BIBC 103: Biochemical Techniques

Fall Quarter, 2022

Instructor: Aaron Coleman, Ph.D.
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Office Hour: York Hall 3080A (my office) and York 2300 (conference room). Try my office first; if several people show up we will move to the conference room that is just down the stairs on the ground floor.
Mondays 3:00 – 4:00 PM

Lecture: Sequoyah Hall 147; Mon/Weds/Fri 1 – 1:50 pm. Lectures are in-person only and will not be recorded or podcast.

Labs: York Hall 3306 and 3406; Weds/Friday 2:30 – 6:30 pm.

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 conceptual understanding and hands-on experience in various protein purification techniques and methods for analyzing the different properties of proteins. The laboratory work will consist of three big multi-week projects and some shorter side projects. 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 (see Canvas for information on the type of notebook required)
3) Safety glasses
4) Lab coat

Course Structure

Activity	Point Value
LDH Purification: Lab notebook	50
LDH Purification: Purification table analysis	100
Drosophila Alcohol Metabolism: Lab notebook and statistical analysis	50
Sea Urchin Fertilization Signaling: Lab notebook	25
Sea Urchin Fertilization Signaling: Lab report	220
Fluorescent Proteins: Lab notebook	25
Fluorescent Proteins: Identify unknowns	20
Bioinformatics: Lab manual questions	40
Lab Practical: Assemble and load SDS-PAGE gel	10
Quizzes: Four at 35 points each	140
Exam 1	100
Exam 2	220
Total	**1000**

Point Cutoffs for Grade Assignments: (Cutoffs may be lowered at the instructor's discretion.)

910-1000	A	790-799	C+
900-909	A-	705-789	C
890-899	B+	695-704	C-
810-889	B	600-694	D
800-809	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 are focused on having you use what you are learning in the class at a level that requires application and analysis. They may include some basic

questions on the concepts we have covered, but will emphasize using the knowledge and skills you have developed for more in-depth problem solving. 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. 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. An unexcused absence will result in 10 points being deducted. **Only the instructor can excuse an absence. Two unexcused absences will result in the student failing the course.**

Turning in the Lab Report:
Lab reports 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.

Lab Schedule

	Dates	Experiment/Activity	Lab Manual Chapter
Week 0	Sep. 23	Enrollment and safety orientation; Lab skills and equipment exercises	Lab 1 (and pp. 1-11)
Week 1	Sep. 28	Introduction to SDS-PAGE	Lab 2
	Sep. 30	**Quiz 1 at beginning of lab** LDH 1: Initial purification of lactate dehydrogenase (LDH) from crude homogenate; centrifugation, ammonium sulfate precipitations	Lab 3
Week 2	Oct. 5	LDH 2: Affinity chromatography	Lab 4
	Oct. 7	LDH 3: Size exclusion chromatography	Lab 5
Week 3	Oct. 12	LDH 4: Enzyme activity assays; Bradford protein assays	Lab 6
	Oct. 14	**Quiz 2 at beginning of lab** LDH 5: SDS-PAGE of LDH purification fractions	Lab 7
Week 4	Oct. 19	**LDH purification table analysis due** 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
Week 5	Oct. 26	**Exam 1 in lab**; Statistical analysis of fly data	
	Oct. 28	Sea urchin fertilization, prepare cell lysates	Lab 9A
Week 6	Nov. 2	MAP kinase Western blot—SDS PAGE and electroblotting	Lab 10
	Nov. 4	**Quiz 3 during incubation** MAP kinase Western blot—Immunodetection	Lab 11
Week 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	
Week 8	Nov. 14	**Sea urchin fertilization signaling lab report due on Monday**	
	Nov. 16	FP 2: Purification and analysis of fluorescent proteins	Lab 16
	Nov. 18	FP 3: SDS-PAGE of fluorescent proteins	Lab 17
Week 9	Nov. 23	**Quiz 4 at beginning of lab** Bioinformatics 1: Investigation of an unknown melanoma gene	Lab 19 part A
	Nov. 25	Thanksgiving Holiday, no lab	
Week 10	Nov. 30	Bioinformatics 2: Modeling protein structures	Lab 19 parts B – D
	Dec. 2	**Exam 2 in lab**	