CHEM 350
BIOLOGICAL CHEMISTRY

SPRING 2016

Class Schedule: Class Lectures MWF 10-10:50 AM Neckers 240

Professor: Keith Gagnon Neckers 291 ktgagnon@siu.edu

Office Hours: M-W after class lectures until 12 noon, or by appointment. Email for an appointment. NO OFFICE HOURS on Fridays or exam days.

Course Objectives: This course will explore the chemical basis of biological phenomena and the principles that govern biological life. The structure, synthesis and function of the four major classes of biological macromolecules, proteins, nucleic acids, lipids and carbohydrates, will be discussed in the context of fundamental chemical and biochemical processes. The central importance of enzymes as biological catalysts and their regulation in metabolism will be explored. Catabolic breakdown pathways that generate cellular energy and anabolic synthesis pathways that build molecules will be discussed. We will also emphasize key metabolic pathways essential for life. Students will be expected to use basic knowledge for understanding and then explaining how these biological molecules and metabolic processes function and how they are regulated. This will frequently involve critical thinking skills using factual knowledge learned in this class to explain scientific observations and presented data.

“The value of a college education is not the learning of many facts, but the training of the mind to think.”
- Albert Einstein, 1933


Prerequisites: C or better in CHEM 210 and 339 or 340. One semester of a biological course (BIOL 200A/B, PLB 200, ZOOL 118).

Outside Class Expectations: Students are expected to read the assigned sections of the textbook that correspond to the material discussed in class lectures and answer the assigned study guide questions. In addition to class lecture material and in-class discussion, this material and these questions will constitute the questions on exams. Students should understand that additional topics and material may be covered in class that are not necessarily in the textbook. Therefore, class attendance is essential for obtaining all course material that will be included in the exams. Students should consider 2 hours of outside reading and studying lecture notes appropriate for each 50 minutes of lecture. This study time does not include the time needed to prepare for the hour exams. In addition, studying with a peer group or study team in preparation for exams is a key strategy for performing well in CHEM 350.
CHEM 350 COURSE OUTLINE

I. Water and pH

II. Organic Functional Groups in Biochemical Molecules and Reactions

III. Chemical Reactions: Equilibrium and Thermodynamics

IV. Amino Acids and Protein Primary Structure

V. Protein Structure and Folding

VI. Fibrous and Globular Proteins: Structure and Function

Hour Exam I

VII. Enzymes: Kinetics, Inhibitors, Mechanisms

VIII. Cofactors: Essential Ions and Coenzymes

IX. Nucleotides and Nucleic Acids

X. Protein and RNA Synthesis

Hour Exam II

XI. Lipids and Membrane Structure

XII. Membrane Transport and Signal Transduction

XIII. Carbohydrates

XIV. Overview of Metabolism

XV. Glycolysis

XVI. TCA Cycle

Hour Exam III

XVII. Oxidative Phosphorylation and ATP Synthesis

XVIII. The Nitrogen Cycle

XIX. Photosynthesis

Comprehensive Final Exam
**EXAM DATES AND GRADING SCALE**

<table>
<thead>
<tr>
<th></th>
<th>Date</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Hour Exam I</td>
<td>Wednesday, February 17</td>
<td>100</td>
</tr>
<tr>
<td>Hour Exam II</td>
<td>Wednesday, March 23</td>
<td>100</td>
</tr>
<tr>
<td>Hour Exam III</td>
<td>Wednesday, April 20</td>
<td>100</td>
</tr>
<tr>
<td>Comprehensive Final Exam</td>
<td>Wednesday, May 11 (10:15 AM - 12:15 PM)</td>
<td>200</td>
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<tr>
<td>In-Class Problems and Bonus Points</td>
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<td>50+</td>
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**TOTAL** 500 points

Your final grade will be determined based upon a final total of 500 points (total divided by 500). In-class work and take-home study guides will be added to your exam points for a final point total.

Grading Scale (% of total points):

- **A** 88-100%
- **B** 75-87%
- **C** 62-74%
- **D** 50-61%
- **F** <50%

**BONUS POINTS, GRADING and EXAMS:**

In-class problems and take-home study guides will account for over 50 bonus points throughout the semester. Accumulation of bonus points is critical for most students in attaining the final course grade desired. For some, bonus points will be essential for passing the course or satisfying a C-wall requirement.

*All* exam grades will be used to determine your final grade. Only documented and verified sickness or immediate family deaths/emergencies are acceptable excuses for missing an exam and qualifying for a make-up exam. The above grading scale will be used to determine your final grade. There is no “extra” work that you can do to raise your grade. Only exams, in-class problem sessions and take-home assignments will be used to determine your final grade. Exams will consist of short answer define/explain/describe questions, drawing of structures/chemical reactions/biosynthetic pathways, and interpreting data. Very few, if any, multiple choice, true-false, or fill-in the blank questions will appear.

I will not answer class material questions by email. When coming to my office for extra help, please have a clear understanding of the material or concepts you are having trouble understanding. Indicating to me that you don't understand protein structure, for example, tells me that you have not studied the class notes sufficiently or have not done the appropriate reading in the text to know what is clear and, more importantly, what is unclear. Students who do not attend class should not expect me to review missed lectures during office hours. There are NO office hours on exam days.
**CLASS NOTES and FILES:**
Class notes will be made available via D2L to enrolled CHEM 350 students as PDF files. These files will typically be available a week in advance of class and students are expected to print out hard copies and bring them to class lectures. These files are the numerically ordered topics that will be used as power point outlines in class. These notes are *ONLY A SKELETON* of what will be discussed in class. They are incomplete and for the most part make little sense until you fill in the missing information. Be careful about reducing them in size as you need to fill in missing information. Most students will find that two Powerpoint slides per sheet is reasonable, leaving the back blank for additional notes. One way is to assemble these pages in a loose-leaf notebook. A few pages will be in color and it is to your advantage to print out these pages in color as certain graphic features are color-coded.

**IN-CLASS STUDY TEAMS:**
The first day of class you will be assigned to a “study team.” These will consist of 6-8 students. When an in-class problem is presented during the lecture, you will need to gather with your team to solve the problem. Each member should contribute information as is appropriate to solving the problem and developing an answer. Please take turns sharing the writing load to record the group’s collective answer. Each week a new team leader should be designated. These study teams provide three important values. *First,* they train us to work together as a team and solve problems as a group. In almost every workplace, a job requires working well with other individuals and coming up with solutions together. *Second,* they teach us to be diplomatic and tactful in communicating. If nothing else, they will teach patience and tolerance. *Third,* success in biochemistry is greatly improved when students work together to learn.

**TAKE-HOME STUDY GUIDES:**
Throughout the semester I will distribute study guide questions via D2L to enrolled students. These questions are designed to help you learn the course material. Assigned readings will be included with these study guides. The study guide questions are optional and for your benefit. However, if you turn in your study guide questions with completed answers by the date indicated on the first page, you will receive up to 2 bonus points. Late study guide submissions will not be accepted. Answers for take-home assignments will be provided after the turn-in date.

**IN-CLASS PROBLEMS:**
During each lecture I typically present an in-class problem. At that time, study teams will join together to solve the problem. You will have several minutes to come up with a collective solution, sign your names and turn in the answer. Falsely signing for another student will result in zero points for all team members and the inability to earn future bonus points for that team. Solutions not turned in after the allotted time will not receive credit. In-class problems may be presented at any time during lecture. One or two problems will be presented per lecture. Problems are often selected from the take-home study guide questions. Each successfully completed in-class problem can earn each student up to 1 bonus point.

**PRE-EXAM RESOURCE SESSIONS:**
Resource sessions will be held at Morris Library on Monday and Tuesday evenings before every exam. This is a unique opportunity to ask questions, work problems and determine what you know and don’t know. Practice exams will be available prior to the resource session. We can work through the problems together and answer concerns as a class. This will be an interactive but controlled discussion time. I will not lecture during this time. If no questions are asked, then no answers will be given.
CHEM 350 COURSE POLICIES

1. Students are expected to conduct themselves in a professional manner. This includes being on time for class and respecting other students during class time. Adhering to the class and exam schedules should be a priority and students are expected to arrange their personal and job/work time around the class and exam schedule.

2. All students are expected to have completed the prerequisites for this course and possess the appropriate knowledge from these prerequisite courses, unless otherwise approved by the university.

3. All official university drop dates will be observed. Course drop forms or changes in grading to audit or pass/fail will not be signed after the last official drop day.

4. Attendance at all lectures is expected. Success in CHEM 350 is dependent upon attending lectures and participating in in-class problem sessions. Often there is additional material that is discussed in class that is not part of the formal class notes. These discussions can later form the basis of exam questions. Also, bonus points for the final grade can be accumulated from in-class problems. These additional bonus points are often needed for a successful experience in CHEM 350.

5. Participation in study team activities is expected. Learning to work together with others as a team is not only a critical aspect of performing well on exams and learning the material, but also a life skill that will serve you well in your future career.

6. Assigned study guide questions are due at the specific time and date indicated on the first page of the handout. These homework assignments are usually graded and returned within one week.

7. A grade of incomplete will be given ONLY when course requirements have not been completed. An incomplete grade WILL NOT be given simply because a student has a failing grade in class or has unexcused absences for class or hour exams.

8. Students taking the class for credit only must obtain a letter grade of C to get credit for the course. Students auditing the course must take ALL exams and make an effort to answer the questions to successfully audit this course.

9. Students requiring special classroom and exam accommodations will have documentation from the Disability Support Services sent directly to me. These students must discuss with me their needs and then work with the DSS office.

10. PERSONAL SICKNESS AND FAMILY EMERGENCIES/DEATHS ARE THE ONLY ACCEPTABLE EXCUSES FOR MISSING AN EXAM. In both cases, appropriate/supporting written documentation is required for receiving an excused absence. Such documentation must be provided to me in person (a family obituary notice or medical documentation from a physician, for example). For personal sickness and family emergencies, students will also need to provide a phone number (doctor’s or family home phone) to confirm the excused absence. Documented professional commitments (professional school interviews, scientific meetings, university-sanctioned events) may be considered as an excused absence but notification must be provided well in advance of the exam date.

11. Make-up exams are given ONLY when a student has a legitimate and documented excused absence. Make-up exams will be different from the exams given during the normal exam time and may consist of essay questions. These questions will require accompanying biochemical structures, chemical, biochemical, enzymatic reactions, and quantitative calculations. Make-up exams must be taken within one week of the original exam date unless otherwise rescheduled with me by the student. Failure to take the make-up exam within the required time frame will result in a grade of zero for that exam. As these are essay questions, students scheduling a make-up exam must allow 130 minutes to complete the exam.
12. Cell phones and electronic devices should be silenced in class. Electronic devices cannot be used during in-class problem sessions.

13. When the lecture begins, students are expected to quiet down, begin listening and start taking notes. It is inconsiderate to your classmates to continue talking after class has begun. Class begins when the first Powerpoint slide appears on the screen.

14. Any needed changes or corrections in exam grades, or requested re-grading of any exam must take place during that week immediately following the return of the graded exam. If an exam is re-graded, all questions may be re-graded at that time. Upon return of an exam, please review your exam and make certain that you have received all the points you deserve including confirming the total number of points you have been given for that exam.

15. At the start of an exam, your desk and surrounding seat must be cleared of all papers, books, cell phones, all electronic devices, etc. No electronic devices including calculators will be needed during the exam. Any material on your person including extraneous papers and electronic devices or writing on the desk may be considered cheating and result in disciplinary action, including a grade of ZERO for that exam. A certain number of exams may be photocopied after grading is completed and before they are handed back in class to ensure academic integrity. Altering answers or adding additional information to corrected questions/exams and then requesting a re-grading of the exam will be considered cheating and result in disciplinary action, including an automatic grade of ZERO for that exam.

16. Any student discovered cheating on an hour exam will receive an F for that exam. If a student decides to appeal such action, then the student may submit an appeal to the university for further consideration.

17. There is no "extra credit" work that can be done to raise a student's grade. The grade is entirely based upon the hour exams and bonus points from in-class problems and take-home assignments ONLY. I do not grade "on a curve" so the points you earn directly correlate to your final letter grade.

18. Please be prompt for class to avoid disrupting the lecture and disturbing other students in the class. Students who are late are expected to enter from the back of the classroom to avoid disrupting me and the other students.

19. Students will not be allowed to take the first exam until the course policy form has been signed.
Five Keys for Success in CHEM 350

1. **Class attendance is critical for success in CHEM 350.** Attending class is much more than simply getting the class notes. You should consider time in class as study time. During lecture, we will be discussing topics in more detail and depth than what is simply on the power point slides. Often times I will be asking questions about the material under discussion. These questions can sometimes form the basis of an exam question. There will also be in-class problem sessions that are not part of your PDF file lecture notes. Additional questions will be presented to get students to think more deeply about a fundamental concept or biochemical structure or reaction. If you consider attending CHEM 350 optional, then you may also consider passing optional.

2. **Studying two hours for every 50 minutes of class lecture is critical for success in CHEM 350.** Continuous studying of the class lecture material is essential for success. After each class and before the next, you should spend two hours studying the latest lecture notes, reading the appropriate assigned sections of the textbook, and working on the take-home study guide. Often material covered in one lecture is critical for understanding the next lecture as well as subsequent lecture topics that will require this knowledge. CHEM 350 proceeds at a rapid pace and covers a great deal of material for each hour exam. Waiting until a day or two, or even a week, before an exam to begin studying will guarantee you a poor performance on the exam.

3. **Reading textbook assignments and working take-home problems are critical for success in CHEM 350.** The assigned readings in textbook are very specific and will include the bulk of the class material, often giving you a different viewpoint of the topics discussed in class. In addition, there will substantial material that we will not be able to cover in detail in lecture but will be covered in the textbook. The take-home study questions are designed to help you understand fundamental and critical concepts, the structure and chemistry of biological molecules and their biological reactions and functions. These assignments will help you keep up with the course material. You need to consistently and seriously read the textbook and answer thoughtfully and completely the questions. Once you have read the assigned textbook sections and answered the assigned questions, you should be saving these questions and your answers which you can then use to help you review and study for the hour exams as well as the comprehensive final exam. You will not need to re-read the assigned textbook sections in studying for the exams as long as you have done this thoroughly the first time when working on the study guide. Failure to make a full and thorough effort on these questions will not earn you bonus points and likely impact your ability to answer exam questions.

4. **Studying in groups is critical for success in CHEM 350.** You can read the assigned textbook sections on your own and work problems for take-home assignments by yourself. However, you should meet with other classmates or members of your study team during the week to exchange answers and ideas in order to complete the take-home assignments. For exam preparation, it is extremely valuable to combine your understanding with others in a study group to ensure you understand the material. If you understand a topic well, then you should be able to teach it to your fellow student. In turn, if you do not understand a topic, it is likely that someone in the study group will.

5. **Seeking help immediately and early when you are having difficulty is critical for success in CHEM 350.** If you have questions about any material that is unclear or that you do not understand, you should seek help from your study team first, then me as soon as possible. This can be right after class, during regularly scheduled office hours, or by appointment. Frequently, subsequent lecture material builds upon understanding previous lecture material so it is important to understand the discussed topics and concepts as you go. If you are having trouble on the exams and receiving poor grades, come see me immediately. Do not assume that on the next exam "I will do better." This is typically not the case and two poor exam grades will make it almost impossible to recover and earn a passing grade. Most often students who are doing poorly are doing so because they are not putting in the necessary effort to be successful in this class. Sometimes students are studying for the exams using the wrong approach or not teaming up with other students to study. Often times these students have significant outside distractions or unrealistic priorities. Getting help immediately can get you on the right track. This will be especially important for those students planning to graduate at the end of the semester.