Course Description

Chem328 is a laboratory course designed to expand the technical experience of biochemistry students. The experiments completed focus on the analysis of major classes of biological compounds using advanced techniques and instrumentation. Chem328 also includes opportunities to develop literature research, writing, and presentation skills critical for scientific study.

Pre-requisite or co-requisite Chem327 or Chem324 or Biol324

Required Resources

Laboratory Manual: (provided in dept)
Laboratory Notebook: removable page notebook
Registration on D2L

Course Objectives

Chem328 should help develop your skills in the following areas:

- **Experimentation**
  - Reading and interpreting scientific protocols
  - Planning and carrying out experiments to analyze biochemical molecules
  - Using, maintaining and sharing analytical instruments
  - Troubleshooting materials or instrumentation 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
  - Writing concise but informative summaries of data and concepts
  - 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. 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 Chem328 should be brought to me so we can address the situation. Specifically, please notify me if you have any special circumstances (like allergies or pregnancy) that might require alternate experimental arrangements.

- **Class Attendance**
  Each student is expected to complete all experimental work and activities planned for Chem328. All reports must be submitted as scheduled to receive full credit, and attendance at all the student presentation sessions is required unless alternate arrangements have been made.

  Chem328 will also require significant scheduling coordination with your lab partner(s) and the instructor. Meeting at times other than the published class time allows efficient use of several departmental instruments. Note that it is critical for each student to arrive on time for each assigned experimental time. Please notify me of any special 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 Chem328. Anyone caught cheating in these ways will be assigned a score of zero on the work.

- **Computer Resources**
  Students are expected to use D2L regularly for Chem328. This provides mechanisms for contact, distribution of information and data, submission of written work, and completion of peer reviews. Students are also responsible for all course information sent to their campus e-mail address.
Course Schedule (tentative)

Jan 29-Feb 12: *Glucose and Taurine in Sports Drinks*
- Strategy Quiz: **Jan 29**
- Focus Section: **Feb 19**
- Peer Reviews: **Feb 26**
- Final Report & notes: **Mar 5**

Feb 19-Feb 27: *Fatty Acid Composition of Plant Extracts*
- Strategy Quiz: **Feb 19**
- Focus Section: **Mar 9**
- Peer Reviews: **Mar 26**
- Final Report & notes: **Apr 2**

Mar 26-Apr 2: *Identity and Structure of Dipeptides*
- Strategy Quiz: **Mar 26**
- Focus Section: **Apr 9**
- Peer Reviews: **Apr 16**
- Final Report & notes: **Apr 23**

Apr 16-Apr 23: *Protein Electrophoresis*
- Strategy Quiz: **Apr 16**
- Theoretical Analysis: **Apr 30**
- Final Report & notes: **May 11**

**Bioanalytical Technique Presentation**
- Presentation Topic sheet & survey: **Jan 22**
- Presentation Article approval: **Feb 5**
- Presentation Draft peer reviews: **Mar 5-6**
- Presentations: **Mar 19, Apr 9, Apr 30, and**
  **Wed, May 9 10:15-12:15 (** **MWF 2:00 exam block)**

**Grading**

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Strategy Quizzes</td>
<td>40 pts</td>
</tr>
<tr>
<td>Peer Reviews</td>
<td>50 pts</td>
</tr>
<tr>
<td>Reports &amp; Notes</td>
<td>290 pts</td>
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<tr>
<td>Presentation</td>
<td>100 pts</td>
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<tr>
<td><strong>Total</strong></td>
<td>480 pts</td>
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**Letter Grade Correlation**

<table>
<thead>
<tr>
<th>Grade</th>
<th>%</th>
<th>Grade</th>
<th>%</th>
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<tbody>
<tr>
<td>A</td>
<td>94.0 - 100.0</td>
<td>A-</td>
<td>90.0 - 93.9</td>
</tr>
<tr>
<td>B+</td>
<td>87.0 - 89.9</td>
<td>B</td>
<td>83.0 - 86.9</td>
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<tr>
<td>C+</td>
<td>77.0 - 79.9</td>
<td>C</td>
<td>73.0 - 76.9</td>
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<tr>
<td>D+</td>
<td>67.0 - 69.9</td>
<td>D</td>
<td>63.0 - 66.9</td>
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<td>F</td>
<td>&lt; 60.0</td>
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**Strategy Quizzes**

To prepare for each experimental project, you should read the background material and relevant instructions included in the lab manual. The primary goals are to be familiar with the molecules under study and how the experimental work is used for the analysis. There will be an online quiz addressing the general strategies of each experiment. The quiz must be completed by 8 am on the first day of each project. You may use your manual or other references while taking the quiz. There will be a 60-minute limit for completing the quiz from when you first open it, so it is recommended that you be familiar with the project information before beginning the quiz.

**Laboratory Notes**

Laboratory notebooks provide an official record of the rationale, procedures, observations, data collected and interpretations relating to scientific research. Every scientist is obligated to keep accurate and complete records as documentation of their research. Often data notebooks must be permanently-bound, signed and dated and remain in the lab at all times. For our purposes in Chem328, you will need to hand in prior notes while working on new experimentation. Therefore, notes should be taken on paper that can be handed in for review along with each lab report (removable page notebook or legal pad).

Because you will be using multiple resources for experiments and sometimes changing details, it is critical that you keep careful and complete notes of the work you do. Reagents used, experimental procedures, instrumental parameters, and primary data must be recorded directly into your notes as you are working. The information does not have to be neat but should be clearly labeled so it can be used later to accurately write your report, including materials and methods. Each partner must record and submit an independent set of lab notes.

**Reports**

The culmination of scientific research is the reporting of findings to the greater scientific community. The sharing of data and ideas allows for the development of broader scientific models based on work from multiple sources. A key to publication is writing an informative and cohesive report of the experimentation undertaken and the results obtained. Authors are required to provide the context for their work, outline experimental procedures needed to reproduce their results, present the data collected and provide a balanced interpretation of their results. Over the semester, you will be writing and reading reports to develop skills relevant to the scientific writing process. We will be successively focusing on the various aspects that go into a scientific journal article. Writing checklists are included here.

Background material and a report guide are provided for each experiment. These should help direct your writing about the techniques used and analysis done. General descriptions of the components used in scientific journal articles are also given here. Instructions for citing information from published or internet sources are also included. Plagiarism will not be tolerated. In addition, keep in mind the KISS principle for scientific writing: Keep It Simple & Stupid. Work on making defined and precise statements that follow a progression through a concept. Complicated sentences and flowery language will detract from the points that you need to communicate. Clarity is more important than creative use of language.
General Report Format

As the semester progresses, we will be focusing on different components of a scientific journal article. Each student will first submit an individual draft of the Focus Section for a given lab. These will be: Expt 1: Results; Expt 2: Materials & Methods; Expt 3: Abstract & Discussion. The protein experiment will have a theoretical analysis of proteins using online resources rather than a focus section.

Lab partners will collaborate to write the other article sections based on the experiment. Groups are encouraged to provide substantial editing to drafts of various sections. The shared sections should then be combined with each individual focus section. The focus section should incorporate feedback from peer and instructor reviews to receive full credit. Each partner will submit a final report. Experimental notes from each partner should be submitted once the report is complete.

Written assignments for Chem328 are due by 4 pm on the due date. It is critical that your Focus Sections be submitted on time so that Peer Reviews can begin. There will be a 10% deduction for each day an assignment is late. Documents must be submitted in Word format. Focus Sections should include the experiment title but not your name to allow anonymous peer review.

All writing should conform to standards of grammar, spelling, and font style and size. Each separate subsection should be clearly indicated with a heading. Any tables or figures should be clearly labeled in a caption and inserted into the document. Hard copy data to be included should be scanned and inserted. Supporting hard copy data not shown in the report should be submitted along with your lab notes.

The Final Reports will increase in point value as more aspects of scientific writing are incorporated. Principles learned about each Focus Section style should be applied to the writing process of later reports.

Assessment of reports will be:

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<th>Points</th>
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<tbody>
<tr>
<td>Focus Sections</td>
<td>75 pts</td>
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<tr>
<td>Expt 4 Theoretical</td>
<td>25 pts</td>
</tr>
<tr>
<td>Revised Focus</td>
<td>30 pts</td>
</tr>
<tr>
<td>Final Reports (1: 20; 2: 30; 3: 40; 4: 50)</td>
<td>140 pts</td>
</tr>
<tr>
<td>Notes (5 pts x 4)</td>
<td>20 pts</td>
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<tr>
<td>Total</td>
<td>290 pts</td>
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Typical Journal Article Sections:

Title: A title should be concise but informative. Good titles refer to the subject of the study and generally address the critical conclusion as well.

Abstract: Abstracts are brief summaries of the reported study that allow a reader to quickly assess the content and conclusions of the paper. They include a statement of the question under investigation, a general description of the approach taken and the major results obtained in the study. It is most advantageous to write the abstract as a summary after completing the rest of the report.

Introduction: The Introduction of a manuscript should provide the context for the reported study. It can be difficult to narrow down the information to be included in an Introduction. The most important aspect is to explain the relevance of the experiment being reported. The facts included should direct the reader specifically to the questions addressed in the study. Your introduction should include basic information about the biological compounds under study as well as the technique being used. Textbooks or reviews should be a good source for you of summarized background information.

Materials & Methods: The Materials & Methods section should be a factual listing of information critical to performing the reported experiments. You should include information about the materials used, summarized experimental protocols and instrument parameters. Another scientist should be able to reproduce your results based on the information given in your Materials and Methods. This section should NOT resemble most lab manuals you have used for classes. Rather, you should streamline and summarize the procedures. To fully appreciate the difference, refer to published journal articles.

Results: The Results section should explain the techniques used and summarize the data collected. Include separate subsections for each main aspect of the experiment. For each, describe the basic experimental strategy and show corresponding data collected. Avoid the temptation to make overall conclusions in this section. Instead, concentrate on descriptively summarizing how each method was used to obtain the relevant data. Well-written results will allow readers to come to the same conclusions as the authors do.

Discussion: The Discussion section should logically direct the reader in understanding the meaning of the overall results of the study. This is the place to interpret the experiments done and indicate the corresponding conclusions. However, you should be careful to avoid making broad, sweeping conclusions. You should also note any limitations, errors or uncertainties that could have affected the work presented. This will be particularly important in Chem328 where experimentation sometimes goes awry but cannot be repeated as it would be in a research lab.

References: Sources of unique information should be listed in the Reference section according to standard ACS format (guidelines are summarized below). Most information in textbooks is general knowledge that does not need to be referenced. You should also NOT include this lab manual itself as a reference. However, you should include references for the actual published articles used as a basis for our experimentation.
Writing Check Lists

Results:
___ Do you have separate subsections for each major experimental aspects?
___ Have you clearly described the experimental strategies used?
___ Have you explained what information can be understood from the data collected?
___ Are your results appropriately summarized in a table or graph?
___ Have you stated any results that are inherent from the data collected?
___ Have you avoided interpreting the results beyond the obvious conclusions?

Materials & Methods:
___ Did you list information for special reagents, including unknown samples?
___ Do you have separate subsections for each reaction or process done?
___ Did you summarize each protocol to give the critical details without including excessive trivial details?
___ Did you specify any instrumental information, parameters or running conditions used for analysis?
___ Is your information about conditions and reactions meaningful (ie: total amounts or concentrations rather than just volumes)?

Discussion:
___ Did you clearly summarize overall key results from the presented data?
___ Did you create a context for understanding the relevance of the conclusions?
___ Did you describe any analysis of collective results that led to additional conclusions?
___ Did you connect the significance of your results to known information?
___ Did you note any unexpected results or difficulties encountered in interpreting your data?

Introduction & Abstract:
___ Did you describe in general the material being analyzed?
___ Did you describe in general the relevance of the techniques used to the analyses being done?
___ Does each topic mentioned relate directly to the experiment being done?
___ Does the abstract concisely state the purpose of the experiment and the techniques used?
___ Are the overall results and conclusions stated in the abstract?
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 essentially affirm that the experimental data presented was collected appropriately and interpreted fairly. In some cases, they are also responsible for assessing the importance or impact of the reported work for publication or funding. Ideally, this process serves to improve the quality of scientific research.

In Chem328, you will be asked to read and comment on the work of your peers. These reviews will not affect your report grade, but comments from your peers should give helpful feedback 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. Submitted work will be distributed randomly for anonymous peer review, and you will have a week to read and comment on the papers assigned to you for each experiment.

You will also do peer reviews related to the presentations planned. Small groups of students will meet to look over drafts of your presentations and make suggestions for clarity. Each student will be expected to share comments with others in your group. In addition, you will record comments on all final presentations. (You will also evaluate each presentation as delivered to the class. However, these scores will be part of your overall presentation grade.)

The main goals for these peer reviews are to expand your perspective when writing and to practice evaluating presented information for both content and form. Your comments should demonstrate a meaningful review of the report or presentation. Your peer review comments will be evaluated by the instructor for how thorough, insightful, and fair they are in addressing the work under review.

Assessment of peer review will be:

<table>
<thead>
<tr>
<th>Comment Type</th>
<th>Points</th>
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<tbody>
<tr>
<td>Focus section comments (10 pts x 3)</td>
<td>30 pts</td>
</tr>
<tr>
<td>Presentation draft comments</td>
<td>10 pts</td>
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<tr>
<td>Final presentation comments</td>
<td>10 pts</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>50 pts</strong></td>
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**Presentation**

Oral presentation of scientific ideas is another crucial aspect of scientific discovery. Scientists regularly report on their work through seminars as a way of gaining broader insight for interpreting data. Therefore, it is important to be able to clearly evaluate, summarize and communicate information.

In Chem328, each student will give a 30-min PowerPoint presentation relating to an analytical biochemistry technique. The presentation should have two main parts: 1) a general description about how the technique works; 2) presentation of how the technique was utilized in a primary research article. The first part of your presentation will be a general review of the analytical technique selected. Your goal is to provide your peers with an overall understanding of the principles of the technique. Focus on clearly providing the big picture. You may also include how the technique was developed or variations on use of the technique. The second part of your presentation should demonstrate use of the technique in research. You will identify a journal article where your technique was used and clearly explain how the authors applied the technique. The whole article does not have to be presented, but you should specifically show the data obtained using the technique and explain how the interpretation of that data.

Intermediate deadlines are laid out to facilitate the progress on your presentation: selection of your topic, approval of the article you intend to use, and a preliminary version of your presentation (in PowerPoint) to allow for feedback. Presentations will be given on several dates during the semester as well as during the final exam period. You MUST attend all sessions.

**Assessment of Presentations**

<table>
<thead>
<tr>
<th>Topic selection</th>
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<tbody>
<tr>
<td>Article approval</td>
<td>5 pts</td>
</tr>
<tr>
<td>Preliminary Draft</td>
<td>10 pts</td>
</tr>
<tr>
<td>Explanation of technique</td>
<td>30 pts</td>
</tr>
<tr>
<td>Summary of article data</td>
<td>30 pts</td>
</tr>
<tr>
<td>Quality of presentation materials</td>
<td>10 pts</td>
</tr>
<tr>
<td>Audience assessment</td>
<td>10 pts</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100 pts</strong></td>
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Referencing Guidelines
Despite differences in format, all references should include a basic set of information that allows the source to be uniquely identified. The following guidelines should be sufficient for your reports. More detailed information can be found in ACS Style Guide: A Manual for Authors and Editors (2nd ed., Janet Dodd, Washington, DC: American Chemical Society, 1997).

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 the sentence but may be made at any logical place. References may be cited either by numbering or by directly identifying the author and date.

- **Numbering**: each reference cited is assigned a sequential number as used.
  - There are two options for the in-text format:
    - superscripted: *Ex*: Ipk1 is an IP$_5$ 2-kinase.$^6$
    - in parentheses: *Ex*: Ipk1 is an IP$_5$ 2-kinase (6).
  - Once a reference has an assigned 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).

- **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
    *Ex*: ... an essential mRNA export factor (Murphy and Wente, 1996).
  - When there are more than two authors, use only the first name listed followed by “et al.”
    *Ex*: Ipk1 is an IP$_5$ 2-kinase (York et al., 1999).
  - To distinguish two references published by the same author(s) in the same year, use lowercase letters.
    *Ex*: ... has specific FG Nup interactions (Bayliss et al., 2002a).
Reference listing
A complete listing 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.

➢ **Numbering:** Place the references in numerical order according to their number in the text.

➢ **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.

➢ **Reference listings** should include the following information:

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

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).
     

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

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)