

**Course Information**

**What is this course about and how will it help you?**

This course is about learning lab techniques that are commonly used in biochemistry research. Together, we will first learn the theory behind these techniques in lectures, and then you'll learn how to do these techniques in the lab sessions (no prior lab experience is required). You'll also get a chance to develop some skills that will be important for your professional careers: critical thinking, quantitative reasoning, teamwork, and oral and written communication. By the end of the course, I hope you'll appreciate that science itself is a process, not just a bunch of random facts to memorize. I hope that you will enjoy taking this course as much as I will enjoy teaching it!

**Lectures:** Tuesdays, Wednesdays, Thursdays, Fridays; 9:30–10:50 AM in Center Hall 220

**Labs:** Tuesdays, Wednesdays, Thursdays, Fridays; 12:00–3:50 PM in York Hall 3306

Find these buildings on [maps.ucsd.edu](https://maps.ucsd.edu).

**Prerequisites:** BILD 1 & [Lab Safety Training and Assessment](#) before the first lab session

**UC Course Credits:** 4

**Instructional Team**

**Instructor:** Raymond Mak

**Email:** [rhmak@ucsd.edu](mailto:rhmak@ucsd.edu)

**Office Hours:** Mondays, 1–3 PM in York Hall 2300

**Virtual Office:** Mondays, 1–3 PM by [Zoom Video Conferencing](#)

**Instructional Assistant (IA):**

Aurian Saleh [ausaleh@ucsd.edu](mailto:ausaleh@ucsd.edu) Lab Section A01

**Lab Coordinator and Safety Officer:** Joe Stagg

Email: [jstagg@ucsd.edu](mailto:jstagg@ucsd.edu) Tel. 858-534-2195

Hi, I'm Ray.



Pronouns: He/His/Him  
 From: Ottawa, ON  
 BSc (Toronto)  
 MSc (ETH Zürich)

Feel free to talk to me at any time before or after lectures and during lab sessions. I'm here to help you learn! I also want you to have the best possible learning experience, so I welcome your feedback at any time on how to improve the course. During office hours, my door and virtual Zoom door are always open. If these office hours don't work for you, please let me know, and we'll try to find a time that works for the both of us. If you prefer email, I'll try my best to reply within 24 hours, but please write to me from your [UCSD email account](#). Thanks!

**Learning Objectives of BIBC 103**

By the end of this course, you'll be able to:

- Demonstrate a conceptual understanding and hands-on proficiency of lab techniques used in biochemistry research. For a full list of these concepts and techniques, please see [Canvas](#).
- Acquire, document, and interpret experimental data.
- Present data and write in a scientific format.

**SHOPPING LIST - UCSD BOOKSTORE**

- BIBC 103 Lab Manual, 2018-2019 edition
  - Lab notebook: composition or coiled-bound notebook or Microsoft OneNote. Duplicate pages are not required.
  - Calculator that can perform log calculations
  - Safety glasses (goggles are OK, but not as comfy)
  - White lab coat
- Note: iClickers are not required.

**How will you be evaluated in this course?**

Evaluation	Points	Weight*
5 Lab Notebook Checks	5 × 25	12.5%
4 Lab Quizzes	4 × 25	10%
Bioinformatics Exercise	25	2.5%
LDH Lab Report	200	20% or 10%
FGF Lab Report	200	20% or 30%
Midterm Exam	100	10% or 0%
Final Exam	250	25% or 35%
<b>Total</b>	<b>1000</b>	<b>100%</b>

\* Everyone deserves a second chance! If you do better on your second lab report, it will carry more weight. Same thing with the exam. It's a chance for you to improve on your second attempt. The weighting scheme that gives you the better grade will be chosen for you automatically.

Grade Cutoffs	Performance Qualities
<b>A+</b> 98-100%	<b>Excellent:</b> demonstrates advanced scientific literacy and lab skills; superior grasp of the subject matter.
<b>A</b> 92-97.9%	<b>Good:</b> demonstrates competent scientific literacy and lab skills; proficient understanding of the subject matter.
<b>A-</b> 90-91.9%	
<b>B+</b> 88-89.9%	
<b>B</b> 82-87.9%	<b>Fair:</b> demonstrates adequate scientific literacy and lab skills; sufficient familiarity with the subject matter.
<b>B-</b> 80-81.9%	
<b>C+</b> 78-79.9%	
<b>C</b> 72-77.9%	<b>Poor/Fail:</b> limited scientific literacy and lab skills; some understanding of the subject.
<b>C-</b> 70-71.9%	
<b>D</b> 60-69.9%	
<b>F</b> <59.9%	

The points you earn are yours to keep. The grades will not be curved, so you are not in competition with each other for the top grades. Grade cutoffs can be lowered for everyone at the instructor's discretion.

**Important Course Dates**

**July 2:** first day of lectures and labs (mandatory safety training in lab)

**July 3:** last day to drop course without a "W" grade

**July 4:** Independence Day holiday (no lecture or lab today)

**July 5:** last day to drop course to have fees refunded

**July 17:** midterm exam in lecture

**July 19:** last day to drop course and receive a "W" grade

**July 20:** LDH lab report due at 3 PM – submit on [Canvas](#)

**July 28:** FGF lab report due at 3 PM – submit on [Canvas](#)

**August 2:** final exam in lab (no lecture on this day)

## Course Website: Canvas

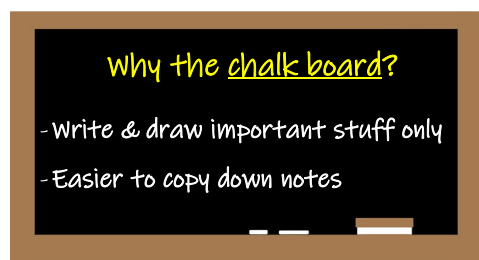
**URL:** <https://coursefinder.ucsd.edu>  
**Apps:** [Android](#), [iOS](#)  
**Course:** BIBC103\_S119\_A00  
**Login:** UC San Diego Active Directory credentials

Check Canvas daily for the latest announcements and updates for the course. If you're having trouble accessing Canvas, please contact [servicedesk@ucsd.edu](mailto:servicedesk@ucsd.edu) or call 858-246-4357.

## Lectures

Together in lectures, we will go over the theoretical concepts of the techniques that you'll be doing in the labs. Most of the time, I'll be using the chalk board to present material. You may make audio recordings for personal use. **If you're unsure or if something isn't clear, please let me know or ask me to clarify.** It's my job to present the material clearly. If I'm not doing my job, I want you to tell me this!

We'll also be doing group discussions that involve problem solving in lecture. The problems that we'll discuss will be similar to what will be on the midterm and final exams. I know that group discussions can be intimidating, but I want to assure you that **all perspectives will be respected and valued in this course**, so please don't be shy when participating in these discussions.



Did you know that taking notes by hand is better than typing on a laptop? [Read about it here.](#)



## Labs

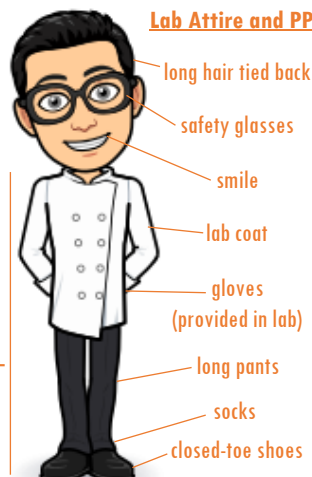
In the lab sessions, you'll get hands-on training in techniques that are commonly used in biochemistry research. No prior lab experience is necessary or expected for this course. We'll learn these techniques from the ground-up together. Some of these techniques will include:

- Fundamental lab skills (using micropipettes, using balances, making solutions, making pH buffers, spectrophotometry)
- Protein purification, quantification, activity assays, crystallization
- SDS-PAGE, western blotting, ELISA
- Bioinformatics analysis of nucleic acid sequence and protein sequence and structure

Throughout the labs, you'll be working in pairs (2 students per lab group). The goal is to **work together as a team to learn the techniques and to help each other complete the experiments.** If a serious situation arises that is beyond your control and you need to miss a lab session, [notify me](#) as soon as possible to see if alternate arrangements can be made. After that, notify your IA and lab partner.

### Lab Attire and PPE

When working in the lab, we need to work together to create a **safe environment for everyone.** Please read the relevant lab manual chapter(s) beforehand to familiarize yourself with what you'll be doing each day. We'll warn you when you'll be working with hazardous substances and show you how to handle them safely. For your safety and those around you, always be aware of your surroundings, bring appropriate lab attire, and wear your personal protective equipment (PPE). Further guidelines will be given at the safety orientation in Lab 1. Thanks!



## Lab Notebook

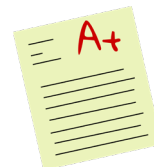


Keeping a lab notebook is an essential skill for all scientists. In it, you **document how you performed an experiment, results, and observations** as you go along. Your notebook entries should be completed such that you (or another scientist) can understand and reproduce what you did.

In this course, you may keep either a hard copy (composition or spiral-bound notebook) or electronic (Microsoft OneNote) lab notebook. On [Canvas](#), you will find specific guidelines for keeping your lab notebook, example lab notebook entries, and a blank Microsoft OneNote template document. To encourage you to keep your lab notebook up-to-date throughout the course, your IA will conduct five notebook checks as listed in the course schedule.

## Quizzes and Exams

There will be four short quizzes to **ensure that you're keeping up with the lab material.** These quizzes will be on the background of the experiment, the concepts underlying the procedures, and include mathematical and analytical problems based on what you have done in lab. Once your quiz is returned, you may re-submit incorrectly answered questions for partial credit by the following lab session. This will allow you to review any missed concepts and give you a chance to re-answer the question.



The two exams are cumulative and will test how well you know the lecture and lab material. The main emphasis will be on **integrating and applying the key concepts that you've learned to new problems.** To help you prepare for the quizzes and exams, practice problem sets will be posted on [Canvas](#). If you do better on the final exam than on the midterm exam, only the final exam's score will count towards your grade. This will give you a chance to review any concepts that you may have missed on the midterm exam for the final exam.

## Lab Reports

There will be two lab reports in this course: one for the LDH project and another for the FGF project. The lab reports will be a chance for you to show how well you can **present the data that you've acquired in lab, analyze these data, critically think about these data, and communicate the findings and significance of these data in a written format.** The format of the report will be similar to a manuscript that is submitted to the [Saltman Quarterly](#) for publication. Specific guidelines for each lab report will be posted on [Canvas](#).



To help you prepare for these lab reports, we will have two peer feedback sessions in lab. In these feedback sessions, you can bring in a partial writing draft or a data figure that you've prepared and get feedback from your classmates. Participation in these feedback sessions is voluntary and will earn you extra credit points.

An **electronic copy** (Microsoft Word or Adobe PDF format) of the lab report **should be submitted on [Canvas](#).** The due dates in the course schedule are set to help you manage your time and to give your IA enough time to grade and return your reports. If a serious situation arises that is beyond your control and you need extra time to complete your lab report, please consult with your IA first. If you do better on your second lab report, it will count more towards your final grade. This will give you a chance to review and incorporate the feedback from your first report and improve on your second one.

## Collaboration & Academic Integrity

I encourage you to discuss the lectures and lab material with your classmates, including studying for quizzes and exams together. You may also discuss lab reports with each other, but the report you submit must be written in your own words. The quizzes and exams evaluate your individual abilities, so these must represent your **own and honest effort.**

## Grading & Regrade Requests

Quizzes and the midterm exam will be graded and returned by the next lab session. Lab reports will be graded and returned in three days. From time to time, we will make an error in grading and we apologize in advance for this. Please give us a chance to correct this error by **submitting a written regrade request on a separate sheet of paper** explaining the error and submitting this to your IA within two lab sessions. Your IA will then consider your regrade request and notify you of their decision by the lab session after that. If you and your IA are unable to come to a satisfactory agreement, then submit your regrade request to me for a final decision. After the course, there will be a final exam viewing session where you can compare your graded exam to an answer key.



## Diversity, Equity & Inclusion

I strive to uphold the values articulated by the Office of the Vice Chancellor for Diversity, Equity, and Inclusion: "We believe that true excellence is achieved through productive relationships among people of diverse perspectives. When the collective talents of our students, faculty, and staff at UC San Diego are united in an environment that is open and inclusive, creativity and innovation prosper." I hope you will join me in creating a class that upholds [these values](#) to further enhance our learning as a community. Please [contact me privately](#) if a conflict arises that interferes with your ability to learn or participate in this class to your fullest abilities. Your request for an equitable accommodation will be held in the strictest confidence. Please take advantage of these [campus resources](#), including those that support [Basic Needs](#), [Disabilities](#), [Mental Health](#), and [Violence Prevention](#).

## Course Schedule – Summer Session 1 (July 1–August 3), 2019



This course will start with an introduction to fundamental lab skills in Labs 1 and 2, after which we will complete three main projects where you will learn and apply lab techniques to solve biochemical problems:

**Project 1: Purification and Analysis of Lactate Dehydrogenase** (LDH, Labs 3–8)

**Project 2: Signal Transduction of Fibroblast Growth Factors in NIH 3T3 Cells** (FGF, Labs 9B–12)

**Project 3: Expression and Purification of Fluorescent Proteins** (FP, Labs 15–18)

Week	Date	Project	Manual	Lab Activity	Evaluation
1	July 2		v–vii Lab 1: A-D	Lab Organization, Mandatory Safety Orientation Using Micropipettes	
	July 3		Lab 2: A-C	Making a pH Buffer, Quantitative Measurements	Quiz 1
	July 4			Independence Day holiday (no lecture or lab)	
	July 5	LDH	*Lab 3: A, B	Initial Purification of LDH: Centrifugation and Ammonium Sulfate Precipitation; Preparation of Size Exclusion Column	
2	July 9	LDH	*Lab 4: A, B	Affinity Chromatography Purification of LDH	
	July 10	LDH	*Lab 5: A, B	Size Exclusion Chromatography Purification of LDH	Quiz 2
	July 11	LDH	*Lab 6: A-H	Determination of LDH Activity Units and Specific Activity	Notebook Check 1
	July 12	LDH	*Lab 8: A, B	SDS-PAGE of LDH Purification Intermediates	
3	July 16	LDH	Lab 7: A-C	Determination of LDH Isozymes by Electrophoresis	
	July 17	FGF	Lab 9B: A-C	FGF Signaling: Develop Model and Design Experiments	Midterm Exam in Lecture
	July 18	FGF	Lab 9B: D, E	Preparation of Cell Lysates for Western Blotting and ELISA	
	July 19	FGF	Lab 10: B-D	SDS-PAGE and Western Blotting for MAPK	Notebook Check 2
	July 20			Submit your LDH lab report on <a href="#">Canvas</a> by 3 PM.	LDH Lab Report
4	July 23	FGF	Lab 11: A-D	Immunodetection of MAPK	Quiz 3
	July 24	FGF	Lab 12: A-D Lab 19: A	ELISA Determination of IP <sub>1</sub> Levels Bioinformatics Exercise (Part A only) in York Hall 3060	
	July 25	FP	Lab 15: A-C Lab 20: A	Preparation of Competent Cells and Transformation Set up Lysozyme Crystallization	
	July 26	FGF	Lab 19: C-E	Bioinformatics Exercise (Parts C, D, E) in York Hall 3060	Notebook Check 3
	July 28			Submit your FGF lab report on <a href="#">Canvas</a> by 3 PM.	FGF Lab Report
5	July 30	FP	Lab 16: A-D	Purification and Analysis of Fluorescent Proteins	Quiz 4
	July 31	FP FP	*Lab 17: A, B Lab 18: A	SDS-PAGE of Fluorescent Proteins Analysis of Fluorescent Protein SDS-PAGE Gels	
	Aug 1		Lab 20: B	Examine Lysozyme Crystals	
	Aug 2			Final Exam in Lab (no lecture)	Notebook Checks 4, 5 (FP Project)

\* There are changes to the procedures of these labs that are not yet printed in the lab manual. Please read these changes on [Canvas](#).