SYLLABUS- INTRODUCTORY CELL BIOLOGY LABORATORY, LIFE 212-FALL 2021

COURSE INFORMATION
Instructor: Dr. FARIDA SAFADI-CHAMBERLAIN  E-MAIL: FSAFADI@COLOSTATE.EDU
Office hours: Wed and Friday 1-2 pm, in Yates 314 in person, online or by appointment.
Office Location:  Yates 314  Phone:  (970) 491-1771
Communication Policy: Responses to emails will be provided within 36 hours

WEEKLY RECITATION:  Monday, 4:00 pm to 4:50 pm FACE-TO-FACE  ROOM: BIO136
LAB SECTIONS:

<table>
<thead>
<tr>
<th>Section</th>
<th>Day and Time</th>
<th>LAB ROOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>L01 and L09</td>
<td>Tues 9:00 - 11:50 AM</td>
<td>Yates 311 (L01) and Yates 309 (L09)</td>
</tr>
<tr>
<td>L02 and L07</td>
<td>Tues 2:00 - 4:50 PM</td>
<td>Yates 311 (L02) and Yates 309 (L07)</td>
</tr>
<tr>
<td>L03</td>
<td>Wed 9:00 - 11:50 AM</td>
<td>Yates 311</td>
</tr>
</tbody>
</table>

GRADUATE TEACHING ASSISTANTS
Please see GTA information in CANVAS, under COURSE INFORMATION Module.

COURSE DESCRIPTION
Why do you need to take this lab? Whether you are a Biochemistry, a biomedical science, or neuroscience major, you will be in labs in almost every course throughout your 4-year schooling. This course will teach you the basic techniques that will make you comfortable and confident going into your labs; from using the pipettes to measure accurate volumes, to calculating and preparing your solution concentrations accurately, to understanding enzymes and their roles in cells and health, to using a simple, fluorescence or laser guided microscopes to see cell parts, you will be confident in your labs, in your senior research projects, internships and your future careers. You will have the hands-on laboratory skills used in modern cell biology research labs and you will learn the science behind the experiments. You will learn how to design and execute an experiment, collect, record, and interpret the data through critical thinking, and then communicate your results through scientific writing. You will not only appreciate these skills when you go into the real world, but you will understand the science that revolves around medicine, health, medical lab results and vaccines.

The Lab exercises cover the following topics distributed over 12 weeks:

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

The course materials align with the goals, priorities and missions of the College of Natural Sciences and The Department of Biochemistry and Molecular Biology for excellence in Undergraduate Education.
**IMPORTANT INFORMATION FOR STUDENTS ON COVID-19:**

All students are expected and required to report any COVID-19 symptoms to the university immediately, as well as exposures or positive tests from a non-CSU testing location.

If you suspect you have symptoms, or if you know you have been exposed to a positive person or have tested positive for COVID, you are required to fill out the COVID Reporter (https://covid.colostate.edu/reporter/). If you know or believe you have been exposed, including living with someone known to be COVID positive, or are symptomatic, it is important for the health of yourself and others that you complete the online COVID Reporter. Do not ask your instructor to report for you. If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491-4600. You may also report concerns in your academic or living spaces regarding COVID exposures through the COVID Reporter. You will not be penalized in any way for reporting. When you complete the COVID Reporter for any reason, the CSU Public Health office is notified. Once notified, that office will contact you and, depending upon each situation, will conduct contact tracing, initiate any necessary public health requirements and notify you if you need to take any steps.

For the latest information about the University’s COVID resources and information, please visit the CSU COVID-19 site: https://covid.colostate.edu/.

**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 tissues.
- 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
- Utilize online tools to understand and analyze the 3-D structures of proteins. **Textbook:**

**On-Line Laboratory manual:** Lab exercises, background material, Lab protocols and Lab report forms are in an on-line lab manual that is accessed 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.
<table>
<thead>
<tr>
<th>Week of</th>
<th>LECTURE AND LABORATORY</th>
<th>Learning Objective</th>
<th>Resources</th>
</tr>
</thead>
</table>
| Aug 23  | RECITATION: Introduction to Concentrations of Solutions, Units of measurement, Accuracy and Precision of lab instruments  
           Exercise: Concentrations of Solutions, Accuracy and Precision | Mastering Basic Lab techniques | Lab Manual, Report download Videos, Lecture |
| Aug 30  | Recitation: Introduction to Immunoassays  
           Exercise: Enzyme Linked Immunosorbent Assay; ELISA | Immunology, testing for antibodies and antigens | Lab Manual, Lab session 10, Report downloads Videos, Lecture |
| Sept 6  | Cancelled, Labor Day Holiday:  
           RECITATION: Introduction to Spectrophotometry and Enzyme Kinetics  
| Sept 13 | Enzymes II: Effect of the Environment on Enzyme Kinetics  
| Sept 20 | RECITATION: Enzymes III: Parameters of Enzyme Kinetics  
| Sept 27 | RECITATION: Characterization of Proteins: Determination of Protein Concentration; Protein Gel Electrophoresis  
           Exercise: Gel Electrophoresis: Examining Tyrosinase Enzyme by SDS PAGE  
           Exercise: Determination of Protein Concentration: Bradford Assay | Protein detections and Quantitation methods | Lab Manual, Report downloads |
| Oct 4   | Review/ assessment MIDTERM EXAM  
           Notebooks DUE First term-paper Staged assignment due | Study Guides Library resources | |
           Exercise: Compound Light Microscope: Types and Proper Use. | Cell structure and Function/the microscope | Lab manual, videos, and purple folders |
| Oct 18  | TOPIC: Microscopy part 2: Cells of Living Organisms,  
           Minitest: covers lab 6  
           Exercise: Scale of Cellular and subcellular features; Imaging methods | Cell structure and Function/the microscope | Lab Manual, Report downloads |
| Oct 25  | RECITATION: Cell fractionation/cell metabolism; Mitochondria Isolation and Respiration  
           Exercise: Qualitative Assay of Mitochondrial Respiration | Cell structure and Function/respiration | Lab manual, videos, Report download |
| Nov 1   | RECITATION: Photosynthesis: Light/Hill Reactions  
           Exercise: Chloroplast Isolation and Quantitative Assay of Hill reaction | Cell structure and Function/photosynthesis | Lab manual, Report Download |
| Nov 8   | RECITATION: Introduction to Fluorescence Microscopy.  
           Exercise: Immunofluorescence staining of Cells | Cell structure and Function/Fluorescence microscopy/immunology | Term Paper assignments |
| Nov 15  | Viewing The Fluorescent cells  
           Hemocytometer and Cell Viability Assay? | Cell structure and Function/cell viability | Term Paper assignments |
| Nov 22-28 | Fall Recess: Fall Recess | | |
| Nov 29  | RECITATION:3-D Protein Structure: PDB of tyrosinase or choose-your-enzyme  
           Exercise: PDB of tyrosinase and exercise with associated questions to answer. | Protein Biochemistry | Posted lab exercise, videos, Staged assignment?? |
| Dec 6   | Exam II, Covers Labs 7 through 13 Lab notebook due (Review session TBD), Check out and evaluations | | |
**TERM PAPER: FLUORESCENCE MICROSCOPY**  
**STAGED ASSIGNMENT SCHEDULE**

**Introduction:** The Fluorescence Microscopy experiment will be the subject of a Term Paper written in the format of a publishable scientific journal article. To help you with writing the paper, I broke the assignment down into stages as outlined in the table below. You will submit parts of the paper at various due dates starting in the second half of the semester. We will grade the submitted portions of the paper and give you feedback that you will incorporate into your final product. We hope that staging the paper will eliminate some of the stress of writing and help you learn from the feedback. Since the paper is assigned to a lab experiment that is conducted later in the semester, I will give you earlier reading assignments. I will also give you instructions and guidelines for writing a scientific paper. We will also go to the library during midterm week for instructions on searching the database for articles on our topic. The CSU librarian and I will post resources on writing and database search on the LIFE 212 Library research Guide [http://libguides.colostate.edu/LIFE212/Safadi-Chamberlain](http://libguides.colostate.edu/LIFE212/Safadi-Chamberlain). The Rubric for the term paper will be on Canvas.

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

**Timelines for the assignments (40 points):**

<table>
<thead>
<tr>
<th>Date</th>
<th>week</th>
<th>Assignments/Due</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 23rd</td>
<td>First week of classes</td>
<td>Brief description of the staged paper assignment and deadlines</td>
<td>Assignment will be described briefly as an Addendum to the syllabus</td>
</tr>
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</table>
| October 4th     | Midterm Week | Asst #1: Reading: FM and the paper guidelines. **Take home quiz (10 pts)**  
Library Instructions  
Literature search: One review and 3 research articles + Synopsis (8 pts) | Take home quiz: FM and the cytoskeleton                                |
| October 11th    | Week 8     | Asst #2: Title and Author (3 pts)  
Due Asst #1: Take home quiz  
Due Asst #3: Lit search: One review and 3 research articles + Synopsis | Instructors will grade and give feedback                               |
| October 18th    | Week 9     | Due: Asst #2: Title and Author  
Asst #4: Introduction (8 pts) | will grade and give feedback                                               |
| October 25th    | Week 10    | Due Asst # 4: Introduction  
Asst #5: Materials and Methods (6 pts)  
Asst #6: Abstract without results (5pts) | will grade and give feedback                                               |
| Nov 1th         | Week 11    | Due Asst # 5: Materials and Methods  
Due Asst # 6: Abstract without results | will grade and give feedback                                               |
| November 8th    | Week 12    | Fluorescence Microscopy Lab practicum: Immunostaining | will grade and give feedback                                               |
| November 15th   | Week 13    | Fluorescence Microscopy Lab practical: Fluorescence image viewing, Questions on feedback | will return all graded assignments to students with feedback              |
| November 29th   | Week 15: after Thanksgiving | Paper due-online submission: Results and Discussion, Conclusion, and whole paper | will grade and give final feedback                                       |
ADDITIONAL RESOURCES

• **CANVAS online**: Additional exercises, instructions and supporting material will be posted online at [http://info.canvas.colostate.edu/login.aspx](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 a valuable resource for you; 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](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.

COURSE ORGANIZATION AND TEACHING METHODS

The exercises in this Laboratory course contain hands-on experiments supported by their background material. We emphasize the science behind the experiments and the technical reasons for using the steps and the reagents of the protocols. The curriculum is heavily supported by assignments to help all methods of student learning. To SUCCEED in this course, keep up with the assignments and be sure to understand the flow of the experiments and the reasons behind every step you do. Below are details of the course assignments.

**PRE-LAB PREPARATION:**

It is essential that you plan your experiments before you attend the lab. This will help you do well on the quizzes and finish labs on time. To do this you are required to complete assignments that are **due on Monday at 4 pm**, these include:

- **Lecture**: Listen to a pre-recorded lecture about the week’s Lab/assignment
- **Reading assignment**: Complete the reading assignments
- **Videos**: Watch any videos that are relevant to the labs/Assignments
- **Pre-lab Writeup (5-points)** Complete a Pre-laboratory write-up in your E-Notebook. See Lab writeup section below and the specifics for notebook writing in the Addendum

**RECITATION MONDAY: 4:00-4:50 PM**

**Attendance is mandatory.** An introduction to the week’s experiment will be given here. Learning activities will be presented and discussed to emphasize background and protocols behind the week’s experiments. Questions and Discussions are encouraged, Iclicker questions will be used to evaluate your learning. Additional discussions of previous lab results, pointers and potential changes to the protocol are also discussed.

**QUIZZES (ON-LINE AND OPEN NOTEBOOK)**

A 20-point weekly quiz will be administered before recitation on Mondays to assess your preparation for the week’s Lab. Quizzes will cover the current week’s pre-lab preparation and the previous lab’s principles and results. Quizzes will be cumulative; questions will be repeated from earlier labs to enforce retention of the information. Students who do their pre-lab preparation, keep up the notebook writeups, and who take good experimental observations and data evaluation will do well on the quizzes.

**LABS**: A three-hour lab time is reserved for you to run the experiments. Graduate Teaching Assistants (GTAs), aided by Undergraduate Teaching Assistants (UTAs), lead the instruction and supervision of lab
experiments in the labs. 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 must be
LABELED clearly to include: 1) Contents 2) concentration (if applicable), 3) date; including the year,
4) legible student names, and 5) Section.

ASSESSMENTS AND GRADING
Assessments allow you to practice the material taught and give me feedback about your learning.
Assignments align with the course learning outcomes and are based on critical thinking that engage
you in a thinking conversation with your peers. The assessments below are designed to
accommodate the diverse learners
- Weekly Prelab writeup Grade (PLWG) 5 pts, Due Before recitation on Mondays.
- Weekly open-notebook quizzes, Due before recitation on Mondays (20 pts each).
- Lab Completion Grade (LCG) 5 pts: Due after each lab, assesses completing current lab and previous
  lab’s conclusions.
- Weekly experiment-based lab reports, (50-100 pts each), Due online Before recitation on Mondays.
- One term paper (100 pts), Due after thanksgiving Break
- Lab notebook checks: twice a semester (100 points each).
- Two exams + minitest : a midterm, a minitest and a final exam (250 pts total).
- Assignments to engage students in learning (pts vary)
- Extra Credit assignments to enforce understanding of concepts

QUIZZES (20 POINTS EACH)
A biweekly open-notebook quiz will be administered online before Recitation on Mondays. The quiz will cover
the last two completed labs. 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 before recitation at 4 pm on
Monday of the following week. NO LATE REPORTS. 10 pts deduction per day for late reports.

Lab Notebooks:
The Lab notebook is provided in the form of a running Word documents to which lab writeups, and lab reports
are weekly added. See the addendum for the specifics for writing in the lab notebooks. A Lab notebook is
a legal document in which authenticity of the research and research results are preserved. Lab writeups for
LIFE 212 consist of prelab and post lab assignments. Lab reports are added to the document after grading.

RUBRICS: Rubrics for each report are posted online to guide you through filling the assignments. 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. Letter grade scheme is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>&gt; 95.1%</td>
</tr>
<tr>
<td>A</td>
<td>90% &gt; ≤ 95.1%</td>
</tr>
<tr>
<td>A−</td>
<td>89 &gt; ≤ 90</td>
</tr>
<tr>
<td>B+</td>
<td>85.1 &gt; ≤ 89</td>
</tr>
<tr>
<td>B</td>
<td>80 &gt; ≤ 85.1</td>
</tr>
<tr>
<td>B−</td>
<td>79 &gt; ≤ 80</td>
</tr>
<tr>
<td>C</td>
<td>70 &gt; ≤ 79</td>
</tr>
<tr>
<td>D</td>
<td>55 &gt; ≤ 70</td>
</tr>
<tr>
<td>F</td>
<td>less than 55</td>
</tr>
</tbody>
</table>

POINT ALLOCATION:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
<th>Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes:</td>
<td>20 pts ea</td>
<td>total of 11 quizzes 220</td>
</tr>
<tr>
<td>Laboratory Reports</td>
<td>50-100 pts ea</td>
<td>total of 13 reports 710</td>
</tr>
<tr>
<td>Term paper</td>
<td>100 pts</td>
<td>one 100</td>
</tr>
<tr>
<td>Laboratory Notebook</td>
<td>100 pts ea</td>
<td>graded @ mid-term &amp; final 200</td>
</tr>
<tr>
<td>Lab Completion grade (LCG)</td>
<td>5 pts per lab period</td>
<td>Total of 13 65</td>
</tr>
<tr>
<td>Prelab Writeup Grade (PLWG)</td>
<td>5 pts per lab period</td>
<td>Total of 13 65</td>
</tr>
<tr>
<td>EXAMS</td>
<td>50-100 pts ea</td>
<td>Total of 3 Exams 250</td>
</tr>
<tr>
<td>Assignments</td>
<td>60 pts</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td><strong>1670</strong></td>
</tr>
</tbody>
</table>

LAB POLICIES

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 an inclusive community consisting of the instructor, students, and teaching assistants. Together we uphold CSU Principles of Community of inclusion, integrity, respect, service, and social justice.

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 as soon as possible early in the semester to discuss your individual needs. Please note that the week-long Lab Report assignments allow time for completion, use all the resources available to you to complete the reports intime.

MISSING OR COMING LATE TO 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, mail the instructor (not the TA) before the lab session to arrange to attend another laboratory section. Coming late to class past 10 minutes will affect your Lab completion Grade.
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 Completion Grade (LCG).

STUDENT ACADEMIC MISCONDUCT
This course upholds CSU policy of academic Integrity and student misconduct as a part of the university mission in cultivating a community of responsible citizens. All the course assignments therefore 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. We have zero tolerance for cheating, acts of academic misconduct are subject to disciplinary action by the instructor and the CSU Office of Conflict Resolution and Student Conduct Services.

STUDENT BEHAVIOR
CSU policy and Colorado state law prohibit all forms of disruptive or obstructive behavior in academic areas during periods of scheduled use or any actions which would disrupt scheduled academic activities. Classrooms and labs are places for academic activities only, students will be given time to engage in meaningful discussions only. Students engaging in disruptive behavior during scheduled academic activity are identified, warned by the instructor and asked to leave the classroom. Refusing such a request will result in removal by the CSU police and legal /disciplinary actions.

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.

DISPUTING AN ASSIGNMENT GRADING
If you dispute the grading on your assignments, please submit a written request to revise the grading to Dr. Safadi-chamberlain: Include in your request your assignment and clear explanation of your dispute reasons. Submit a packet that contains the following:

1) The question(s) in dispute clearly marked.
2) The reason of your dispute supported by lecture, manual (copied and attached), or video material (referenced clearly) that are related to the question. TA explanation must be documented in writing and signed by the TA in question.
3) If your dispute is based upon a comparison with your peer’s assignment, include both assignments. Be aware that this will result in revising both assignments and possible deduction of points if the question was favorably graded to either one of the assignments.

I will discuss the question with you and reach an agreement that revolves around the proper understanding of the material.
**ADDENDUM: LAB NOTEBOOK WRITEUP SPECIFICS**

**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 Lab notebook assignments:

1) **WEEKLY PRELAB WRITE UP ASSIGNMENT (PLWG-5 PTS):** These are written according to the specific instructions below and by filling under the corresponding headings 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. The notebooks will be checked weekly for the pre-lab writeup by the GTAs and UTAs for PLWG grade.

2) **TOTAL LAB NOTEBOOK ASSIGNMENT (100 PTS EACH):** Lab notebooks will be collected and graded for all the labs twice in the semester, once with midterm and another before the final exam. Complete lab notebook with all the sections as outlined in the specific instructions below is required at this time.

**SPECIFIC LAB NOTEBOOK INSTRUCTIONS:** Follow these 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).

**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.

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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.
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:**

Conclusion form the previously completed lab will be checked by TAs during student check out from the Lab, grade will be given with Lab completion grade (LCG/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 or other scientists do next? Future directions based upon your results.
- 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.