



INTRODUCTORY CELL BIOLOGY LABORATORY

INSTRUCTOR INFORMATION

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GRADUATE TEACHING ASSISTANTS

information in a separate document

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 you to the concepts and lab techniques used in studying cells and to provide training in advanced technical and critical thinking skills that are valuable to your general science education and future professions. The course contains 12 modules of Laboratory exercises. Topics include:

- Calculating concentrations and Preparing solutions
- Enzyme kinetics (3 modules)
- Protein characterization and quantitation
- Types and proper use of microscopes (2 modules)
- Cell fractionation
- Cellular Metabolic pathways: Photosynthesis and respiration
- Immunoassays
- Fluorescence microscopy
- 3-D structures of Proteins

The course materials are grounded in the College of Natural Sciences priorities and goals and align with The Department of Biochemistry and Molecular Biology Mission for Undergraduate Education.

COURSE GOALS

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

- Master basic computational chemistry and units of measurements
- Recognize 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.

- Describe the metabolic pathways of 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 end-of-term experiment that uses a combination of learned lab skills and concepts.
- Identify support and resources available to CSU teaching faculty.

TEXTBOOK:

On-Line Laboratory manual with access from your LIFE212 CANVAS page. Purchasing of the access code is available to you through CSU bookstore or Kendall Hunt Publishing CO. ISBN : 9781792443091. "Safadi-Chamberlain, Farida. (2020). "Cell Biology Laboratory Manual" (Fourth Edition). Kendal Hunt Publishing Company. Dubuque, IA. Lab Exercises and downloadable Reports are compiled in this manual. For support you can either email websupport@greatriverlearning.com or use the [web support form](#) to let Kendall Hunt know of any issues you are having.

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.
- **Graduate Teaching assistants (GTAs) and the instructor** hold **office hours** throughout the week, GTAs are an excellent resource for help; and I am always there for you, visit the office hours or schedule an appointment. We will be happy to assist you with any questions you may have.
- **PEER Educators:** Undergraduate TAs (your peers who took the course last year) are available to facilitate experiments in the lab, answer questions and help with completing lab assignments. They are also a great resource since they have been there not too long ago and will guide you through.
- **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 dedicated a webpage for LIFE 212 at <http://libguides.colostate.edu/LIFE212/Safadi-Chamberlain>, a library staff member is available to help you with the assignments. Instructions on navigating the library databases will be presented during the semester.

COURSE ORGANIZATION AND TEACHING METHODS

CLASSROOM CLIMATE: My teaching method is based upon creating an engaging learning environment that is consistent with CSU's mission and vision of access, research, teaching, and service. A collaborative and vibrant community is a foundation for learning, critical inquiry, and discovery. In LIFE 212, I make every effort to create a community consisting of the instructor, students and teaching assistants to uphold the CSU principles of community of **inclusion, integrity, respect, service, and social justice**. [CSU Principles of Community](#)

UNIVERSAL DESIGN FOR LEARNING/ACCOMMODATION OF NEEDS

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions will be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning. Consistent with the university policy, the Student Disability Center (SDC) and the College of Natural Sciences (CNS), my teaching method is committed to provide ALL students with environments that support their learning. If you will need accommodations in this class, please contact me to discuss your individual needs. Please be aware that the policy of the College of Natural Sciences' regarding Lab assignments that are due on a weekly basis, does NOT allow for extended time accommodations:" Time

extensions will generally **NOT** be granted for assignments or labs that are collected and graded on a weekly basis. Extension as a reasonable accommodation may be considered, though circumstances may limit this possibility." The syllabus and the calendar on Canvas include expected completion times for all assignments and laboratory reports; scheduled due dates are sufficiently long to accommodate students who require extended time to complete assignments. **Therefore, all students (including those with SDC accommodations) are expected to submit all assignments, including laboratory reports or other assignments associated with laboratory courses, as defined in the course syllabus.**

RECITATION (MANDATORY):

All students registered for LIFE 212 sections L01, L02, L03, L07, L09, L11, must meet for one hour on Mondays 4:00-4:50 pm to prepare for the week's experiment. **Attendance is mandatory.** The recitation consists of an interactive lecture and group activities that are designed to help you conceptualize the theoretical background behind the weeks' experiments. 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. Preparing for the recitation ahead of time by looking over the background material and study guides, watching related videos, and writing the specific **PRE-LAB WRITE-UP** in your notebook will help you learn the material better during recitation, participate in the activities and do well in the **prelab quiz** and the lab protocol.

LABS: A three-hour lab time is reserved for you to run the experiments. You will conduct experiments using instrumentation and equipment found in a typical cell biology laboratory. The laboratory exercises do not necessarily follow closely the lecture material in LIFE 210. You are expected to fill the three-hour period by the experiments, plotting your 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 **legible** initials, and 5) Section.

ASSESSMENTS

Assessments are made for you to practice the material learned and to give me feedback about your understanding of the subjects taught. Some assignments will help you with critical thinking in the area of science and to engage you in a thinking conversation with your peers. The assessments below are diverse in types to accommodate the diversity of learners

- Weekly open-notebook quizzes before each lab (20 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

Virtual notebooks are used this semester. A Downloadable Notebook document is posted for you with pre-entered headings to guide you through the Lab notebook writeups. Students will keep a running document of the Notebook by adding to it the required material for every lab. There are two formal graded Lab notebook assignments:

- 1) **WEEKLY PRELAB WRITE UP ASSIGNMENT (NOTEBOOK WRITEUP/LTG)**: These are written according to the specific instructions below and by filling in under the corresponding headings provided in the lab notebook document. You may make additional headings if you need to, but do not spend too much time copying the details of the protocol, be concise but accurate, make charts when possible to plan your experiment.¹ The notebooks will be checked weekly for the pre-lab writeup by the GTAs and UTAs for grade that is included in your **Lab tech grade**.
- 2) **TOTAL LAB NOTEBOOK ASSIGNMENT**: twice in the semester, once with midterm and another before the final exam, Lab notebooks will be collected and graded for all the labs. Complete lab notebook with all the sections as outlined in the specific instructions below is required at this time.

SPECIFIC LAB NOTEBOOK INSTRUCTIONS: Follow the following instructions for writing in your lab notebooks.

a) TABLE OF CONTENTS

Dedicate few pages at the start of your notebook for a table of contents. This includes the title and page of each experiment. Keep it up to date as you write in your notebook.

b) 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.

c) PRE-LABORATORY WRITE-UP

Fill in BEFORE recitation on Monday and in your **own wording, NO COPYING directly from the manual. Include the following:**

- Introduction
- Materials and Methods.

Introduction: In your own wording write the following about each lab

- 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).

¹ Note that in research labs, a notebook is a legal document to protect the authenticity of the lab research work, discoveries, and patents; 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. Online research notebooks that follow these rules are available in research labs.

Materials and Methods: This section should be written **BEFORE** the lab period and then modified as needed during the conduction of the experiment. This should contain

- the materials and reagents,
- the equipment used
- the methods (protocol) that you will follow during lab

Methods are best charted as **flow Chart** of the protocol that you and others can readily follow.

d) LAB REPORTS/ RESULTS AND DISCUSSION:

The Results and Discussion section of your lab notebook is replaced by a “**Report assignment**” that students fill with their experimental data and answers to questions. The reports are submitted and graded separately from the lab notebooks. **Reports are due at the end of recitation on Mondays** unless stated otherwise by the instructor. Graded reports will be returned to you in the following week. 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.

Graphs: You must use Excel (or a comparable software) to generate graphs. Hand drawn graphs on regular paper are unacceptable and will be graded with a zero. Keep e-copies of your graphs.

e) CONCLUSION

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**; Future directions?
- Answer the question: “did I achieve my objective/s?”

f) 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. If you come prepared, maintain a well-organized notebook and are conscientious in your observations and data evaluation/processing, you 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 comprehensive and composed of Multiple-Choice questions only.

LABORATORY REPORTS (50 TO 100 POINTS EACH)

You will fill a weekly downloadable lab report by recording your data, analyzing it, plotting graphs, and answering critical thinking questions. **We strongly encourage you 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 you must 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 pts deduction per day for late reports.**

RUBRICS: Rubrics for each report will be posted online to guide you through filling the reports. The reports will be graded online, and the feedback will be given as comments within the rubric.

GRADING

You are here for learning important skills for your professions, assessments tell me if I am achieving my goal in teaching you. The grade is a good motivating goal, but do not study and work for the grade only, value learning and have fun discovering something new. Grades will be based upon 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+ $\geq 95.1\%$	A $90\% \geq \leq 95.1\%$	A⁻ $= 89 \geq \leq 90$
B+ $= 85.1 \geq \leq 89$	B $= 80 \geq \leq 85.1$	B⁻ $= 79 \geq \leq 80$
C $= 70 \geq \leq 79$	D $= 55 \geq \leq 70$	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	100 pts ea	Total of 2 Exams	200 points
Assignments	60 pts		60 points
Total			1570 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 the instructor (not the TA) before the laboratory session to arrange to attend another laboratory section.

POST-LABORATORY CLEAN-UP

You are required to clean your bench area at the end of each lab session; dispose of experimental waste, dump ice, wash used glassware with hot water and detergent, and put away all assigned equipment. Before you leave, clean your bench with a disinfectant; 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 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. Consult <https://tilt.colostate.edu/integrity/> for more information.

GROUP WORK

Group work is an opportunity for you to learn from one another. We encourage student-to-student engagement to promote deeper thinking and sharing of information, ideas and experiences among you and your classmates. Please respect each other's time, intellect, participation, and contribution to your discussion/assignment. Your learning experience lies within your participation in the critical thinking that goes in the assignment. We reserve the right to change any group individuals or partnership in which discrepancy in participation of the partners is observed and along with it changing the grade that is dependent on participation.