Syllabus for CHEM 472/572 and BIOS 472X/572X- Fall 2017

Course Information:

Title: Biological Chemistry I
Credit Hours: 3
Course Location and Time: FH (Faraday Hall) 144, TuTh 9:30 to 10:45 a.m.

Instructor Contact Information:

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Office Hours:
Tuesday and Thursday: 10:45 a.m. to noon, LaT 426

Course Description:

Applies general and organic chemical concepts to selected biochemical topics. Topics include, but are not limited to, drug interactions, allosterism, pH-dependent switches, kinetic and catalytic mechanisms, and protein-ligand interactions. Throughout the course, the structures of practical compounds and macromolecules are examined and models are developed to illustrate structural determinants of properties and function. Students are also introduced to experimental methods and data analysis through selected published papers.

Student Learning Outcomes:

Included in course modules, which are on Blackboard.

Tentative Course Schedule:

Exams are based on the course modules. Each contains a set of problems to guide students through the relevant concepts. The exam schedule and tentative topics schedule is below.

Exam 1: Thu, September 14, 9:30 to 10:45 a.m.

- Review of the structure and properties of practical compounds, such as nutrients and pharmaceuticals; properties include acid-base, shape, resonance, acid-base, and isomerism. Properties follow from structure which, in turn, determine biological function.

Exam 2: Thu, October 12, 9:30 to 10:45 a.m.

- Protein structure-function relationships. Allosterism and the Perutz model; hemoglobin variants. Thermodynamic and kinetic methods for studying and analyzing protein-protein and protein-ligand interactions in monomeric and oligomeric systems; role of prosthetic groups.

Exam 3: Thu, November 9, 9:30 to 10:45 a.m.

- Active site structure of enzymes; role of cofactors; transition state stabilization, diffusion control, and induced fit; kinetic methods for analyzing the binding of orthosteric and allosteric drugs. Mechanisms of enzyme catalysis with emphasis on hydrolases, including the role of general acids and bases in substitution, addition, and elimination mechanisms.

Exam 4: Thu, December 14, 10:00 to 11:50 a.m.

- Structure and properties of carbohydrates, lipids, and nucleic acids and their interaction with proteins; role in disease.

Student Assessment:

- Level 400 students - Letter grade cutoffs:
  Grade based on four exams, each 100 points. 400 points possible, although extra credit points will be available on each exam that add to your point total.

A: 380 and above	C+: 288 to 312
A-: 360 to 379	C: 260 to 287
B+: 344 to 359	D: 220 to 259
B: 328 to 343	F: 219 and below
B-: 313 to 327	

- Level 500 students - Letter grade cutoffs:
  Grade based on four exams (same as those taken by level 400 students), each 100 points. Level 500 students also will complete and submit for credit two course assignments, each 20 points. These advanced assignments, must be submitted in the Assessments section on Blackboard. For the point totals below, the total exam score will be multiplied by 0.9 and the assignment points (up to 40) added to it.

  Important: C-, D, F, and WF have the same impact as a "U" for graduate students.

A: ≥ 380	C+: 296 to 311
A-: 360 to 379	C: 272 to 295
B+: 344 to 359	C-: 256 to 271
B: 328 to 343	
B-: 312 to 327	

  Some downward adjustment to letter grade cutoffs may occur at the end of the course after all the exam data are compiled and whole class trends become evident.

Course Resources:

- **Textbook**:
  None is required, but having one available to refer to is recommended. A reliable online resource can be substituted. LibreTexts.org, for example, has a free online resource on biological chemistry.

- **Blackboard**:
  Your primary source for exam preparation is a series of course modules posted in the Content section of Blackboard. Each module has a set of problems to guide students through relevant concepts. Success on exams is guaranteed if you understand how to do all the module problems. Most will be addressed in class.

- **Databases**:
  Several will be used in class and all may be accessed with a web browser. Databases include, but are not limited to,
  - The Protein Data Bank (PDB): Useful for obtaining structural information on proteins and interactively visualizing their structures.
  - The Enzyme Structures Database (EC-PDB): Useful for browsing enzyme classes and subclasses; also integrated with the PDB.
  - The PubChem: Useful for visualizing the structure and properties of small, practical compounds; also includes toxicity and safety data.

Course Policies and Recommendations:

- *Pace yourself and do the problems*.
  Students should attempt problems in course modules before class. Your goal is to stay ahead of the instructor. The instructor will also provide time at the start of each class for students to work alone or in small groups to work through the problems. The remaining class time will be spent addressing problems that students had trouble solving. It's not just important to have the correct answer. You must often illustrate how you obtained that answer.

- *Embrace models.*
  Models represent one of the important ways we come to understand scientific observations. Whether it's designing a drug therapy or explain a pH dependence, models provide a framework for thinking about many natural processes. Models will be presented throughout the course. Learn them, since they will reinforce your conceptual understanding of course topics.

- *Do more than memorize.*
  Too much reliance on memorization leads to fragmented and superficial understanding of topics that will limit your performance in this course. Some concepts are threaded throughout the course, such as the acid-base concept. Pace your learning and apply reflective strategies by asking how or why. Make connections where possible. Don't simply memorize the what.

- *Don't expect much multiple choice.*
  Exam problems follow the format of those in the course modules. Some problems will require a written response. Other problems will require a calculation that shows relevant equations and work, or a set of valid chemical structures. You may also be asked to analyze or interpret published data, such as a graph, or to apply an algebraic derivation. Some calculus may also be required. Again, the problems in the course modules are your guide. Be prepared to write structural formulas with correct valence and formal charges, or to interpret line, perspective, Lewis structures, or Newman projections. Module problems will also review key general and organic chemical concepts, since these are often needed to solve biochemical problems. Avoid drawing structures showing carbon atoms with 5 bonds and don't confuse amines and amides. I see these patterns with some students throughout the course. It never gets fixed and it never leads to a good letter grade.

- *Makeups.*
  One makeup exam may be allowed. Valid reasons for missing an exam include a professional obligation (such as attending a conference or symposium that a faculty advisor can validate), a standardized admissions exam scheduled before the start of the course (copy of registration and schedule required), a sports competition if an NIU athlete (and your coach provides the required documentation), or an unforeseen medical emergency or vehicular accident (validation required). Reasons such as you forgot or overslept, a previously scheduled vacation, a friend or family member passing away are not valid reasons for missing an exam. Any missed exam without proper validation or timely notification, as determined by the instructor of record, will receive a zero. For known events, validation must be provided at least one week prior to the scheduled exam, or within a reasonable period after the missed exam for an unforeseen event or medical emergency.

Americans with Disabilities Statement.

- Please read and comply with this statement if you require any type of accommodation due to disability.

Academic Integrity (AI) Statement:

- All students are required to comply with all relevant Academic Integrity (AI) standards. Relevant links can be found here. All students are advised to take the NIU student tutorial on AI if they haven't already.

- Tablets, laptops, and electronic notebooks are allowed in class to access this course's resources on Blackboard or other resources directly related to class content. Cellular device use is not allowed during class time (unless the instructor grants permission) and no electronic devices, other than a simple calculator, will be allowed during exams.

Taking this course for graduate credit as an undergraduate:

This only applies if the following conditions are all true:

- You are registered for CHEM 470, not BIOS 470X.
- CHEM 470 is an elective course and not a requirement for your undergraduate degree at NIU.
- You plan to apply to NIU's graduate program in the Department of Chemistry and Biochemistry.

Taking this course for graduate credit will allow a waiver of 3 credit hours in the course requirements for the M.S. or Ph.D. degree in the Department of Chemistry and Biochemistry at NIU, contingent on approval by the department's Graduate Program Committee. All interested undergraduates must email the course instructor of their intent within the first two days of classes. In addition, **students must achieve a minimum of 50 out of 60 points on the graduate assignments (equivalent to an 83%) and earn no less than a B in the course**.