

INTRODUCTORY CELL BIOLOGY LABORATORY

LIFE212, Fall Semester 2017

Course Syllabus

Instructor: Farida Safadi-Chamberlain, PH.D.

Office: Yates 314

Office hours: Wednesday 12-1 pm and Friday 1-2 pm in Yates 314 or by appointment.

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Class Hours: **RECITATION: (attendance mandatory) Monday, 4:00pm to 4:50pm**
in Bio136 (The new Biology Building)

LAB sections 1 and 9: Tues 9:00 - 11:50AM,

LAB sections 2 and 7: Tues 2:00 - 4:50PM,

LAB sections 3 and 11: Wed 9:00 - 11:50AM,

Lab Rooms: Yates 311; Yates 316

Graduate Teaching Assistants

TA name	Lab Section	Office hours	Office location	Email address
Mathew Saxton	L01/09 Tues 9:00 - 11:50AM	Tues 4-5 pm	Yates 310	saxtonmn@gmail.com
Andrew Lamb	L02/07 Tue 2:00 - 4:50 PM	Mon 9-10 am	Yates 311	A.Lamb@colostate.edu
Nicholas Rivera	L02/07 Tue 2:00 - 4:50 PM	Mon 1:00 - 2:00 pm	Yates 311	Nicholas.Rivera@colostate.edu
Sharon Lian	L03/11 Wed 9:00 - 11:50AM	Mon 2-3 pm	Yates 311	Sharon.Lian@rams.colostate.edu

Course Description

This two-credit-hour laboratory course aims at equipping students with hands-on laboratory skills that are fundamental to modern cell biology and biomedical research. The lab exercises are designed to introduce students to the basic concepts and lab techniques for studying cells and to provide advanced skills that help students' senior research projects. Students of the Biomedical Sciences, Neuroscience and Biochemistry majors find this lab course useful not only in understanding some of the cell biology lecture course content, but also in developing critical thinking aptitudes necessary for their general science education and professions.

Upon completion of this course, students will be able to:

- Master basic computational chemistry and units of measurements
- Understand the importance of accuracy and precision of lab instrumentation.
- Use the UV/visible spectrophotometry in the study of protein and solute concentrations.

- Purify enzymes and study enzyme kinetics.
- Analyze proteins through protein gel electrophoresis
- Conceptualize and practice immunoassays to detect antigens or antibodies in organisms or tissue extracts.
- Acquire hands-on skills in light and fluorescence microscopy to study cell ultrastructure and function.
- Enhance the understanding of metabolic pathways such as respiration and photosynthesis.
- Use vital dyes, cell counting grids and microscopes to assess viability of cells
- Practice technical writing through lab reports and a science-journal-format term paper
- Design an experiment as an end of term exercise that uses a combination of learned lab skills and concepts.

Required Lab Manual (Available at CSU Bookstore)

Safadi-Chamberlain, Farida. (2015). Cell Biology Laboratory Manual (Third Edition). Kendal Hunt Publishing Company. Dubuque, IA. 207 pages

The lab manual is available in **printed** and **electronic formats** at CSU bookstore. The printed book and the electronic access code are each **packaged with a lab notebook** that is required to use in the lab. It is your choice to purchase either the printed or the electronic manual.

Additional Resources

- **CANVAS online:** Additional exercises, instructions and supporting material will be posted online at <http://info.canvas.colostate.edu/login.aspx>. This will be the online educational platform that LIFE 212 instructor and TAs will use to communicate with students.
- **Office Hours:** GTAs and the instructor hold office hours throughout the week, please visit the office hours or schedule an appointment. The teaching staff will be happy to assist you with any questions you may have.
- **Peer Educators:** Undergraduate TAs (your peers) are available either as study group leaders or learning assistants to facilitate experiments in the lab and help with completing lab assignments.
- **CSU Morgan Library:** You will need the library to find resources that will help you answer questions in the lab reports and for your term paper assignment. The library has designated a libguide webpage for LIFE 212 at <http://libguides.colostate.edu/LIFE212/Safadi-Chamberlain> and a library staff member is available to help students with the assignments. Instructions on navigating the library databases will be presented during the semester.

Course Organization and Teaching Methods

- **Recitation:** All LIFE 212 sections' students meet for one hour on Mondays 4:00-4:50 pm to prepare for the week's experiment. **Attendance is mandatory.** Students are required to prepare for recitation by a specific **PRE-LAB WRITE-UP** described in this syllabus. The recitation consists of an interactive lecture and group activities that are designed to help students conceptualize the theoretical background behind the weeks' experiment. A brief description of the experiment protocols, additional pointers and potential changes to the protocol are also discussed. Discussions and questions about the previous lab and report writing may be addressed here. An **OPEN-NOTEBOOK QUIZ** is given at the end of the recitation period.
- **Labs:** A three-hour lab time is reserved for students to run the experiments. Students conduct experiments in groups of two using instrumentation and equipment found in a typical cell biology laboratory. The laboratory exercises do not necessarily follow closely the lecture material in LIFE 212. Students are expected to fill the three-hour period by the experiments, plotting their data and answering the report questions.

Note: All experimental material used by students should be LABELED clearly: LABELS must include: **1) Contents of the tube**, **2) concentration** (if applicable), **3) date; including the year**, **4) student *names* or clear initials**, and **5) Section**.

Assessments

- Weekly open-notebook quizzes will be administered to students at the end of recitation (30 pts each).
- Weekly experiment-based lab reports (50-100 pts each).
- One term paper (100 pts).
- Lab notebook checks: twice a semester (100 points each).
- Two exams: a midterm and a final exam (200 pts each).
- Assignments to engage students in learning (pts vary)
- Lab Tech Grade (LTG): assesses the prelab notebook write-up and student performance in the lab (10 pts each)
- Extra Credit assignments to enforce understanding of concepts

Laboratory Notebooks

Students need to follow the specific instructions outlined in section C) below for writing in their lab notebooks. Lab notebooks will be collected twice during the semester for grading. Legible handwriting and neatness is crucial for good grades.

A) A secure spine-bound notebook is required:

- Not spiral bound, NO tear out page perforations.
- The laboratory notebook of a scientist is a legal document: it outlines daily progress of experiments.
- Written in Ink: Calculations, notes, and results should be recorded in ink directly into the notebook.
- Nothing should be erased or obliterated. Mistakes are crossed out with a single line so the original work is still visible. Empty spaces in the notebook are crossed out.

B) Pre-laboratory write-up and preparation:

Written BEFORE recitation on Monday in the student's wording and not copied directly from the handouts. This will help you do well on the quizzes and finish lab on time. Prelab write-up should include the following:

- **Title & Date of the experiment**,
- **Introduction**
- **Materials and Methods**.

C) Specific Instructions for Lab notebook write-ups: You should write legibly and follow the following format:

1. Table of Contents: at the beginning of your notebook, dedicate a few pages for use as a table of contents which includes title of each experiment and page numbers for each experiment. Keep it up to date as you write in your notebook.
2. Title and Date: The title of each experiment needs to be descriptive yet concise. Record the date (and possibly what time, if applicable) the experiment was carried out.
3. Introduction: This section should be written with your own wording before the lab period. Cutting and pasting from handouts' material is NOT allowed. The introduction should contain
 - **the theory or background** behind the experiment (not more than 2 to 3 sentences)
 - **the question** to be investigated based upon the background (one sentence)
 - **hypothesis** which includes the predicted results (one to two sentences maximum)
 - **the objectives** of the experiment (one to two sentences).
4. Materials and Methods: This section should be written before the lab period and then modified as needed during the conduction of the experiment. The experiment section should contain
 - the materials and reagents,
 - the equipment used

- the methods (protocol) that you will follow during lab

Use a **flow chart** of the protocol whenever possible. One should be able to repeat the experiment using only the methods you have written in your notebook.

5. Lab reports/ Results and Discussion: For teaching purposes only, the Results and Discussion section of your lab notebook is replaced by a “**Report Handout**” that students fill with their experimental data and answers to questions. Completed reports will be collected weekly by the instructor to grade. Graded reports will be handed back to students in the following week. **Graded lab reports are then stapled into the notebook** to serve as a “Results and Discussion” section. In research labs, the results section contains the observations, sketches of biological specimens, raw data, calculations, and tables and graphs that are generated from the data, as well as any other notes. In research labs, raw data should go **directly** into the notebook for legal reasons such as patents.
6. Graphs: Students must Excel (or a comparable software) to generate graphs. Hand drawn graphs on regular paper are unacceptable. Keep e-copies of your graphs.
7. Conclusions: This section is written right after the experiment is completed or after you write your report and before you submit it for grading. The conclusion should include:
 - Brief summary of the results of the experiment
 - Brief interpretation of the results
 - Significance of the findings
 - What you learned from this experiment
 - What would you do **next** to carry over and expand the results
 - Answer the question: “did I achieve my objective/s?”
8. Signatures: Instructor’s (or TA’s) signatures for signing in and out of the lab.

Quizzes (20 points each)

A weekly open-notebook quiz will cover the current week’s lab (pre-lab write-up and background principles) and more comprehensive material from the previous week’s lab. Students who come prepared, maintain a well-organized notebook and are conscientious in their observations and data evaluation/processing should do well on quizzes and laboratory reports. **Completing the pre-lab write-up in your notebook before recitation will help your quiz grade.**

Exams (200 points each):

Midterm exam will be a combination of multiple choice and essay questions, the final exam will be non-comprehensive and composed of multiple Choice questions only.

Laboratory Reports (50 to 100 points each)

Lab results and observations, data tables, and/or graphs and their analyses are reported in the weekly laboratory report. The reports will be a mix of data reporting and critical thinking responses. **Students are strongly encouraged to complete the report during the lab period.** Group discussions with your peers and the TAs regarding questions in the report are highly encouraged, but students are required to write reports independently. Copied reports will be treated as cheating and will get a ZERO grade. Laboratory reports from the previous week will be due at the end of recitation on Monday of the following week. **NO LATE REPORTS. 10 points per day will be deducted for late reports.**

Laboratory Technique Grade (130 points):

Laboratory technique grade applies 10 points per lab to assess students’ preparedness and their participation in the lab. Students will be assessed 5 points for prelab write-up at the beginning of each lab. The remaining five points will assess the students’ participation in the experiment, accuracy in following the experimental protocols and obtaining data, tidiness of the bench and the careful use of the lab supplies and materials. These points will be assessed by the instructors upon the students’ signing out of the lab. The lab period is about 3 hours and the students are expected to fill the lab period with the

experimentation and writing the report. Note that due to the nature of biological research, some experiments require that you come during a later time of the day or week to finish up

Grading

Student evaluation will be based upon the weekly quizzes, two exams, lab reports, lab notebooks, assignments and the lab technique grade. Additional extra credit questions will count towards the grade. Letter grade scheme is as follows:

A+ = 95.1% and above	A = 90 or greater and less than 95.1	A ⁻ = 89 or greater and less than 90
B+ = 85.1 or greater and less than 89	B = 80 or greater and less than 85.1	B ⁻ = 79 or greater and less than 80
C = 70 or greater and less than 79	D = 55 or greater and less than 70	F = less than 55

Point allocation:

Quizzes:	20 pts ea	total of 11 quizzes	220 points
Laboratory Reports:	50-100 pts ea	total of 13 reports	760 points
Laboratory Notebook	100 pts ea	graded @ mid-term & final	200 points
Lab technique grade	10 pts ea	per lab period	130 points
EXAMS	200 pts ea	Total of 2 Exams	400 points
Assignments	40 pts		40 points
Total			1750 points

Lab Policies

Missing laboratory sessions:

MISSING LAB ACTIVITIES CANNOT BE MADE UP; IF YOU MISS A LAB YOUR LAB REPORT GRADE WILL BE ZERO. Submitting a lab report using your partner results will NOT be accepted. If you cannot attend a lab for a very good reason email or see the instructor (not the TA) before the laboratory session to arrange to attend another laboratory section.

Post-laboratory clean-up

At the end of each laboratory period you are required to clean your bench area, properly dispose of experimental waste, dump ice, wash any used glassware with hot water and detergent and put away all assigned equipment. Before you leave, wipe your bench with a cleaner disinfectant. Note that sloppy clean-ups or failure to comply with these instructions will affect your lab technique grade.

Student academic misconduct

The weekly quizzes, reports, assignments and extra credit exercises must be your individual work and cannot be copied from your friend or partner in the lab. Acts of student misconduct are defined as: cheating, plagiarism, unauthorized possession or disposition of academic materials, falsification, or facilitation of acts of misconduct. These acts are subject to disciplinary action by the instructor and the CSU Office of Conflict Resolution and Student Conduct Services. For more information, see: <http://learning.colostate.edu/integrity/index.cfm>

TENTATIVE SCHEDULE

Week of:	LECTURE AND LABORATORY
1- Aug 21	Recitation: Course overview, Organization; Introduction to Concentrations of Solutions, Small Volume Measurement, Accuracy and Precision of Data Measurement Lab Exercise: Check into Laboratory; Concentrations of Solutions, Accuracy and Precision of Instruments
2- Aug-28	Recitation: Introduction to Immunoassays Exercise: Enzyme Linked Immunosorbent Assay; ELISA
3- Sept 4	Recitation: Cancelled, Labor Day Holiday Introduction to Spectrophotometry and Enzyme Kinetics / Lecture during the lab period Exercise: ENZYMES I: Partial Purification and Characterization of Tyrosine Enzyme from Potato Tubers
4- Sept 11	Recitation: Effect of the Environment on Enzyme Activity Exercise: ENZYMES II: Effects of Enzyme Concentration, pH and Temperature on Enzyme Activity
5- Sept 18	Recitation: Parameters of Enzyme Kinetics Exercise: ENZYMES III: Kinetic analysis of the Tyrosinase Enzyme: K_M and V_{MAX} ; Enzyme inhibitor analysis
6- Sept 24	Recitation: Characterization of Proteins: Protein Gel Electrophoresis and Determination of Protein Concentration Exercise: Gel Electrophoresis: Assessing the Purity of Tyrosinase Enzyme by SDS PAGE, Quantitative Determination of Protein Concentration by Colorimetric Assays,
7- Oct 2	Recitation: EXAM I, Notebooks DUE (Review session TBD) Exercise: Morgan Library Instructions; Data Base Search
8- Oct 9	Recitation: Introduction to Microscopy Exercise: Introduction to the Compound Light Microscope: Types and Proper Use.
9- Oct 16	Recitation: Light Microscopy/continued Exercise: Microscope Viewing: Cells of Living Organisms
10- Oct 23	Recitation: Cell fractionation, Mitochondria Isolation and Respiration Exercise: Qualitative Assay of Mitochondrial Respiration
11- Oct 30	Recitation: Introduction to Photosynthesis: Light/Hill Reactions Exercise: Chloroplast Isolation and Quantitative Assay of Hill reaction
12- Nov 6	Recitation: Introduction to Fluorescence Microscopy Exercise: Immunostaining of Cells for Fluorescence Microscopy
13- Nov 13	Recitation: Fluorescence Microscopy continued- The Hemocytometer and Cell Viability Assay Exercise: Fluorescence- Stained Cell viewing, Cell Viability Assay
14- Nov 20-Nov 24	Fall Recess: Thanksgiving Break
15- Nov 27	Recitation: Cell Signal Transduction and Cell Cycle: Yeast pheromones Exercise: Experimental Design Workshop
16- Dec 4	Recitation: EXAM II, Notebooks DUE (Review session TBD) checkout and evaluation

Addendum to the Syllabus: Lab Report 11 Scientific Paper Writing Schedule

Introduction: The report for the Fluorescent Microscopy (FM) Lab # 11 will be a formal lab report paper written in the form of a publishable scientific journal article. To help students with writing, the assignment is broken down into stages: Parts of the paper will be due at various milestones during the semester. Submitted portions of the paper will be graded and feedback will be provided to students. This allows for early completion of sections of the paper and the use of grading feedback to improve the paper before turning in the final product. Since the paper is assigned to a lab experiment that is conducted later in the semester, reading assignments will first be given to help students understand the background behind the experiment. For instructions on how to write the paper, students will follow guidelines for the writing assignment that is posted on CANVAS and on the LIFE 212 Library Guide (Libguide.libraries.colostate.edu).

The table below outlines the scheduled paper assignments and their due dates.

Timelines for the assignments (40 points):

Date	week	Assignments/Due	Notes
August 21st, 2017	First week of classes	Brief description of the staged paper assignment and deadlines	Assignment will be described briefly as an Addendum to the syllabus
October 2nd, 2017	Midterm Week	<ul style="list-style-type: none"> ▪ Asst #1: Reading about FM and the paper guidelines. Take home quiz, ▪ Library Instructions ▪ Literature search: at least three relevant articles + Synopsis 	Take home assignment: FM and the cytoskeleton
October 9 th , 2017	Week 8	Due Asst #1: Take home quiz (10 pts) Asst #2: Title and Author (3 pts) Due Asst #3: Literature search: at least three relevant articles + Synopsis	Instructors will grade and give feedback
October 16th, 2017	Week 9	Due: Asst #2: Title and Author (3 pts) Asst #4: Introduction (8 pts)	will grade and give feedback
October 23 th , 2017	Week 10	Due Asst # 4: Introduction (8 pts) Asst #5: Materials and Methods (6 pts) Asst #6: Abstract without results (5pts)	will grade and give feedback
Oct 30th, 2017	Week 11	Due Asst # 5: Materials and Methods section (6 pts) Due Asst # 6: Abstract without results (5pts)	will grade and give feedback
November 6 th , 2017	Week 12	Fluorescence Microscopy Lab practicum: Immunostaining	will grade and give feedback
November 13 th , 2017	Week 13	Fluorescence Microscopy Lab practicum: Fluorescence image viewing, Questions	will return all graded assignments to students with feedback
Nov 27 th , 2017	Week 15: after Thanksgiving	Paper due: Results and Discussion, Conclusion and whole paper based upon the guidelines in the manual	will grade and give final feedback