CHEM 4242/BIOL 5242 BIOCHEMISTRY LAB

Fall 2024 Syllabus Thursday 1:30 pm -05:20 pm. Bolin 311/313

Course Instructor

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Office: Pierce Hall 210
Class Website: We will be using the Desire 2 Learn (D2L) platform accessible through the MSU portal. You will need to download lab materials from D2L on your own – I will not do it for you.
Office Hour: MW 10:00-12:00 am; F 10:00-11:00 am by appointment

Purpose of the Course

There are many techniques used in the modern biochemistry lab – so many techniques, in fact, that it is impossible to teach you all of them. We will, however, cover some of the major techniques, including spectrophotometry, protein isolation (especially chromatography) and analysis, and molecular methods of analysis involving DNA. Predominantly, we will focus on *how* to do research science, *how* to troubleshoot, and *how* to problem-solve. Wherever you go, you will be taught techniques; here, we will learn why and how to use techniques to answer real questions.

Class Format due to COVID-19

(1) Face covering is recommended, but not required.
(2) If a student is approved by Disability Support Services to limit or eliminate their physical class attendance due to an underlying condition, please email me the information and I will implement "livestreaming" our face-to-face classroom sessions. But you still have to show up for the quizzes, exams and lab work, because I will not give the online test or online lab.
(3) Students will not attend/hold class if they are experiencing illness or any signs/symptoms of COVID-19, please email me the information and I will implement "livestreaming" our face-to-face classroom sessions.
(4) In the event of increased incidence and risk of COVID-19 that results in the university moving back to a shelter-in-place mode, the course instruction will transition to fully online. More instructions will be given at that time.

Required Materials

1. There is no required lab manual for this course. Most materials will be posted to D2L – the rest you will need to look up for yourselves.
2. Laboratory Notebook: this can be either a quad-ruled composition book or a standard laboratory notebook, but it may not be loose pages, spiral notebooks, etc. The laboratory notebook must be bound such that you cannot remove pages from it. You need to take notes, do pre-lab preparation, do calculations, etc. and so you need to develop a system in which you write down EVERYTHING that goes on in the lab in your notebook.
3. Scientific Calculator: bring every day unless you like doing math in your head.
4. Printed protocols, handouts, and readings –print these materials out, read them, make notes, and use them during lab. These should be contained in a 3-ring binder along with quizzes, lab reports, and so forth so that you have all of your materials at hand during and after lab.

Prerequisites

Credit for or Concurrent Enrollment in CHEM4243. Note: if you drop the lecture and are enrolled in the lab, then you must drop the lab as well. Lecture and lab do NOT follow the same sequence, so you will need to study both together and sometimes read ahead in the textbook to do well in the lab.

Attendance Policy

Attendance of the lab is mandatory (this includes the pre-lab lecture and the lab itself). Lab meets once per week and labs build upon each other. Although you will be working in groups, it is not acceptable to miss class and make your lab partners do all of the work. Students are expected to have read all materials prior to class and to have formulated their own datasheets and flowcharts for the day's work. If you have a dire excuse (extreme and verifiable illness, accident, or injury; extreme family emergency) and you have proof of this dire excuse (which must be provided to me), one lab may be missed without penalty. Missing more than one lab will result in an instructor drop with the grade of "F". Please plan on being present the entire lab period as well; you *may* get out early, but you should not assume that you will. Do NOT be late to class. Pre-lab lecture begins on time and you are expected to be there.

Laboratory Notebooks

Students are required to maintain a laboratory notebook. You will use the notebook to record protocols and any changes made to those protocols, individual and class lab data, and all calculations made during the course of your experiments. You will then use your notebook to write your lab reports. Below are some guidelines for keeping a laboratory notebook.

1. Everything that you do must be recorded directly into your notebook and it must be recorded in pen. Mistakes should be neatly crossed out, initialed by you, and the correction written down next to the mistake. Never remove pages or obliterate mistakes, use correction fluid, etc. Never write in pencil. Write legibly!!!
2. All calculations must be written down in your notebook (show your work; I can't help you troubleshoot problems if I can't see your math).
3. All recorded measurements, pictures, computer printouts, computer rendered graphs, etc. (i.e., data) must be taped or written directly into your notebooks; data should not be left loose, nor placed in a separate binder or folder. Data should be well-documented so that it is clear what the data represent, when the data were collected, etc. A bunch of un-labeled numbers on a page is not data – it is doodling.
4. Each new lab should start on a new page, and each experiment should have a title, date, and objective. Protocols should not be blindly copied into your notebook or taped in without annotation – you need to write down what was actually done, what was measured, what it looked like, whether accidents occurred, etc. Use subheadings to denote different parts of any given experiment (most experiments will run over at least 2 days). Data sheets can be designed and written directly into your notebooks.
5. The dates should appear at the top of each page so you know exactly when you performed specific parts of each experiment.
6. Never record information on loose sheets of paper, paper towels, etc. with the intent of copying material into your notebook later – everything must go directly into the notebook. If you do not write neatly, now is the time to learn.
7. Each time you record data (measurements, absorbencies, etc.), record a brief interpretation. For example, is a given measurement higher or lower than what you expected and what effect might that measurement have on the overall results? At the end of the experiment you should also include an overall interpretation/summary of

your work that will help you write your lab report. Essentially, you need to 'think out loud' into your notebook.
8. Record all mistakes or accidents and what you did or will do to try and fix them.
9. Record any questions you have and the answers you receive – this can help with your interpretation later when you write your reports and study for your exam and quizzes.
10. If you look material up, you need to cite your sources using proper scientific citation style.
11. Laboratory notebooks will be turned in at the end of the semester for a grade.
12. Laboratory notebooks are made to be written in – you should NEVER write a lab report that includes a protocol that was not done because you failed to actually use your laboratory notebook for the purpose for which it is designed. Incorrect, copied protocols in lab reports will earn you a zero for the report.

There should be enough information in your notebook that anyone can pick it up, read it, and actually perform the experiment inside and compare their data to yours. Thus, you must do a lot of writing. Used correctly, your notebook should be FULL at the end of the semester.

Weekly Quizzes

Quizzes will be given each week at the end of the pre-lab lecture and will cover material from past labs and the lab to be done on that given Thursday. No make-up quizzes will be given for any reason. These quizzes will involve open-ended questions and calculations.

Pre-lab Assignments

To ensure that you are actually ready to perform daily Experiments, you will draft your own data sheets for each lab day that contain a brief outline or flowchart of what will be done during the experiment and the data that are to be collected (weights, descriptions of materials, spectrophotometer data, etc.). Pre-lab assignments may include a simple list of data to collect, or tables that will be filled out, etc. These data sheets should be incorporated into your laboratory notebooks so that all experimental information is contained in the same place. You should leave plenty of room for notes as you work your way through your Experiments. Pre-lab assignments are part of your grade and are a pre-requisite for actually doing the lab that day. You must show me or the TA your data sheets to perform the lab, and if you do not have the data sheets, you will receive a "zero" for the data sheet AND YOU WILL NOT BE ALLOWED INTO THE LAB, thus receiving a "zero" for the lab and the resulting lab report. This is not a group data sheet; every member of the group must devise a datasheet of their own. You may then "merge" them while working in the lab, but each person must be prepared to do the work.

Laboratory Reports

Over the course of the semester you will be asked to write four lab reports. Below you will find descriptions of the sections that must be included in each report along with general requirements for writing the lab reports.

1. All text for all reports (e.g., abstracts, text results, figure captions, etc.) must be typed. No handwritten reports will be accepted and hand annotations will be marked off. Additionally, all graphs and tables must be computer-generated.
2. Calculations, equations, and structures may be handwritten (include only if relevant to the report).
3. No raw data is to appear in the report at all – only the results derived from the raw data should be included. All raw data must appear in your lab notebook, however, and you must be able to present it to me if I ask for it. Special note on gel pictures: an

unannotated gel picture is raw data. To be included in a lab report, the picture must be annotated by adding size marker labels, highlighting specific bands, etc.

4. All work must be proofread and checked for mathematical errors prior to submission. Both grammar and spelling count. Poorly written reports will be docked 10 points even if they are technically correct.
5. All reports are to be individually written, but you may talk with your lab partners and work together when discussing results and any problems/mistakes that may have occurred during the experiment.
6. Do not be afraid to rewrite/rework various sections of your reports to make them and the overall report coherent and informative. Do NOT wait until the night before to write your reports. Last minute work always receives a poorer grade.
7. **KNOW YOUR AUDIENCE.** You are writing for me, not someone who knows nothing about biochemistry. I know how a spectrophotometer works, for example, so do not insult me by telling me about Beer's Law.
8. **Late Report Policy**:
    a. Reports are due at 1:30pm as specified on the class schedule. If they are not turned in at 1:30pm, they are late. (Even if you are only 5 minutes late, the report is late, as are you.)
    b. Late reports will lose 10 points from the score you earn on the report for each 24 hour period (beginning at 1:30pm on the date due) that it is late (ex., a report that earns a score of 85/100, but which was turned in 3 days late will receive a 55/100). Even if you are 5 minutes late, you still lose 10 points.
    c. After 5 days late, reports will NOT be accepted and you will receive a "0/100".
9. Reports are to contain the following sections:
    a. **Separate Title Page:** Descriptive title, your name, the names of your lab partner(s), the date(s) the lab(s) were performed and a 100-word-or-less statement of purpose (the goal of the experiment or experimental series performed – what was done overall, what was done specifically, and why it was done).
    b. **Abstract** [150 words or less]: simplified purpose, the techniques used (in general), the results obtained, and the conclusions drawn from the results. If further work should be done or will be done, then include a statement of what that work should or will be.
    c. **Introduction:** This should be a brief section setting the stage for the rest of the report. What did you do and why (in general)? Why does the experiment matter? We have a purpose for the experiments, but are the experiments chosen the best ones to achieve our purpose? In a lab class this should not be a grand statement of cosmic significance, but it should set up why we are looking at the results and conclusions reported.
    d. **Materials and Methods:** This section consists of your protocol(s) written in brief format in paragraph form, just as such sections are written in normal journal articles (you will need to read the Methods sections of several primary journal articles to get a feel for how to write this section). This section must reflect what was *actually* done, not what we *thought* we were doing. Remember, a protocol not reflective of reality will earn you a "0" for the entire report because your report will not reflect what was done (thus it is fraudulent).
    e. **Results:** The Results section is ALWAYS a combination of text PLUS figures, tables and/or graphs, with the text explaining the visual results. Each method usually has a result, which needs to be presented, and all methods/results together produce a final overall result of the experimental sequence. Make sure there is logic and cohesion to this section and that you actually walk the reader

through the key results of the report. Figure legends must be informative and figures/tables/graphs must be interpretable on their own (a legend is more than just a title). The reader should be able to tell from the figure legend and figure what was done and why it mattered.

f. **Discussion/Conclusion:** The Discussion is not a rehash of the results, but rather summarizes the results and places them within a broader scientific context. Do not forget to give this context and a final conclusion. Note: Discussions are usually better for citing the work of others to bolster your claims for your personal results. Additionally, the Discussion describes problems encountered and their solutions, suggestions for further refinement of the experimental system, and usually recommends further research or changes to the protocols used; you should include such a commentary in your report.

g. **Literature Cited (if any):** If you go to the literature in any way to help you prepare your reports, you must cite your sources. Please cite using the following format:
    i. Use bracketed numbers in the text (example: [1]) and number the references in the order of use; if the same reference is used more than once, always use the same original number assigned to it.
    ii. List the references at the end in the References section in the order of usage by their assigned number (do not alphabetize).
    iii. Use this citation format: Author Last Name, Author first initials. (Year) "Title of the Article", *Journal Title*, Vol #(Issue#): page numbers. doi #.

Cell Phones in Lab

You should never make or receive phone calls or texts during lab. Phones are a distraction that can result in lab accidents that are harmful to you, your lab partners, and your experiments. If I catch you on your phones playing, you will lose 1% from your overall grade in the lab. An exception to the "no cell phones in lab" policy may on occasion be made for data collection purposes. Cell phones can be of surprising use in documenting data; HOWEVER, should you spill anything caustic on your phone or contaminate your phone with potentially hazardous or infectious materials, YOUR PHONE WILL BE CONFISCATED AND TREATED AS WASTE (i.e., it will be destroyed and you will NOT be reimbursed for your loss). Many phones will fit into a plastic baggie if you wish to protect your phone and use it in the lab. In all cases, cell phone use is to be limited and any loss of damage associated with cell phone use in the lab will be the fault and responsibility of the student, not the department or instructor.

University Code of Conduct

For university standards of conduct please refer to the MSU Student Handbook. In general, students are to attend all meetings of all classes; instructors may drop students for excessive absences, indifference, disruptive behavior, or failure to complete class assignments; students are prohibited from cheating, plagiarizing, or colluding. Students are expected to have read the Student Handbook.

Academic Dishonesty

Cheating, plagiarism, and collusion (as well as several other forms of conduct) are all strictly prohibited at MSU. Please read the MSU Student Handbook definitions of cheating, plagiarism, and collusion and MAKE SURE that you do not engage in any of these behaviors. If you are unclear on what may count as cheating, plagiarism, or collusion, please see the

instructor or the Dean of Students. If I am even suspicious that your report is plagiarized, you will receive “0/100”.

Instructor Drops

According to the 2012-2013 MSU Student Handbook, p. 47, “An instructor may drop a student any time during the semester for excessive absences, for consistently failing to meet class assignments, for an indifferent attitude, or for disruptive conduct.” For the purposes of this course, “consistently failing to meet class assignments” includes consistently not turning in assigned work or turning in work that consistently receives a failing grade.

Intellectual Property

By enrolling in this course, the student expressly grants MSU a “limited right” in all intellectual property created by the student for the purpose of this course. The “limited right” shall include but shall not be limited to the right to reproduce the student’s work product to verify originality and authenticity, and for educational purposes.

Grading

Students are expected to demonstrate their mastery of the material through the successful completion of all assignments, quizzes, and exams. Final grades will be calculated using the following distributions:

Pre-lab Assignments (10 exp., 10pts each)	10 %
Weekly Quizzes (10 weeks; 15 pts each, lowest drop)	15 %
Lab Notebook	10 %
Lab Reports (4 reports total; 100pts each)	55 %
Lab Final	10 %

Grades will be assigned on a strict 10% scale (100-90% = A; 89-80% = B; 79-70% = C; 69-60% = D; 59% and below = F).

The Lab Final will be oral presentation that requires covering the techniques you exposed to in the laboratory.

Specific information regarding what is to be included in each lab report will be given during lab lecture. This information will be in addition to the material in this syllabus.

Schedule of Experiments

Dates	Experiments	Lab-Report Due
Aug. 29	Course Introduction; Lab-Safety; Lab Check-In ***Students should review scientific notation, significant figures, basic statistics, units, simple concentration calculations (% solutions, molar solutions, dilutions), and graphing to prepare for the course***	
Topics (1): BASIC TECHNIQUES (Report #1)		
Sept. 5	Pipet Calibration, Dilutions, and Spectrophotometry	
Topics (2): PURIFICATION OF LACTATE DEHYDROGENASE FROM BEEF HEART (Report #2 and #3)		
Sept. 12	Disruption of Cells, Salting Out	**Report #1**
Sept. 19	Desalting and Affinity Chromatography	
Sept. 26	LDH Enzymatic Assay	
Oct. 3	Protein quantification and LDH Purification Chart	
Oct. 10	SDS-PAGE Analysis of Purified LDH	**Report #2**
Oct. 17	Western-Blot Analysis of Purified LDH-Part 1	
Oct. 24	Western-Blot Analysis of Purified LDH-Part 2	
Topics (3): GENETIC FINGERPRINTING (Report #4)		
Oct. 31	Analysis of GMOs-PCR	**Report #3**
Nov. 7	Analysis of GMOs-Agarose Gel Electrophoresis; Check-Out	
Nov. 14	Lab Final Presentation	
Nov. 21	Lab Final Presentation	**Report #4**