

# BIBC 103: Biochemical Techniques

## Winter Quarter 2023

**Instructor:** Michael Burg, Ph.D.  
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**Office Hours:** TBD

### Lecture:

MWF	1pm-1:50pm		Sequo	147
B01	Wed/Fri	2:30p-6:20p	YORK	3306
B02	Wed/Fri	2:30p-6:20p	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

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

Quiz 1	30 points
Exams (130 pts. and 260 pts.)	390 points
LDH purification table analysis	160 points
Sea Urchin Lab report	260 points
Lab Notebook (30pts LDH;30pts Fly sea urchin: 30pts 30pts crystals)	120 points
Bioinformatics	20 points
Misc lab points	Around 20 points
<b>Total</b>	<b>Around 1000 points</b>

**Point Cutoffs for Grade Assignments:**

99-100%	A+	79.0-79.9%	C+
90-98.9%	A	70.0-78.9%	C
89.0-89.9%	B+	60.0-69.9%	D
80.0-88.9%	B	<60.0%	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: (SEE LAB INSTRUCTOR FOR SPECIFICS)**

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:

**YOUR LAB INSTRUCTOR WILL GIVE YOU SPECIFIC DETAILS ON HOW THEY WANT YOUR NOTEBOOK TO BE FORMATTED**

- 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.
- Project title** following the date on each page (*e.g.*, LDH Purification and Analysis). Be sure to separate the three projects in your notebook.
- Brief introduction stating overall purpose/overview of lab (see example lab report)**
- Experiment title** underneath the project title on each page. This should be a single sentence indicating the specific procedure that was performed.
- Briefly list any changes to the procedures from the lab manual. Other than that, you do not need to write out procedures.
- 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.
- 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.
- All electrophoresis gel and Western blot images should be clearly labeled with text, printed, and pasted into your notebook.
- 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:**

. There will be one quiz during lecture period and two exams (which 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 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:**

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**

	Dates	Experiment/Activity	Lab Manual Chapter
<b>Wk 1</b>	Jan 9 Jan. 11	<i>Intro to course/math</i> Enrollment and safety orientation; Lab skills and equipment exercises	Lab 1 (and pp. 1-11)
	Jan. 13	Introduction to SDS-PAGE	Lab 2
<b>Wk 2</b>	Jan 16 Jan. 18	<i>No lecture;holiday</i> LDH 1: Initial purification of lactate dehydrogenase from crude homogenate: centrifugation, ammonium sulfate precipitations; prepare size exclusion column	Lab 3
	Jan. 20	LDH 2: Affinity chromatography	Lab 4
<b>Wk 3</b>	<b>Jan 23</b> Jan. 25	<b>Quiz 1</b> LDH 3: Size exclusion chromatography	Lab 5
	Jan. 27	LDH 4: Activity assays; Bradford protein assays	Lab 6
<b>Wk 4</b>	Jan 30 Feb 1	<i>Lecture</i> LDH 5: SDS-PAGE of LDH purification fractions	Lab 7
	Feb. 3	LDH 6: Native gel electrophoresis of LDH with activity stain	Lab 8
<b>Wk 5</b>	Feb. 6	Lecture	
	Feb. 8	Fly Lab 1: Sort flies and prepare assays	Canvas pdf
	<b>Feb. 10</b>	<b>Exam 1 in Lab</b>	
<b>Wk 6</b>	Feb 13 Feb. 15	Lecture <b><u>LDH writeup due Wed Feb 15 by 2:30pm</u></b> Fly Lab 2: Ethanol Mobility Behavior Assay; alcohol dehydrogenase activity assays; determination of substrate specificity	Canvas pdf
	Feb. 17	Fly Lab 3: Statistical analysis of data; Lysozyme crystallization: prep crystals round 1	Lab 18 parts A - C
<b>Wk 7</b>	Feb 20 Feb. 22	No lecture:holiday Sea urchin fertilization, prepare cell lysates	Lab 9A
	Feb. 24	MAPK Western blot—SDS PAGE and electroblotting	Lab 10
<b>Wk 8</b>	Feb 27 Mar 1	Lecture MAPK Western blot—Immunodetection	Lab 11
	Mar. 3	ELISA for phospholipase C activity; Lysozyme crystallization: examine crystals round 1; prep crystals round 2	Lab 12
<b>Wk 9</b>	Mar 6 Mar. 8	Lecture Bioinformatics 1: Investigation of an unknown melanoma gene	Lab 19 part A
	Mar. 10	Bioinformatics 2: Modeling protein structures	Lab 19 parts B - D
		<b>Sea urchin paper due Mar 10 2:30pm</b>	
<b>Wk 10</b>	Mar 13 Mar. 15	Lecture Lysozyme crystallization: examine crystals round 2	Lab 18 part D
	Mar. 17	Exam 2 in Lab	

