CHEM 328: Analytical Biochemistry Laboratory
Spring 2022
Friday 12:00 pm – 3:00 pm
Caputo 225

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Office Hours: Mon 10-12, Tues 11-12, Thurs 11-12, Fri 10-11
Additional times available by appointment.

Course Description: CHEM 328 is a laboratory course designed to expand the technical expertise of biochemistry students. The experiments completed focus on the analysis of major classes of biological compounds using advanced techniques and instrumentation. CHEM 328 also includes opportunities to develop critical thinking, literature research, writing, and presentation skills critical for scientific study.

Pre-requisite or co-requisite: CHEM 327 or CHEM 324 or BIOL 324

Course Materials and Readings:
Laboratory Manual (provided by department)
Laboratory Notebook of your choice
Registration on D2L

Course Objectives:
CHEM 328 should help develop your skills in:
Experimentation

- Reading and interpreting scientific protocols
- Planning and implementing experiments to analyze biochemical molecules
- Using, maintaining, and sharing analytical instruments
- Troubleshooting materials, instrumentation, or protocols used in experiments
- Recording and reporting experimental procedures and data

Scientific Literature

- Finding and using online reference information
- Searching literature databases for publications
- Reading and interpreting scientific manuscripts

Scientific Communication

- Writing concise but informative summaries of data and concepts for a variety of audiences.
- Presenting and discussing experimental data, analysis, and interpretation
- Presenting information from a scientific manuscript

Course Policies:

Cooperative Environment

CHEM328 is largely experimental and includes independent student work. My primary task is to facilitate your learning experience by acting as a resource and a guide. Since most work will be carried out in research teams, students are expected to respect each other and contribute equally to the experimental work and reporting. Any concerns regarding the course and cooperative work should be brought to my attention as soon as possible so we can address the situation. Specifically, please notify me if you have any special circumstances (allergies, pregnancy, COVID-related concerns) that might require additional experimental arrangements.

Class Attendance

Each student is expected to complete all experimental work and activities planned for this course. All assignments must be submitted as scheduled to receive full credit, and participation in all group meeting or workshop sessions is required unless alternative arrangements have been made.

There will be some experiments and group work that will require significant scheduling coordination with your lab partner(s) and your instructor. Meeting at times other than published class time allows efficient use of some departmental instruments and allows you to have individual access to instrumentation. Note that it is critical for each student to arrive on time for each assigned experimental time. Please notify me of any specific needs you have for completing lab requirements and contact me immediately if you have an excused absence that conflicts with your scheduled work.

Academic Honesty

Students are expected to abide by the policy outlined by Millersville University. Students will collaborate on collecting, interpreting, and reporting data. Students are expected to contribute equally on collaborative work. Fabrication of data or plagiarism in preparing reports will NOT be tolerated in this course. Anyone caught cheating in these ways will be assigned a score of zero on the work.

Computer Resources

Students are expected to use D2L for CHEM 328. This provides mechanisms for contact, distribution of information, and data, submission of written work, completion of peer reviews, etc. Students are also responsible for all course information sent to their campus email address.

Evaluation of Learning:

Pre-Lab Quizzes (4)	100
Blog Post	100
Industrial Technical Report	100
Research Communication	100
Literature Results Section	100
Group Meeting presentations and participation (30 pts each)	120
Technique Infographic & Assignment	100
Professional Development Tasks	30
Participation, Peer Review, Lab Citizenship, and Scholarly Contributions	50
Total Points	800

Final letter grades will be assigned on a standard plus/minus scale:

	A 93.0-100.0	A- 90.0 – 92.9
B+ 87.0 – 89.9	B 83.0 – 86.9	B- 80.0 – 82.9
C+ 77.0 – 79.9	C 73.0 – 76.9	C- 70.0 – 72.9
D+ 67.0 – 69.9	D 63.0 – 66.9	D- 60.0 – 62.9
	F < 60.0	

Pre-Lab Quizzes

Before each laboratory experiments, you should read the background material and relevant instructions included in the laboratory manual. Your primary goals are to be familiar with the molecules we will study and the experimental work that will be used for analysis. There will be several online pre-lab quizzes throughout the semester, each addressing the general strategies of an experiment. The quiz must be completed by **8 am** on the day it is due. You *may* use your manual and other resources while taking the quiz but there is a 60 minute time limit for completing the quiz. Therefore, it is recommended that you become familiar with the experiment before beginning the quiz.

Laboratory Notebook

Laboratory notebooks are essential tools for biochemists to provide an official record of the rationale, procedures, observations, data collected, and interpretations related to scientific research. You are obligated to keep accurate and complete records as documentation of your research. You may use a bound laboratory notebook of your choosing for this laboratory course.

Throughout the semester you will be using multiple resources for experiments and might change experimental details mid-experiment as needed. It is critical that you keep careful and complete notes of the work you do. There are some experiments where each group will develop their own protocol and you will not be able to revisit a published protocol or a different group's protocol to obtain information. Reagents used, experimental procedures, instrumental parameters, and primary data *must* be recorded directly into your notebook as you are working. The information does not have to be perfectly neat but it should be

clearly labeled and legible so you can use it later to prepare your assignment. Each partner must record independent laboratory notes.

Group Meeting Presentations

An essential part of a research team is working collaboratively and discussing results in a more informal, group-meeting setting. After each experiment, we will get together for a group meeting to discuss experimental challenges, data analysis, and data interpretation. For some experiments, each group will collect data that will be used by every student for analysis. Group meetings provide a setting where this data can be discussed and analyzed as an entire research team.

Each group will be responsible for presenting at every group meeting. You should prepare a couple of slides of data and interpretation to present and discuss with your peers. Your slides will be due by **8 am** the day of the group meeting. This is an informal presentation with the goal of getting feedback on data presentation and interpretation. However, your figures should be prepared to assist your audience in understanding your data and your interpretation. You may include questions to the audience if you would like assistance in analysis or interpretation. Additionally, the audience should ask questions or provide experimental suggesting for analysis or troubleshooting in the future. *ALL* students are expected to participate in discussion during Group Meetings.

Assessment of Group Meeting Presentations and Participation

Preparation of Material (slides or chalk pres)	5 pts
Presentation of Material	10 pts
Participation in Discussion	15 pts
	30 pts x 4 = 120 pts

Blog Post

Each student will prepare a guest blog post for a popular science blog summarizing your results from the Glucose and Taurine in Sports Drinks experiment. Please see more details following the Glucose and Taurine in Sports Drinks section of this laboratory manual.

Industrial Technical Report

You will write one industry technical report this semester, focused on the "Fatty Acid Composition of Plant Extracts" experiment. The technical report will highlight the data and results obtained. More details about the Industrial Technical Report assignment can be found in the manual section with this experiment.

Research Communication

You will write one research communication paper, focused on the Protein Electrophoresis experiment. More details can be found in the Protein Electrophoresis section of the manual.

Technique Inforgraphic

Throughout the semester we will use different analytical techniques to answer biochemical questions. However, there are many more techniques commonly used in biochemical

research that are interesting and important to learn about! Each student will prepare an infographic related to a unique analytical biochemistry technique not already used in CHEM 328. Your goal is to provide your peers with an overview of how the technique works, its advantages and limitations, and an example of how it is used in research. You will identify at least two principal research articles to use for your presentation (although you are welcome to use more).

Selection of your topic via survey and approval of your article(s) you intend to use will be completed before spring break. You will have designated laboratory time after spring break during which you can work on your infographic. After submission you will be provided with a file containing all of the infographics (and therefore a small database of techniques). You will be expected to read your peers' infographics and complete a scavenger hunt assignment related to the techniques.

Assessment of Technique Infographic

Article Approval	5 pts
Explanation of Technique	20 pts
Technique Benefits and Disadvantages	20 pts
Example of Technique Use	20 pts
Quality of presentation materials	20 pts
Technique Assignment	15 pts
	100 pts

Participation, Peer Review, Lab Citizenship, and Scholarly Contributions

Being a good researcher requires that one be able to ask appropriate questions, provide good answer to the queries of others, work collaboratively as a part of a group, maintain an organized laboratory space, and be somewhat flexible with your schedule. Your performance will be evaluated on your ability to work with your peers to carry out experiments and your overall engagement in the class. You are encouraged to ask questions of each other and of me.

We share our laboratory space with other teaching labs and research students. At the end of each laboratory session, it is important to clean up the area where we worked. We should: clean up/wipe down benchtops, clean up balance area if needed, put away solutions, supplies, and equipment, and make sure the instrument room is free from debris and biochemistry-related materials.

Peer Review

Peer review plays a significant role in scientific publication and funding. Work submitted for publication or funding is evaluated by respected colleagues in the field. These reviewers affirm that the experimental data was collected accurately, presented appropriately, and interpreted fairly. In some cases, they are also responsible for assessing the important or impact of the research and its findings. Ideally this process serves to improve the quality of scientific research.

In CHEM 328 you will be asked to read and comment on the work of your peers. These reviews should give helpful feedback to each other about how clearly you reported on the experiment. In addition, by reading and assessing the written work of other students, you may discover ways to improve your own scientific writing.

During the peer review process, it is important to remember to be respectful but also provide *meaningful* comments to help your peers. You will be provided with a set of guidelines you may use to review each others' work. Your peer review comments will be evaluated for how thorough, insightful, and fair they are in addressing the work under review.

As a writer, you have the choice to make changes based on your reviewers comments or to thoughtfully disregard some suggestions. If you have any questions about this process or how to interpret reviewer comments, please come see me!

Professional Development

Many of you will be graduating at the end of the semester or withing a year. Engaging in professional development opportunities for your field or career of interest will be beneficial for your success. Throughout the course of the semester you will be asked to complete *four (4)* professional development tasks from nine (9) different options. After completing a task, you should comment on the CHEM 328 Professional Development Padlet (https://padlet.com/melissamullendavis/nk34ntcycs9xf750, PW: enzymes). The link will also be posted on our D2L page.

Referencing Guidelines

We will use American Chemical Society (ACS) format for references in this course. Guidelines included below should be sufficient. More detailed information can be found in the *ACS Style Guide: A Manual for Authors and Editors* or online at the ACS website (link on D2L).

Citing in-text

When expressing previously published information or ideas, a citation should be made to identify the source. This is generally appropriate at the end of a sentence but may be made at any logical place. References may be cited by numbering or by directly identifying the author and date.

1) Numbering. Each reference cited is assigned a sequential number as used.
    - There are two options for this in-text format:
        Superscripted: Ipk1 is an IP_5 2-kinase.[8]
        In parentheses: Ipk1 is an IP_5 2-kinase (8).
    - Once a reference has been assigned a number, it should be used for all further citations in the paper.
    - If referring to multiple references in one citation, list the numbers in increasing order, separate the numbers by commas, including spaces for the 'in parentheses' option but not when superscripted. If using three or more references in a series, use a dash to indicate the range of references cited.
        Ex: … was reported.[2,4-7]
        Ex: … was reported (2, 4-7).

2) Author name and date. Each reference is cited by the author name and date of publication.
    - These are always listed in parentheses.
        Ex: Ipk1 is an IP_5 2-kinase (York, 1999).
    - When there are two authors, use both names.
    - When there are more than two authors, use on the first name listed by "et al."
    - To distinguish two references published by the same author(s) in the same year, use lowercase letters.
        Ex: Ipk1 is an IP_5 2-kinase (Bayless et al., 2002a)

Reference Listing

A complete list of references should be made at the end of the written text. The format will depend on the citation format used in-text. For sources other than those listed, you should give enough information to allow the source to be identified and located.

1) Numbering: Place the references in numerical order according to their number in the text.

2) Author name and Date: List the references in alphabetical order based on the last name of the first author. References from the same author should be ordered from earliest publication to most recent.

3) Reference listings should include the following information:

- Journals: author(s), *abbreviated journal title*, **year of publication**, *volume number (issue number)*, page(s).

  Ex: Ryan, K.J.; Wente, S.R., *Curr. Opin. Cell Biol.* **2000**, *12:* 361-371.

  At least the initial page must be given but the complete span is preferred. Some journals begin each issue within a volume with page one. In this case, the issue number must also be given in parentheses after the volume number. Standard abbreviations for journals can be located in several online resources. Complete article titles may be included after the author names as a way to provide more information for the reader.

- Internet sources: author(s), site title, URL (accessed date).

  Ex: ACS Publications Division Home Page, http://pubs.acs.org (accessed Feb 1997).

- Books: author(s) or editor(s), *book title*, publisher, city of publication, year of publication.

  Ex: Horton, H.R.; Moran, L.A.; Ochs, R.S.; Rawn, J.D.; Scrimgeour, K.G. *Principles of Biochemistry*; Prentice Hall: Upper Saddle River, 1996.

  Indication of specific pages may also be given at the end. An editor is indicated by the letters Ed. After their name.

- Visual Content

  Diagrams or figures from journal articles should be referenced as above. However, any visual content from internet sources should be indicated by citing the source directly beneath the figure itself as follows:
  (Source: http://www.neurotransmitter.net/alzheimers_drug_reference.html)

As a general rule, data figures from journal articles that need to be used can be and should be cited. Schematics and diagrams should not be used directly from an article and should be re-made. It should be cited as (adapted from: Reference).