Course Syllabus
CH4721 – Research Methods in Biomolecular Chemistry
College of Science and Arts
Spring 2015

Instructor Information
Instructor: Professor Thompson
Office Location: 510B Chem Sci
Office Telephone: 906-487-3522
E-mail: thompson@mtu.edu *Put ‘CH4721’ in subject line*
Office Hours: 1:00 – 3:00 pm Tuesdays and by appointment

Course Identification
Course Number: CH4721
Course Name: Research Methods in Biomolecular Chemistry
Course Location: 504 Chem Sci (Tuesday Labs)
215 Chem Sci (Thursday Presentations)
Class Times: Tues: 12-5 pm; Thur: 2 - 4 pm
Prerequisites: CH4710 (Biomolecular Chemistry I) and CH4222 (Bioanalytical Chemistry)
or CH4212 (Instrumental Analysis)

Course Description/Overview
The goal of the course is to introduce you to a variety of modern protein and nucleic acid techniques in a discovery-based manner. The course is divided into two parts: the first part will focus on the introduction of common biochemical techniques in a guided-inquiry format. In the second part, students will undertake a research project which will involve question formulation, project design, consultation of primary literature, execution of the project, and communication skills.

Course Resources

Course Website
- Course syllabus and detailed methods will be posted on Canvas.

Suggested Course Text
- Fundamentals of Biochemistry by Voet, Voet, and Pratt, 3rd edition
Grading Scheme

Grading System

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percentage</th>
<th>Grade Points/credit</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90% &amp; above</td>
<td>4.00</td>
<td>Excellent</td>
</tr>
<tr>
<td>AB</td>
<td>85% – 89%</td>
<td>3.50</td>
<td>Very good</td>
</tr>
<tr>
<td>B</td>
<td>80% – 84%</td>
<td>3.00</td>
<td>Good</td>
</tr>
<tr>
<td>BC</td>
<td>75% – 79%</td>
<td>2.50</td>
<td>Above average</td>
</tr>
<tr>
<td>C</td>
<td>70% – 74%</td>
<td>2.00</td>
<td>Average</td>
</tr>
<tr>
<td>CD</td>
<td>65% – 69%</td>
<td>1.50</td>
<td>Below average</td>
</tr>
<tr>
<td>D</td>
<td>60% - 64%</td>
<td>1.00</td>
<td>Inferior</td>
</tr>
<tr>
<td>F</td>
<td>59% and below</td>
<td>0.00</td>
<td>Failure</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete; given only when a student is unable to complete a segment of the course because of circumstances beyond the student’s control. A grade of incomplete may be given only when approved in writing by the department chair or school dean.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Conditional, with no grade points per credit; given only when the student is at fault in failing to complete a minor segment of a course, but in the judgment of the instructor does not need to repeat the course. It must be made up within the next semester in residence or the grade becomes a failure (F). A (X) grade is computed into the grade point average as a (F) grade.</td>
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</table>

Grading Policy

Each lab experiment will be worth 100 points – 10% for pre-lab questions, 20% for lab performance, 35% for post-lab presentation/discussion, and 35% for the lab report. The final project will be worth 200 points, 50% for the final report and 50% for the final presentation.

University Policies

Student work products (exams, essays, projects, etc.) may be used for purposes of university, program, or course assessment. All work used for assessment purposes will not include any individual student identification.

Michigan Tech has standard policies on academic misconduct and complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990. For more information about reasonable accommodation for or equal access to education or services at Michigan Tech, please call the Dean of Students Office, at [906] 487-2212 or go to http://www.mtu.edu/ctl/instructional-resources/syllabus/syllabus_policies.html
Laboratory Reports

The lab report should consist of the following sections: title, abstract, introduction, materials and methods, results, discussion, conclusion, and references. The experiment lab reports should be about 4-5 pages long and the final project report about 7-8 pages.

I. Abstract (Brief summary of the paper):

- Should be viewed as a mini-version of the paper.
- Should provide a brief summary of each of the main sections of the paper: Introduction, Material and Methods, Results and discussion.
- The Abstract should (1) state the principle objectives and scope of the investigation, (2) describe the methods employed, (3) summarize the results, and (4) state the principle conclusion.
- Brevity is very important
- The Abstracts should be written in the past tense

II. Introduction (What do you intend to do? What is the “Question” that you are setting out to answer?):

- Present the nature and scope of the problem investigated
- Review the pertinent literature to orient the reader
- Highlight unique features
- Explain principles underlying the experiment - present structures and equations
- Do not break up paragraphs to insert figures.
- Do not leave blank white space in your report. If you need to insert multiple figures in the same page, group figures at the top or at the bottom.
- The introduction should be written in the present tense.

III. Materials and Methods (How did you do the experiment to answer the “Question”?):

- Describe the experimental details in a short paragraph since the procedure has been provided to you. Outline the key steps of the experiment.
- Describe any deviations you made from the procedure suggested
- Describe any mistakes made during the experiment
- Provide sufficient detail so that others can repeat the experiment from the same written source (procedure from the instructor) and your comments
- This section should be written in the past tense
IV. Results (What information did you generate in the lab? What is the best way to present the data to answer your “Question”?)

- This is the core of the report. Present all your data here – even if you think it is not correct
- There are two parts to presenting the results: first provide the overall description of the experiment – the “question” you propose to answer by doing a particular experiment (don’t repeat the experimental details previously provided), then, present the data
- Give thought to how best to present the data – graphs? tables? figures? Present raw data in an Appendix.
- Include data generated by other members of your group
- Although the results section is the most important part of the paper, it does not have to be the longest
- Graphs, tables and figures should have a title, should be properly labeled, and graphs and figures should have a legend
- Results should be clearly and simply stated
- Insert graphs, tables and figures at appropriate places in the text, close to when you first refer to them, preferably at the end of the paragraph
- This section should be written in the past tense

V. Discussion* (What do you think the data in Results mean? )

- Present what you think the data in the Results section are telling you. In other words, interpret and discuss your results
- Present principles, relationships and generalizations shown by Results
- Point out experimental mistakes that prevent you from drawing conclusions
- Point out any exceptions and lack of correlations
- The discussion should be written in the present tense

VI. Conclusions (Summarize in a few words the following: What is the answer to the “Question” you set out to answer?)

- Clearly articulate the answer to your “Question” as briefly as possible.
- Recap only the salient points

VII. References

Follow the format used in the Physical Chemistry Laboratory.
http://www.chemistry.mtu.edu/~kmsmith/PChem/MiscInfo/BCCFormat.pdf

*The Results and Discussion sections can sometimes be combined if the later results can be better explained by a more complete discussion of the earlier data.
# Course Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday</th>
<th>Thursday</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction, Check-in, Pipette Calibration</td>
<td>Course Expectations, Report Writing, Presentations</td>
</tr>
<tr>
<td>2</td>
<td>Polymerase Chain Reaction &amp; Separation of DNA</td>
<td><strong>Presentations:</strong> PCR Lab</td>
</tr>
<tr>
<td>3</td>
<td>Enzymatic Digestion of DNA</td>
<td><strong>Presentations:</strong> DNA Digestion Lab</td>
</tr>
<tr>
<td>4</td>
<td>Introduction to Biological Databases</td>
<td>No Class (Winter Carnival)</td>
</tr>
<tr>
<td>5</td>
<td>Protein Separation: SDS-PAGE</td>
<td><strong>Presentations:</strong> SDS-PAGE Lab</td>
</tr>
<tr>
<td>6 &amp; 7</td>
<td>Enzyme Extraction &amp; Purification</td>
<td>Enzyme Extraction &amp; Purification</td>
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<tr>
<td></td>
<td>Enzyme Extraction &amp; Purification</td>
<td><strong>Presentations:</strong> Enzyme Extraction &amp; Purification</td>
</tr>
<tr>
<td>8</td>
<td>Enzyme Kinetics &amp; Inhibition</td>
<td><strong>Presentations:</strong> Enzyme Kinetics &amp; Inhibition</td>
</tr>
<tr>
<td>9</td>
<td>Spring Break</td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>Independent Projects Presentations TBA</td>
<td></td>
</tr>
</tbody>
</table>
1. “Calibration of Pipettes”
   - 01/13/2015
     Group 1- Yuqing & Alexa (No presentations during week 1!!)
     Group 2- Kaley & Eric
     Group 3- Christopher & Andrew
     Group 4- Tyler & Melissa
     Group 5- Christina & Heather

2. “Polymerase Chain Reaction & Separation of DNA”
   - 01/20/2015
     Group 1- Tyler & Eric*
     Group 2- Andrew & Christina
     Group 3- Alexa & Melissa
     Group 4- Kaley & Heather
     Group 5- Yuqing & Christopher

3. “Enzymatic Digestion of DNA”
   - 01/27/2015
     Group 1-Christopher & Christina*
     Group 2- Kaley & Alexa
     Group 3- Andrew & Heather
     Group 4- Tyler & Yuqing
     Group 5- Melissa & Eric

4. “Introduction to Biological Databases”
   - 02/03/2015
     No Partners

5. “Protein Separation: SDS-PAGE”
   - 02/10/2015
     Group 1- Andrew & Alexa*
     Group 2- Heather & Tyler
     Group 3- Melissa & Yuqing
     Group 4- Kaley & Christina
     Group 5- Christopher & Eric

6. “Purification of Polyphenol Oxidase from Fruits and Vegetables”
   - 02/17/2015 - 02/24/2015
     Group 1- Kaley & Yuqing*
     Group 2- Christina & Eric
     Group 3- Heather & Christopher
     Group 4- Melissa & Andrew
     Group 5- Tyler & Alexa

7. “Enzyme Kinetics & Inhibition”
   - 03/03/2015
     Group 1- Melissa & Heather*
     Group 2- Alexa & Christopher
     Group 3- Kaley & Tyler
     Group 4- Christina & Yuqing
     Group 5- Andrew & Eric