

BIBC 103: Biochemical Techniques

Spring 2022

(last updated 4/1/2022)

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)

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Lectures: M/W/F 9:00-9:50 am in SEQUO 148. 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, 2020/2021 Edition (available from the Bookstore)
- 2) Bound laboratory notebook (not loose leaf; do not need carbon copies)
- 3) Safety glasses
- 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 Requirements and Grading: Your final grade for the class will be calculated using the following criteria:

Activity	Value
LDH Lab Notebook	40 points
LDH purification table analysis	120 points
Sea Urchin Lab Report	250 points
Bioinformatics Lab manual questions (Lab 19 part A)	50 points
Bioinformatics Lab manual questions (Lab 19 part C)	30 points
Bioinformatics PyMOL project	50 points
Fluorescent protein Lab Notebook	40 points
Fluorescent protein Unknowns	30 points
Quiz 1 (April 15)	30 points
Quiz 2 (May 13)	30 points
Exam 1 (April 27)	130 points
Exam 2 (June 3)	200 points
Total	1000 points
Got crystals? 20 points extra credit	

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

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.

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 topics that will be covered on each quiz will be posted in an announcement on Canvas on the Monday prior to the quiz.

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.

Lab Schedule:

	Dates	Experiment/Activity	Lab Manual Chapter
Week 1	March 30	Organization/safety; Working efficiently in lab	Lab 1
	April 1	Electrophoresis & SDS-PAGE	Lab 2
Week 2	April 6	LDH 1: Initial purification of LDH from crude homogenate: centrifugation, ammonium sulfate precipitations; prepare size exclusion column	Lab 3
	April 8	LDH 2: Affinity chromatography	Lab 4
Week 3	April 13	LDH 3: Size exclusion chromatography	Lab 5
	April 15	Quiz 1 in Lab LDH 4: Activity assays; Bradford protein assays	Lab 6
Week 4	April 20	LDH 5: SDS-PAGE of LDH purification fractions	Lab 7
	April 22	LDH 6: Native gel electrophoresis of LDH with activity stain; Set up lysozyme crystallization 1	Lab 8 Lab 18
Week 5	April 25	LDH purification table analysis due Monday by 11:59 pm	
	April 27	Exam 1 in Lab	
	April 29	Sea urchin fertilization, prepare cell lysates	Lab 9A
Week 6	May 4	MAPK Western blot—SDS PAGE and electroblotting	Lab 10
	May 6	MAPK Western blot—Immunodetection	Lab 11
Week 7	May 11	ELISA for phospholipase C activity; Examine lysozyme crystals 1	Lab 12 Lab 18
	May 13	Quiz 2 in Lab Work up ELISA and Western blot data; make figures for lab report; Set up lysozyme crystallization 2	Lab 12 Lab 18
Week 8	May 18	Bioinformatics 1	Lab 19 part A
	May 20	Bioinformatics 2	Lab 19 pts B-D
	May 21	Sea urchin lab report due Friday by 11:59 pm	
Week 9	May 25	FP 3: Fluorescent proteins (FP): Make competent cells and transform with plasmid	Lab 13 pts A/B Lab 15
	May 27	FP 4: Purification and analysis of fluorescent proteins	Lab 16
	May 28	Bioinformatics assignment due Friday by 11:59 pm	
Week 10	June 1	FP 5: SDS-PAGE of fluorescent proteins; Examine lysozyme crystals 2	Lab 17 Lab 18
	June 3	Exam 2 in Lab	