introduce some of the experimental methods used in biochemistry and molecular biology, with an emphasis on those techniques used to study proteins. You will gain a conceptual understanding of, and some hands-on experience in, various protein purification techniques, expression and purification of recombinant proteins from bacterial cells, and methods for analyzing the different properties of proteins. The laboratory work will consist of three big, multi-day projects, as well as some smaller, single-day experiments. All the lab work will emphasize mastery of the skills that are essential to work independently in a biochemistry lab, including hands-on wet-lab and quantitative reasoning skills.

More importantly, this course is designed to give an appreciation of what science is and how it works. Science is not just a bunch of random facts...it is a process! It is easier to understand biology, or any field, when you understand how we know what we know about it. Understanding how information in biology is brought to light is just as important as the information itself. Through the laboratory projects, we will develop the skills necessary to interpret data from experiments in order to answer questions about biological systems and to design experiments to ask new questions. In keeping with this, the importance of good experimental design, including the use of appropriate controls, will be highlighted in all experiments.

Materials Required:

- 1) Biochemical Techniques Lab Manual, 2022-2023 edition (available from the Bookstore)
- 2) Bound laboratory notebook (not loose leaf; do not need carbon copies; composition notebooks are okay)
- 3) Safety glasses (no need for goggles)
- 4) Lab coat
- 5) KN95 mask, or a double mask in lab: Note: You need a mask for lecture but do not need to wear KN95 mask.

Course Web Site:

Except for the lab manual, all course materials will be accessed through the course webpage on Canvas. Much of the data you generate in your experiments will be accessed through Canvas, in addition to lab report guidelines and practice problem sets for quizzes and exams. Be sure to check Canvas frequently for announcements and updates on assignments.

Course Requirements and Grading: Your final grade for the class will be calculated using the following criteria:

Activity	Value
LDH: Lab Notebook	50 points
LDH: Purification table analysis	150 points
Fly Lab: Lab Notebook	20 points
Fly Lab: EMBA and ADH activity analysis	50 points
Sea Urchin: Lab Notebook	30 points
Sea Urchin: Lab Report	170 points
Fluorescent protein: Lab Notebook	30 points
Fluorescent protein: Identification of unknowns	50 points
Bioinformatics: Lab manual questions (Lab 19 part A)	40 points
Bioinformatics: Lab manual questions (Lab 19 part C)	20 points
Bioinformatics: Lab manual questions (Lab 19 part D)	30 points
Quiz 1 (Oct 7)	20 points
Quiz 2 (Nov 18)	20 points
Exam 1 (Oct 26)	120 points
Exam 2 (Dec 2)	200 points
Total	1000 points

Point Cutoffs for Grade Assignments:

915-1000	A	780-794	C+
895-914	A-	715-779	C
880-894	B+	695-714	C-
815-879	B	600-694	D
795-814	B-	0-599	F

Lab Quizzes and Exams:

All quizzes and exams will be taken in person during the lab sessions. The purpose of the lab quizzes is to be sure you are mastering the basic concepts behind your experiments as we go through the class. This includes understanding the purpose of the lab projects and how each experiment fits into this, the basic concepts underlying the procedures, and simple mathematical and analytical skills based on what you have actually done in lab. The quiz dates are given in

the lab schedule. Quizzes will be given at the beginning of lab, will take 15 – 30 minutes, and will consist of 5 to 7 questions.

The two exams are cumulative and will be problem solving-based. They may include some basic questions on the concepts we have covered, but will emphasize taking the information you have learned and extrapolating to solve problems you have not seen before. Practice questions will be provided on Canvas to help you prepare for the exams.

Lab Attendance Policies:

In-person attendance at each lab session is mandatory. An unexcused absence will result in 10 points being deducted. If you test positive for COVID-19 or feel ill, however, stay home and contact the instructor by email. If you test-positive for COVID-19 and must isolate, we will work with you to keep you in the class. If you know that you need to miss a lab session, discuss this with the instructor (not the IA, they are not authorized to give you permission) to see if it will be possible to make up the lab session or excuse you from the lab with no consequences. Please bring this to the instructor's attention as soon as you know that it will be an issue. **Only the instructor (not the IAs) can excuse an absence. Two unexcused absences will result in the student failing the course.**

Turning Written Assignments:

Lab report and data write-ups will be submitted electronically on Canvas. Lab reports are due before the end of the day (11:59 pm) on the due date. Ten points will be deducted for each day following the due date that the lab report is late. Students agree that by taking this course all required papers will be subject to review for textual similarity by Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin service is subject to the terms of use agreement posted on the Turnitin site.

Lab Report Grading and Regrade Policy:

Your lab report will be graded by your IA, based on the lab report guidelines. I work closely with all the IAs to ensure that the grading is accurate and equivalent between sections. If you disagree with the grading of your lab report, discuss this with your IA to get clarification on why points were deducted. If you still disagree with the grading you may submit the report to me for a re-grade. This must be done within one week of receiving the graded report. I will re-grade the entire report and give you a new score, and this is the score that will be recorded.

Making Up Quizzes and Exams:

Please note that it is extremely burdensome for the instructor and IAs to have to prepare and proctor make-up exams. Missing a scheduled quiz or exam will only be excused for medical reasons where documentation can be provided.

Monday Lecture Schedule: On Mondays, we have a lecture but there is no lab session. We use this time to review our lab practices, observations and analyses. Problem set answers will also be discussed at this time.

Week	Dates	Discussion Topics
Week 1	September 26	Review of lab practices
Week 2	October 3	Review of lab calculations
Week 3	October 10	Problem set 1 answers
Week 4	October 17	LDH activity calculations

Week 5	October 24	Problem set 2 answers
Week 6	October 31	Exam 1 answers
Week 7	November 7	Sea urchin lab report discussion
Week 8	November 14	Problem set 3 answers
Week 9	November 21	Problem set 4 answers
Week 10	November 28	Review of all lecture materials

Lab Schedule:

	Dates	Experiment/Activity	Lab Manual Chapter
Wk 0	Sep. 23	Enrollment and safety orientation; Lab skills and equipment exercises	Lab 1 (and pp. 1-11)
Wk 1	Sep. 28	Introduction to SDS-PAGE	Lab 2
	Sep. 30	LDH 1: Initial purification of lactate dehydrogenase (LDH) from crude homogenate; centrifugation, ammonium sulfate precipitations	Lab 3
Wk 2	Oct. 5	LDH 2: Affinity chromatography	Lab 4
	Oct. 7	Quiz 1 in Lab; LDH 3: Size exclusion chromatography	Lab 5
Wk 3	Oct. 12	LDH 4: Activity assays; Bradford protein assays	Lab 6
	Oct. 14	LDH 5: SDS-PAGE of LDH purification fractions	Lab 7
Wk 4	Oct. 19	Fly Lab 1: Sort flies and prepare assays	Canvas pdf
	Oct. 21	Fly Lab 2: Ethanol Mobility Behavior Assay; alcohol dehydrogenase activity assays	Canvas pdf
Wk 5	Oct. 26	Exam 1 in lab; Statistical analysis of fly data	
	Oct. 28	Sea urchin 1: Sea urchin fertilization, prepare cell lysates	Lab 9A
Wk 6	Nov. 2	Sea urchin 2: MAP kinase Western blot—SDS PAGE and electroblotting	Lab 10
	Nov. 4	Sea urchin 3: MAP kinase Western blot—Immunodetection	Lab 11
Wk 7	Nov. 9	FP 1: Fluorescent proteins (FP): Make competent cells and transform with plasmid	Lab 13 A – B Lab 15
	Nov. 11	Veterans Day Holiday, no lab	--
Wk 8	Nov. 16	FP 2: Purification and analysis of fluorescent proteins	Lab 16
	Nov. 18	Quiz 2 in Lab; FP 3: SDS-PAGE of fluorescent proteins	Lab 17
Wk 9	Nov. 23	Bioinformatics 1: Investigation of an unknown melanoma gene	Lab 19 A
	Nov. 25	Thanksgiving Holiday, no lab	--
Wk 10	Nov. 30	Bioinformatics 2: Modeling protein structures	Lab 19 B – D
	Dec. 2	Exam 2 in lab	--