Biochemistry Principles (CHE 381)
Tuesday/Thursday, 9:20 – 10:50, Hoyt 369

Instructor: Dr. Patrick Lackey  
Office: Hoyt 363  
E-mail: lackeyp@westminster.edu

Office Hours: 10:00 – 11:30 AM on Mondays, 11:00 AM – 12:30 PM on Tuesdays, 2:00 – 3:30 PM on Wednesdays, or by appointment

COURSE OVERVIEW

Course description: As described by the Westminster course catalog, CHE 381 is *A study of proteins, carbohydrates, lipids and nucleic acids in a biological context. Emphasis is placed on the relationship between the structure and function of these biomolecules. Other optics include methodologies to analyze biomolecules, membranes, transport, kinetics, and biosignaling.* In simpler and terms, this is a class about the lifeless components that make up life, how they do that, how we study them.

Required text: *Lehninger Principles of Biochemistry* by David L. Nelson and Michael M. Cox. 7th ed. ISBN: 1464141819. *A brief word on used copies and older editions of the book:* The seventh edition is brand new and not all that different from the sixth edition, so you can likely use the sixth edition without much issue. I have no issues if you want to use an older edition than this, though I can tell you that the fourth edition does have some noticeable differences from the sixth/seventh. The in-class notes will occasionally refer to figures/page numbers/questions/etc. from the text; these will be match the seventh edition. If you use an older edition, it’s up to you to figure these differences out.

Course notes: Lecture outlines (divided by chapter, and not individual lectures) and supplemental materials will be posted on the 381 D2L page before class. You may use these as you see fit.

Calculators, cell phones, etc.: You will need a scientific calculator capable of solving logarithms, but cannot use a graphing calculator capable of storing data. Smartphones should not be used to fulfill this purpose during class. In general, phones should be stowed away and kept on silent during class. *Any use of a phone or smartwatch during an exam will be treated as cheating* and dealt with as outlined in the academic integrity section of this syllabus.

Course outcomes: (At the end of the course, students should be able to...)

- Demonstrate an understanding of the relationship between chemical structure and biological function in a wide variety of biological contexts.
- Successfully analyze and interpret experimental evidence and data to solve biochemical problems.
- Carry out quantitative calculations related to pH, buffering, kinetics, and thermodynamics.
- Utilize computer-based tools of bioinformatics, protein visualization, data analysis, and data presentation to effectively learn about and present biochemical information.
List of topics:
- Foundations of biochemistry
- Water and acid-base chemistry
- Amino acids, peptides, proteins
- Protein structure
- Protein function and examples
- Enzymes
- Carbohydrates
- Nucleotides and nucleic acids
- DNA-based information technologies
- Lipids
- Biological membranes and transport
- Biosignaling

Expectations: This course covers a large amount of challenging material and will require significant time from you outside of class. Class will not just be a lecture on the listed material: in-class time will often be used for discussion or to work on problem-solving for the topics at hand, which means that you are expected to have read the material for each chapter ahead of time. Between pre-class reading and post-class review, you should spend about 2-3 hours outside of class time per hour in class.

COURSE GRADING

Grade distribution:
- Exams (4@15% each): 60%
- Homework and quizzes: 10%
- Applied biochemistry investigations: 15%
- Protein project: 15%

Grading scale:
- A 90–100%
- B+ 87 – 89%
- C+ 77 – 79%
- D+ 67 – 69%
- F 0 – 59%
- B 83 – 86%
- C 73 – 76%
- D 63 – 66%
- B– 80 – 82%
- C– 70 – 72%
- D– 60 – 62%

Please note that these are guidelines and the instructor reserves the right to shift the grade breakdowns based on the class’s grade distribution.

ASSIGNMENTS AND EXAMS

Exams: There will be three exams throughout the semester and a final exam. The exams will be a combination of multiple choice, short answer and written response. Each essay question will be primarily focused on one or more areas to reflect the course outcomes. The final exam is cumulative.

Homework sets: A homework problem set will be assigned most weeks. The solutions can be hand-written and are due at the beginning of class according to the schedule. You must complete all problems to receive a homework grade. The class will review some of the homework for understanding by working problems on the board. Some or all of these questions may be checked for correctness, as well as completeness. I strongly advise you complete these assignments without outside help; these sets are assigned to help you form your own understanding of biochemistry.
and to find the best way for you to work through various question types that you may encounter on the exam. Specifically, these assignments will be checked for plagiarism from online sources and the academic integrity policy will be enforced on them.

**Comprehension quizzes:** Short quizzes may be given periodically to gauge your ongoing understanding of the material. They may be unannounced, so the best way to prepare for the quiz is to continually review your course notes and homework problems.

**Applied Biochemistry Investigations (ABI):** One of the great temptations of Biochemistry from your perspective as a student is to think of it as a memorization course. Biochemistry is a living and breathing field. Many of the concepts in your book were discovered in a lab not all that long ago. All of them are constantly evolving. These assignments will require you to utilize literature, case studies, and/or bioinformatics resources to extend their knowledge beyond the textbook. The goal of these assignments is to use the knowledge from the textbook and lectures and apply them critically to biochemical phenomena.

Follow the following guidelines for applied biochemistry investigations:

- Responses **must be typed.** It is expected that your submissions are in “polished” presentation form with regards to formatting.
- If calculations are required, a separate sheet of paper may be used for neatly written responses. The typed portion of the case study should clearly refer to the written work. (e.g. The typed portion for question number three might look like: 3. See attached sheet for printed calculations for this problem.)
- To receive full credit, all your work must be written/printed on separate pages that you staple together. If no calculations are required, the assignment may be turned in via D2L.
- Add a heading on the upper left side of the first page to identify the assignment, the date, yourself, and collaborators. Work must be neatly presented and the problems must be answered in numerical order.
- Work the problems by yourself first by utilizing the text and other authoritative sources on biochemistry. Once you have completed your first attempt, collaboration with classmates is encouraged to identify misunderstandings. If you significantly collaborate on an assignment, the collaborators should be listed on the heading (e.g. Author: Jane Doe with collaborator: Jack Smith)

**Protein Project:** The protein project provides an opportunity to read and understand biochemistry literature, to utilize protein visualization software to explore the structure of a particular protein. More information detailing this project is will be provided separately.

**COURSE POLICIES**

**Attendance:**

- If you must miss class for any reason (field trip, athletics, emergencies, etc.), provisions for turning in assigned work or taking an exam should be made **at least one week before** your absence.
- Reasonable emergencies (family, medical, etc.) will merit consideration. Poor planning is not an emergency. In the case of an emergency, you must make every effort to contact your professor **ahead of time.** If this is not possible, you must make arrangements with your professor **within 24 hours of the assignment due date or exam.** Please understand that you may be asked for documentation of your emergency to confirm your absence
- Late work will be penalized 20% of the total possible points for each day the assignment is late until its value is 0%.
Working in Groups: Discussion of coursework may include brainstorming and verbally walking through possible solutions, but should not include one person telling the others how to solve the problems. Each student must write/type independent solutions to all assignments.

Academic Integrity Policy: Students should refer to the Westminster Course Catalog, which lists violations to the Academic Integrity Policy as including, but not being limited to: plagiarism, cheating, misrepresentation of facts or experimental results, unauthorized use of or intentional intrusion into another’s computer files and/or programs, intentional damage to a computer system, and unauthorized use of library materials and privileges. There are extensive examples of each these behaviors in the catalog, but it is important to remember that copying or significantly replicating online material is plagiarism. Academic dishonesty will not be tolerated. With regard to homework, ABIs, and lab assignments, the first citation of academic dishonesty will result in a grade of zero for the assignment. The second citation will result in a failing grade for the course. With regard to exams, all incidents of cheating will result in failure of the course. All citations of academic dishonesty will be reported to the Dean of the College, in accordance with the College policy.

Available Support Services: Westminster College makes every effort to accommodate and serve students with a variety of support services. Please visit me outside of class if you are not performing at your desired level. The Learning Center is also great place to get additional free tutoring; contact the director, Sally Huey at x 6700 to make an appointment with a well-qualified peer tutor. Students with disabilities who require access to solutions for environmental or curricular barriers should contact Disability Resources by contacting the director, Faith Craig at 724-946-7192.
# COURSE SCHEDULE (subject to change)

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16  Ch 1: Foundations of biochemistry</td>
<td>1/18  Ch 1: Foundations of biochemistry</td>
</tr>
<tr>
<td>1/23  Chapter 2: Water</td>
<td>1/25  Chapter 2: Water</td>
</tr>
<tr>
<td><strong>HW 1 due</strong></td>
<td>1/25  Chapter 2: Water</td>
</tr>
<tr>
<td>1/30  Chapter 3: aa’s, peptides, proteins</td>
<td>2/1   Chapter 3: aa’s, peptides, proteins</td>
</tr>
<tr>
<td><strong>HW 2 due</strong></td>
<td>2/1   Chapter 3: aa’s, peptides, proteins</td>
</tr>
<tr>
<td>2/6   Chapter 4: 3-D structure of proteins</td>
<td>2/8   Chapter 4: 3-D structure of proteins</td>
</tr>
<tr>
<td><strong>HW 3 due</strong></td>
<td>2/8   Chapter 4: 3-D structure of proteins</td>
</tr>
<tr>
<td>2/13  Exam review/catch up</td>
<td>2/15  Exam 1 (Chapters 1-4)</td>
</tr>
<tr>
<td><strong>HW 4 due</strong></td>
<td>2/15  Exam 1 (Chapters 1-4)</td>
</tr>
<tr>
<td>2/20  Chapter 5: Protein function</td>
<td>2/22  Chapter 5: Protein function</td>
</tr>
<tr>
<td><strong>Protein project discussion</strong></td>
<td>2/22  Chapter 5: Protein function</td>
</tr>
<tr>
<td>2/27  Chapter 6: Enzymes</td>
<td>3/1   Chapter 6: Enzymes</td>
</tr>
<tr>
<td><strong>HW 5 due</strong></td>
<td>3/1   Chapter 6: Enzymes</td>
</tr>
<tr>
<td>3/6   No Class – Spring Break</td>
<td>3/8   No Class – Spring Break</td>
</tr>
<tr>
<td>3/13  Chapter 6: Enzymes</td>
<td>3/15  Chapter 6: Enzymes</td>
</tr>
<tr>
<td><strong>HW 6 Due</strong></td>
<td>3/15  Chapter 6: Enzymes</td>
</tr>
<tr>
<td>3/20  Exam 2 (Chapters 5-6)</td>
<td>3/22  Chapter 7: Glycobiology</td>
</tr>
<tr>
<td>3/27  Chapters 8 and 9: Nucleotides</td>
<td>3/29  No Class -- Easter</td>
</tr>
<tr>
<td><strong>Applied biochem investigation 3 due</strong></td>
<td>3/29  No Class -- Easter</td>
</tr>
<tr>
<td>4/3   No Class, Tuesday is a Monday</td>
<td>4/5   Chapter 8 and 9: Nucleotides</td>
</tr>
<tr>
<td>4/10  Chapter 8 and 9: Nucleotides</td>
<td>4/12  Chapter 10: Lipids</td>
</tr>
<tr>
<td><strong>HW 7 Due</strong></td>
<td>4/12  Chapter 10: Lipids</td>
</tr>
<tr>
<td>4/17  Chapter 10: Lipids</td>
<td>4/19  Exam 3 (Chapters 8-10)</td>
</tr>
<tr>
<td><strong>HW 8 due</strong></td>
<td>4/19  Exam 3 (Chapters 8-10)</td>
</tr>
<tr>
<td>4/24  Chapter 11: Membranes</td>
<td>4/26  Chapter 11: Membranes</td>
</tr>
<tr>
<td>5/1   Chapter 12: Biosignaling (or TBD)</td>
<td>5/3   Chapter 12: Biosignaling (or TBD)</td>
</tr>
</tbody>
</table>

*Final Comprehensive Exam: Wednesday May 9, 8:00 – 10:30 AM*