

# BIBC 103: Biochemical Techniques

## Winter Quarter, 2016

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**Office Hours:** Mondays 12:30 – 2:00 PM

**Lecture:** Peterson Hall 104; Mon/Weds/Friday 11:00 – 11:50 AM

**Labs:** York Hall rooms 3306 and 3406; Weds/Fri 12:00 – 4:00 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 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 multi-day projects, as well as some smaller, single-day experiments. As this is an introductory lab course, all lab work will emphasize the learning of basic lab skills and good lab practices.

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 why 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 answer new questions. In keeping with this, the importance of good experimental design, including the use of appropriate controls, will be highlighted in all experiments. A complete list of the learning goals and expected outcomes for the course can be found on Ted.

### Materials Required:

- 1) Biochemical Techniques Lab Manual, 2014/2015 Edition (available from the Bookstore)
- 2) Bound laboratory notebook
- 3) Safety glasses
- 4) Lab coat

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

Exams (100 pts. and 240 pts.)	340 points
Lab Reports (2 at 225 pts. each)	450 points
Data Write-up (mini report)	40 points
Lab Quizzes (4 at 30 pts. each)	120 points
Lab Notebook/Bioinformatics/Lab Practical	50 points
<b>Total</b>	<b>1000 points</b>

**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-	0-589	F

### **Course Web Site:**

Many of the course materials are available only through the course website on TritonLink Education, or Ted (<https://ted.ucsd.edu>). All students will need to be able to access this site. Once you are enrolled in the class you will have access to the site using your ACS username and password. Be sure to check the course website frequently for announcements and updates on assignments. Items such as lab report guidelines and image files of gels and other data will be provided through the website. The Additional Materials folder contains additional background material for some of the experiments.

### **Lab Notebooks:**

You will need to keep a formal lab notebook in which you will collect your data from the laboratory experiments. You are strongly encouraged to update your notebook following each lab session. The notebook should be bound (spiral bound or composition book style are both okay), and should have numbered pages with a table of contents (it is okay to write these in). You will need to hand in either photocopies or carbon copies of your notebook pages for the experiments that are written up as lab reports. See pages xi and xii in the beginning of your lab manual for how to format your notebook. Your lab notebook for this course should contain the following: a. any numerical data you collect (such as spectrophotometer readings) neatly written in well-labeled spaces; b. printouts of any gel or film images taped into the notebook with all lanes labeled; c. notes on any changes to the procedure for that experiment or other deviations from the lab manual; d. notes on any mistakes, problems, or ways to improve the experiment—what would you do differently! Your notebook should also include any calculations and analysis that is called for in the lab manual, or that is assigned in lab by your IA. Be sure that each page has the experiment date and a title. A well-kept lab notebook serves as a portfolio of your work in the class that can be useful when interviewing for research internships and laboratory jobs. Your IA will perform five unannounced lab notebook checks that will be worth 5 pts each.

### **Lab Quizzes and Exams:**

The purpose of the lab quizzes is to address the following: Are you keeping up with the material? Are you prepared for that day's lab? Have you been attending lecture? The quiz dates are given in the lab schedule. They will begin precisely at the scheduled lab start time (so be ready to go when you come in) and will take 30 minutes, with six 5-point questions each. They can cover any material from the two weeks of class prior to that quiz, but will focus on 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 quizzes are scheduled on days where we will introduce each new lab project in lecture and they will emphasize that information, including some information not covered in the lab manual.

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 given on Ted to help you prepare for the exams.

**Lab Attendance Policies:**

Attendance at each lab session is mandatory. An unexcused absence will result in 10 points being deducted. 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 can excuse an absence. Two unexcused absences will result in the student failing the course.**

**Turning in Lab Reports:**

Lab reports are due at the beginning of lab on due date listed in the lab schedule. In addition to the hard copy turned in to your lab IA, an electronic copy of the report must also be submitted to Turnitin.com, which is accessed through Ted. The report must be submitted to Turnitin.com before the hard copy is turned in, and the hard copy must contain the Turnitin.com submission receipt in the appendix. Lab reports not turned in at the beginning of the lab session on the due date will be considered one-day late. Ten points will be deducted for each working day that the lab reports are 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.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the terms of use agreement posted on the Turnitin.com site.

**Re-Grade Policy on Lab Reports:** Your lab reports will be graded by your IA, based on the same lab report guidelines (general and specific) that you receive. Note that 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 first 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. Note that it is possible your score may go down. This policy is not intended to scare students off from submitting re-grades; if you believe your report was not fairly graded based on the guidelines posted on Ted then I encourage you to submit it for a regrade.

**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. At the instructor's discretion, a missed exam or quiz that is excused will either be dropped from the student's point total for the class, or made up by an oral exam scheduled within one week of the original exam or quiz.

	<u>Dates</u>	<u>Experiment/Activity</u>	<u>Lab Manual Chapter</u>
<u>Wk 1</u>	Jan. 6	Organization/safety; Introduction to pipettes & pipetting exercises	Lab 1
	Jan. 8	Making a pH buffer; Quantitative Measurements	Lab 2/pp. 1-10
<b>Wk 2</b>	Jan. 13	LDH 1: Initial purification of LDH from crude homogenate: prepare Size exclusion column <b>QUIZ 1</b>	Lab 3 Lab 5
	Jan. 15	LDH 2: Affinity chromatography purification of LDH	Lab 4
<b>Wk 3 NO MON LECT</b>	Jan. 20	LDH 3: Size exclusion chromatography purification of LDH	Lab 5
	Jan. 22	LDH 4: LDH Activity assays; Bradford protein assays	Lab 6
<b>Wk 4</b>	Jan. 27	LDH 5: Native gel electrophoresis of LDH with activity stain <b>QUIZ 2</b>	Lab 7
	Jan. 29	LDH 6: SDS-PAGE of LDH purification fractions	Lab 8
<b>Wk 5</b>	Feb. 3	MAPK: Sea urchin egg fertilization Examine SDS-PAGE gels	Lab 9A Lab 8
	Feb. 5	MAPK: SDS-PAGE and electroblotting	Lab 10
<b>Wk 6</b>	Feb. 8	<b>EXAM 1 DURING MORNING LECTURE</b>	
	Feb. 10	MAPK: Immunodetection <b>LDH LAB REPORT DUE</b>	Lab 11
	Feb. 12	MAPK: IP <sub>1</sub> ELISA to detect phospholipase C activation; Examine Western blot images	Lab 12
<b>Wk 7 NO MON LECT</b>	Feb. 17	Bioinformatics: LDH and Fluorescent Proteins Work up ELISA data <b>QUIZ 3</b>	Lab 19
	Feb. 19	Fluorescent proteins (FP) 1: Plasmid preps	Lab 13
<b>Wk 8</b>	Feb. 24	FP 2: Restriction enzyme digest; agarose gel electrophoresis <b>SEA URCHIN LAB REPORT DUE</b>	Lab 14
	Feb. 26	FP 3: Make competent cells and transform with plasmid; Set up lysozyme crystallization	Lab 15 Lab 20
<b>Wk 9</b>	Mar. 2	FP 4: Purification and analysis of fluorescent proteins	Lab 16
	Mar. 4	FP 5: SDS-PAGE of fluorescent proteins <b>QUIZ 4</b>	Lab 17
<b>Wk 10</b>	Mar. 9	FP 6: Examine SDS-PAGE gels; Examine lysozyme crystals	Lab 18 Lab 20
	Mar. 11	<u>EXAM IN LAB FP DATA WRITE-UP DUE</u>	

**LECTURES WILL CORRESPOND TO LAB TOPICS AND ALL LECTURE POWERPOINTS WILL BE AVAILABLE ON TED**