

# **BIBC 103: Biochemical Techniques**

## **Winter Quarter, 2022 *OMICRON REVISED* third time**

**Instructor:** Michael Burg, Ph.D.  
Office: TBD  
mburg@ucsd.edu

**Office Hours:** TBD

### **Lecture:**

Tue/Thu	12:30p-1:50p	RWAC(Ridge Walk Academic Complex)	0103	
B01	Tue/Thu 2:00p-5:50p	YORK		3306
B02	Tue/Thu 2:00p-5:50p	YORK		3406

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, 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:

Exams (100 pts. and 250 pts.)	350points
LDH purification table analysis	150 points
FGF Lab documents	40 points
FGF Lab Report	250 points
Lab Notebook (25pts LDH;40pts FP)	65 points
Lab Quiz	30 points

Bioinformatics	15 points
Pymol project	35 points
Misc lab points	15 points
<b>Total</b>	<b>950 points</b>

### Point Cutoffs for Grade Assignments:

990-1000	A+	790-799	C+
900-989	A	700-789	C
890-899	B+	600-699	D
800-889	B	<600	F

**In addition: Extra credit pts are available**

**Greater than 80% CAPE response: 5 pts**

### Course Web Site:

Many of the course materials are available only through the course canvas website. All students will need to be able to access this site. 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 keep a formal laboratory notebook for all your work in the class. A well-kept lab notebook serves as a portfolio of the experiments and techniques you have performed, something that can be useful when interviewing for research internships and laboratory jobs. Your notebook needs to be bound (no loose pages), but composition books are okay. The notebook does not need to have carbon copy pages, you will not have to turn in copies of notebook pages. See page *ix – x* in the lab manual for how to format your notebook and what information it should contain. Pay particular attention to the following:

- a. Write the **experiment date** in the upper left-hand corner of **each page**. Make all entries in chronological order. You do not need page numbers or a table of contents—you will index your entries by the experiment date.
- b. **Project title** following the date on each page (*e.g.*, LDH Purification and Analysis). Be sure to separate the three projects in your notebook.
- c. **Brief introduction stating overall purpose/overview of lab (see example lab report)**
- d. **Experiment title** underneath the project title on each page. This should be a single sentence indicating the specific procedure that was performed.
- e. Briefly list any changes to the procedures from the lab manual. Other than that, you do not need to write out procedures.
- f. Raw data and important observations: Enter numerical values in an organized table. For large numbers of numerical values collected electronically, you may paste printer tapes or a printout of the Excel spreadsheet into the notebook. These must be permanently fixed; you will not get credit for items loosely tucked into the pages. Also include any important observations (be brief). Look for prompts in the lab manual for what to include.

- g. Data analysis: Include any calculations, statistics, or graphs immediately following the raw data. This should be done for any and all data you collect (with the exception of the exercises in Lab 1). Graphs and plots should be done using Excel (or another graphing package) and should be labeled in text. They need to be printed and pasted into your notebook. Be sure they look professional!—ask for help with graphing in Excel if you are having trouble.
- h. All electrophoresis gel and Western blot images should clearly labeled with text, printed, and pasted into your notebook.
- i. Include a brief statement of the conclusions from the experiment. This may be a single sentence to simply verify that you successfully concluded that procedure on days where you don't collect any data, to a short paragraph describing the results of a multi-day experiment. You should also succinctly describe anything that went wrong with that experiment. What would you do differently if you had to do the experiment again?
- j. Your lab notebook should not contain lecture notes!

Your notebook should be kept up to date as you carry out each lab. Analysis (including plots and gel images) must be completed and added to the notebook by the lab period following collection of the data. Your IA will perform unannounced lab notebook checks throughout the quarter.

### **Exams:**

. The two exams will be given during lab on the dates listed in the schedule. The final is cumulative and will be problem solving-based. They will also include some basic questions on the concepts we have covered. Practice questions will be given 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. Note: See separate information on COVID procedures**

### **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 Canvas. 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 (five points for LDH write-up) 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.

### **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. If you disagree with the grading of your exams, discuss this with your IA first to get clarification on why points were deducted. Missing a scheduled quiz or exam will only be excused for medical reasons where documentation can be provided.

**LECTURES WILL CORRESPOND TO LAB TOPICS AND  
BIBC103. BURG TENTATIVE SCHEDULE  
COVID MODIFIED**

	<u>Dates</u>	<u>Experiment/Activity</u>	<u>Lab Manual Chapter</u>
<u>Wk 1 Remote</u>	Jan. 4	Arrange groups; Pipetting video and convert absorbance to percent concentration to pipetting accuracy	Lab 1 part E
	Jan. 6	Bioinformatics 1	Lab 19 part A
<b>Wk 2 Remote</b>	Jan. 11	Bioinformatics 2	Lab 19 parts C and D
	Jan. 13	Bioinformatics 3 (select proteins for PyMOL protein image project)	Lab 19 part D
<b>Wk 3</b>	Jan. 18	Fibroblast Growth Factor (FGF) Signaling: Examine dataset, come up with questions	Lab 9B
	Jan. 20	FGF 2: Develop hypotheses to explain dataset and design experiments to test	Lab 9B
	Jan 21-23	<b>Online quiz on basic calculations; Submit pymol images</b>	
<b>Wk 4</b>	Jan. 25	FGF 3: Examine Western blot and ELISA data	Labs 10 - 12
	Jan. 27	FGF 4: Design figures for lab report; Electrophoresis & SDS-PAGE—calculations for SDS-PAGE	Labs 10 – 12 Lab 2
<b>Wk 5</b>	Feb. 1	Safety orientation; Electrophoresis & SDS-PAGE—run SDS-PAGE	Lab 2
	Feb. 3	LDH 1: Initial purification of LDH from crude homogenate: centrifugation, ammonium sulfate precipitations	Lab 3
<b>Wk 6</b>	Feb. 8	<b>Exam 1 in lab;</b> prepare size exclusion columns	Lab 5
	Feb. 10	<b>FGF paper due in class.</b> LDH 2: Affinity chromatography	Lab 4
<b>Wk 7</b>	Feb. 15	LDH 3: Size exclusion chromatography	Lab 5
	Feb. 17	LDH 4: LDH activity assays; Bradford protein assays	Lab 6
<b>Wk 8</b>	Feb. 22	LDH 5: SDS-PAGE of LDH purification fractions	Lab 7
	Feb. 24	LDH 6: Agarose gel electrophoresis of LDH isozymes	Lab 8
<b>Wk 9</b>	Mar. 1	Fluorescent proteins (FP): Make competent cells and transform with plasmid	Lab 15
	Mar. 3	Purification and analysis of fluorescent proteins	Lab 16
<b>Wk 10</b>	Mar. 8	<b>LDH PAPER DUE.</b> SDS-PAGE of fluorescent proteins	Lab 17
	Mar. 10	<b>Last Exam in Lab; TURN IN NOTEBOOK INC FP</b>	

