

INTRODUCTORY CELL BIOLOGY LABORATORY- LIFE 212

RECITATION: Monday, 4:00pm to 4:50pm in ANAZO W118 (attendance mandatory)

Instructor: Dr. Corey Rosenberg; Email: corey.campbell@colostate.edu; Phone : 970-491-8103

Office hours: Mon 2:30-3:30pm in MRB 212, Wed 12:30-1:30pm in Yates 311 or by appointment. Instructor and TAs are available outside of posted office hours; please contact them at least a day in advance to schedule an appointment. We will be happy to assist you with any questions you may have. In addition, contact Dr Rosenberg directly if you are ill and cannot attend class. We will not use the Canvas Discussion board in LIFE 212; instead, please speak to TAs and the Instructor directly to clarify concepts and due dates.

LAB sections

Section L04, Wed 2:00 - 4:50PM, Yates 311

Section L05, Thurs 9:00 - 11:50AM, Yates 311

Section L06, Thurs 2:00 - 4:50PM, Yates 311

Section L08, Thurs 9:00 - 11:50AM, Yates 316

Section L10, Thurs 2:00 - 4:50PM, Yates 316

Section L12, Wed 2:00 - 4:50PM, Yates 316

(Sections 1,2,3,7,9, 11 are taught by Dr. Farida Safadi-Chamberlain)

Course Description: This laboratory course is an introduction to important techniques employed by cell biologists. We start with a review of basic principles of units and measurements used in data collection and analysis. Later sessions introduce techniques such as immunoassays for the detection of antigens or antibodies in tissue extracts, UV/visible spectrophotometry as used in the study of protein and solute concentrations, enzyme purification and kinetics, protein gel electrophoresis and analysis of proteins. Students will

also gain experience in basic principles of light microscopy and fluorescence cell staining in the study of cell structure and types. Additionally, methods for studying respiration and photosynthesis will be covered.

Lab Manual- Exercise instructions, weekly lab report forms, and a lab notebook are bound in a single packet for purchase from the CSU Bookstore (author- F. Safadi-Chamberlain). **Lab Manual modifications and corrections will be announced during the recitation period and posted in weekly lecture slides.** Additional exercises and supporting materials will be posted on Canvas and should be downloaded prior to each lab period. It is your responsibility to obtain your own printouts, when and if needed.

Each recitation will be devoted to 1) background for each subject, 2) a brief summary of the week’s experiment and 3) a quiz; **it is your responsibility to do the pre-lab write-up in your lab notebook prior to recitation.**

SCHEDULE - LECTURE AND LABORATORY

LAB WEEK	LECTURE TOPIC	LAB DAY
Aug 21-26	Recitation: Course overview; Lab Math;	Lab 1: Check into Lab; Lab Math Review
Aug 28- Sep 1	Introduction to Immunoassays Quiz 1 (Labs 1 and 2)	Lab 2: Enzyme Linked Immunosorbent Assay; Mock ELISA
Sept 4-8	Monday- Labor Day holiday (Recitation cancelled) Lab DAY- Introduction to Enzyme Kinetics	Lab 3, ENZYMES I: Partial Purification and Characterization of Tyrosine Enzyme from Potato Tubers
Sept 11-15	Recitation: Environmental effects on Enzyme Activity	Lab 4, ENZYMES II: Effects of Enzyme Concentration, pH

	Quiz 2	and Temperature on Enzyme Activity
Sept 18-22	Recitation: Parameters of Enzyme Kinetics Quiz 3	Lab 5: ENZYMES III: Kinetic analysis of the Tyrosinase Enzyme: KM and VMAX ; Enzyme inhibitor analysis
Sept 25- 29	Recitation: Characterization of Proteins: Protein Gel Electrophoresis and Quantitation Quiz 4	Lab 6: Gel Electrophoresis: Assessing the Purity of Tyrosinase Enzyme by SDS PAGE, Quantitative Determination of Protein Concentration by Colorimetric Assays
Oct 2-6	Recitation: Introduction to Microscopy Quiz 5	Lab 7: Brightfield Light Microscope use
Oct 9	Exam I covers Lab exercises 1-6 (4-6pm)	Lab Day: Notebook grading I
Oct 16- 20	Recitation: Light Microscopy/continued No quiz	Lab 8: Microscope Viewing: Cells of Living Organisms
Oct 23- 27	Recitation: Cell fractionation, Mitochondria Isolation/Respiration Quiz 6	Lab 9: Qualitative Assay of Mitochondrial Respiration
Oct 30- Nov 3	Recitation: Introduction to Photosynthesis: Light/Hill Reactions Quiz 7	Lab 10: Chloroplast Isolation and Quantitative Assay of Hill reaction
Nov 6-10	Recitation: Introduction to Fluorescence Microscope	Lab 11: Immunostaining of Cells for Fluorescence Microscopy

	Quiz 8	
Nov 13-17	Recitation: Fluorescence Microscopy continued- The Hemocytometer and Cell Viability Assay <div style="text-align: center;">Quiz 9</div>	Fluorescence Lab 11 cont'd; Lab 12: Labeled Cell viewing, Cell Viability Assay
Nov 20-24	Fall Recess: Thanksgiving Break	
Nov 27- Dec 1	Recitation: Cell Signal Transduction and Cell Cycle: Yeast pheromones <div style="text-align: center;">Quiz 10</div>	Lab 13: Experimental Design Workshop
Dec 4-8	Recitation: EXAM 2, covers Lab exercises 7-13 (4- 6pm)	Lab day: Notebooks due, checkout and evaluation

Execution of Experiments: Students will work in pairs; a two-student team will be assigned a station and will work together throughout the semester. Instrumentation and equipment will be used that is found in a typical cell biology research laboratory. All written work will be done individually.

Lab safety: Students are required to wear closed-toed shoes and pants that fall at or below the knee. Lab coats and safety glasses are optional. Any student who is not dressed appropriately must acquire appropriate clothing before they will be allowed to complete their experiment. No special allowances will be provided for make-up labs.

Lab Notebook Entries (200 points, includes weekly pre-laboratory write-up and experimental planning): Students will enter the pre-lab writeup, recorded data and experimental results into the lab notebook provided in the purchased course manual packet. The **Title & Date, Introduction** and **Materials and Methods** sections should be completed before you come to the recitation. Pre-lab write-ups should be written in your own words, not copied directly from the Lab Manual. **Pre-lab planning will help you do well on all open notebook quizzes and conduct and finish your experiments with fewer mistakes.** A secure spine-bound (not spiral bound) notebook is used in this course. In it, you will outline the experimental plan before the lab period and document your experimental data and conclusions. Any calculations, notes, and results should be recorded directly into the notebook. The laboratory notebook of a scientist is a legal document that shows the progress of experiments on a given day. Notes will be written in the notebook (in either pen or pencil) as the experiment proceeds, and nothing should be erased or

obliterated. Mistakes are crossed out with a single line so the original work is still visible. The laboratory notebook will be graded according to the criteria below at mid-term and the end of the semester. Notebooks that are not turned in on time will receive a 20 point deduction.

Your notebook should be *legible* and will be graded to confirm that it contains the following:

1. Table of Contents: In the first few pages of your notebook, dedicate a few pages as a table of contents, which will include the title and page numbers for each experiment. Keep it up to date.
2. Title and Date: This section should be written before class. The title of each experiment needs to be concise and descriptive.
3. Introduction: This section, written with your own words, briefly summarizes 1) the general scientific theory behind the experiment (not more than 3 to 5 sentences), 2) the experimental question or hypothesis to be investigated (one sentence), 3) the predicted results (one to two sentences maximum). Cutting and pasting from instructional material is NOT acceptable practice. (Prior to grading, highlight or circle each number to make it easier for the grader).
4. Materials and Methods: This section should be written before the lab period and then modified as needed during execution of the experiment. The experiment section should contain the materials and reagents, the equipment used and the methods (protocol). **Use a flow-chart whenever possible; this will shorten the time required to describe the materials/methods, as well as become a roadmap for you to follow as you execute the experiment.** One should be able to repeat the experiment using the methods you have written in your notebook.
5. Results and discussion: This section contains your observations, sketches of biological specimens, raw data, calculations, tables and graphs that you generate from the data, as well as any other notes. For legal reasons such as patents of experimental results, your raw data should go **directly** into your notebook. However, for the purpose of this class, your lab report (after grading) should be taped or stapled to the notebook to serve as a Results and Discussion section.
6. Graphing should be done using computer software. **You should keep e-copies of graphs, because you may need to refer to the graph before the graded work is returned to you.**
7. Conclusions: (Not more than 10 sentences) This section is written immediately after the experiment is completed and before you submit it for grading. Summarize (and highlight) 1) the results of the experiment, 2) your interpretation of the results, 3) the significance of your findings and what you learned from this experiment, 4) what would you do next to carry over and expand the results, 5) answer the question: “did I achieve my objective/s?” Think *critically about your data*. Were your results what you expected? An important objective of this course is to learn to *critically evaluate data*. Analyze your results and comment on why an experiment failed, if necessary. If the failed experiment is not repeated, state what you might do differently to derive a successful outcome or what you could do to improve it in the future. Students are not penalized for non-optimal results, however, it's essential that you thoroughly and accurately report your actual results.

Post-laboratory clean-up 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. Finally, wipe your bench with a cleaner disinfectant before you leave. Failure to comply or checkout with an instructor will result in loss of lab performance grade points.

Exams (200 points each) There will be a midterm and final exams of 200 pts each, which will be held during the recitation period (see schedule above). Both exams will be composed of multiple choice questions; the final exam is not cumulative. Exam Study aids are available at Canvas/ [2016FA-LIFE-212-L04/ Modules/ Exam Study Aids/](#).

Recitation/Quiz Attendance is mandatory. The recitation lecture will provide theoretical principles behind the week's experiments, potential changes in the protocol, and emphasize key course principles. A quiz will be given weekly at the end of the recitation period, as indicated in the schedule above. Lecture slides will be posted weekly.

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 read background material prior to the lecture, maintain a well-organized notebook and are conscientious in their observations and data evaluation/processing should do well on quizzes and laboratory reports. Study sources for quizzes include lecture slides, lab notebook, lab manual background information.

Laboratory Reports (50 to 100 points each) Students will be required to turn in weekly laboratory reports containing sketches of observations, tables, and/or graphs. The reports will be a mix of data reporting and critical thinking responses. Students are strongly encouraged to complete each week's report during the lab period. If an experiment produces atypical or unusual results, be sure to provide a short explanation as to the possible reason for any anomalies. **Laboratory reports will be due the following Monday at Recitation.** Late laboratory reports will not be tolerated. 10 points per day may be deducted for late reports.

Keys to success:

1. Write legibly. Handwritten answers must be readable. If your handwriting is messy, type your lab reports. If something is illegible, it will NOT be graded and you will have to re-do your submission; this will result in the deduction of points (see point 7 below).
2. In problem-solving, show all your work and calculations; do not simply write the answer. Write out everything of importance. The bottom line is that your math has to be easy to follow. If a problem asks for repetitive calculations, provide one Example calculation only, and indicate that in the answer.
3. Always include units (note: some values are unitless), including on graphs.
4. Everything you submit for evaluation must be solidly stapled

5. Every page you include as an add-on to your lab report must have your name, page number, and section # on it.
6. A reasonable level of aesthetics on submitted assignments is expected. Torn or dirty paper will not be accepted, nor paper previously used for other purposes (i.e. turning in a report with unrelated writing on it).
7. Unless a valid reason is supplied, lab reports or any other assignment turned in late will be subject to point reduction at the Instructor's discretion. Late submissions and resubmissions should be turned in at Yates 311.

Laboratory performance Grade (5 points per week; up to 65 points per semester) is a measure of students' weekly participation in the lab notebook pre-lab write-up, execution of the experiment, thoroughness in following the experimental protocols and recording data, following the rules of lab courtesy and safety requirements, as well as tidiness and the conscientious use of lab supplies and equipment. Coming prepared to work during the lab period is essential to success. Relying on your lab partner to do the work is not acceptable. Instructors will ascertain student participation when assigning lab technique grades. Scientific research and experimentation require special qualities of patience, organization, and accuracy: Careful experimental planning (ie., laying out the sequence of the steps in a protocol) and good time management will help you efficiently obtain accurate and successful experimental results. 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 some steps or make observations. Success in the lab requires attentiveness and participation. The lab period is about 3 hours, and you are expected to complete each experiment and work on the report during this time. Group discussions with your peers and the TAs regarding questions in the report are highly encouraged.

Grading

A+	100%	to 96.67%
A	< 96.67%	to 90.0%
B+	< 90.0%	to 85.1%
B	< 85.0%	to 80.0%
B-	< 80.0%	to 79.0%
C+	< 79.0%	to 76.67%
C	< 90.0%	to %
D	< 76.67%	to 70.0%
F	< 55.0%	to 0.0%

Point allocation- 1660 pts possible

	Points each	Semester totals	Semester Pts total
Quizzes	20 pts	10	200
Lab reports	50-100	13	710
Lab notebook	100		200
Lab performance			65
Exam	200	2	400
e-poster staged assignments	35		35
e-Poster			50

Missed laboratory sessions cannot be made up and will result in a Zero score on the Lab Report. If you cannot attend a lab, contact your lab Instructor (not the TA) in advance to arrange to attend another laboratory section. Alternatively, be prepared to submit a documented medical release form, signed by your physician.

Canvas Students are required to make use of **Canvas** to keep abreast of important announcements, discussions and course materials. Under the LIFE212 course header, you will find all the materials you need for this lab. Please do not rely on the discussion board to send a message to the instructors or the TAs. Instead, directly email them with your questions.

Cheating/Plagiarism All written work in quizzes, reports and exams shall be the work of the individual student; using another student's work is considered cheating. Falsification of data from experiments is also considered cheating. Plagiarism is the use of information without appropriate citation of sources. Instructors allow quizzes to be taken with an open lab notebook. This is meant to encourage detailed note-taking. An open lab manual during quizzes is not allowed and is considered cheating. Plagiarism and cheating are academically dishonest and, as such will incur penalties in accordance with CSU policy. Appropriate use of Resources: If Internet or primary literature sources are used, they must be cited every time they are used in a written

assignment. Penalties for cheating/plagiarism/data falsification: In accordance with CSU Academic Integrity Policies, cheating/plagiarism may result in a reduced grade for a given assignment, a failing grade for the course or the removal of the repeat/delete option for the course.

Staged Scientific writing assignment (e-poster) A LIFE 212 experiment of your choice, from **Labs 2, 4-6, 9-10**, may be used as subject matter for a formal lab report, composed in the form of an e-poster. Students are expected to independently consult online sources to find additional detailed peer-reviewed information pertinent to the subject matter and appropriately cite those sources in the assignment. The subject matter could be focused on an antibody assay (ELISA) (lab 2), enzyme function (labs 4-5), protein quantitation and separation (lab 6), mitochondrial function (lab 9), or chloroplast function (lab 10). **You will report your own data from a LIFE 212 experiment. You are encouraged to think creatively on how best to report that information in an engaging format for the reader.** The creative use of illustrations, graphs and diagrams are strongly encouraged. Drafts of specific parts of this assignment will be graded in stages by the GTAs. This will allow you to make progress in a step-wise fashion and perhaps garner helpful feedback from the TAs on appropriate content for a peer-reviewed journal article. Detailed e-poster instructions will be available on Canvas under Canvas/ 2015FA-LIFE-212/ Modules/ Course Postings. The final e-poster will be submitted electronically through Canvas (see below for dates). The final product should be formatted with the same quality and attention to detail that would be required for a brief report in a peer- reviewed journal. The limited space will require that your writing be highly concise, while conveying all the essential experimental details and results.

There are additional guidelines for literature searches available at <http://libguides.colostate.edu/life212>. Feel free to contact the librarian on the website if you want additional pointers for finding quality peer-reviewed articles.

Library & Research Help The CSU Libraries Help Desk <http://lib.colostate.edu/helpdesk> provides both research (Ph. 970-491-1841) and technical (Ph. 970-491-7276) support.

Staged e-poster writing assignment submission timeline (35 points):

Due Date

Assignments Due- **GTAs will grade and give feedback**

(at recitation)

Starting at Assignment 2, include (all) previous staged assignment(s), so the grader has a frame of reference for your chosen project.

Sept 12th

Library Instruction Pre-writing Assignment (10 pts)

October 24th, 2016

Week 9

Due Assignment #1: e-poster Title, Author, Literature search, which contains at least three relevant primary research articles and Synopsis for each (10 pts)

Nov 7th, 2016

Week 12

Due Assignment # 2: Introduction (10 pts)

November 14th, 2016

Week 13

Due Assignment # 3: Materials and Methods section (5 pts)
e-poster final version due based upon e-poster guidelines in Canvas at

Nov 28, 2016

Week 15: after
Thanksgiving

2016A-LIFE-212 > Modules > eposter Staged Assignments