Course Description

This course is designed to provide students with a broad introduction to biochemistry. This introduction will include the chemistry of water, amino acids, proteins, lipids, membranes, nucleic acids, and carbohydrates, as well as the fundamentals of enzyme kinetics and catalysis, biochemical energetics, intermediary metabolism, and regulatory processes. Throughout this course, our approach will be to emphasize the principles and fundamentals of biochemistry. This emphasis should serve the student well in whatever discipline they pursue, and it should help the student gain a rich perspective of the interworkings of life at the molecular level.

Course Objectives

As a result of taking this course, the student will be able to:

1) solve problems that require an understanding of the chemical properties of water, the ideal solvent of life, especially in relation to acid-base chemistry and noncovalent interactions.

2) solve problems that require an understanding of cell structure and function, especially in relation to the processes that govern the growth, maintenance and, to some extent, the division of cells.

3) solve problems that require knowledge and understanding of the structures (and therefore the chemical properties) of the amino acids, the five aromatic bases, select monosaccharides (e.g. D-glucose, D-ribose), and constituents of lipids (e.g., palmitic acid, stearic acid, glycerol, choline, sphingosine).

4) solve problems that require a knowledge and understanding of the structure, function and, to some extent, the biosynthesis of larger macromolecules (or macromolecular assemblies) including proteins, DNA, RNA, starch, cellulose, glycogen, and membranes.

5) solve problems that require knowledge of the derivation and application of the basic rate equations of enzyme kinetics including inhibition, and solve problems that require knowledge of the step-by-step processes of bond breaking and bond making in select enzyme-catalyzed reactions.

6) solve problems that require knowledge and understanding of the principles of thermodynamics and the basics of biochemical energetics.

7) solve problems that require knowledge of the steps (including the names and structures of starting, intermediate, and final compounds) of select, major pathways in biochemistry (e.g., glycolysis, gluconeogenesis, citric acid cycle, urea cycle, β-oxidation).

8) solve problems that require knowledge of the regulatory processes that cells (and organisms) use to respond to their environment, including allosteric regulation, covalent modification, and transcriptional regulation.

**My Objectives**

My objectives are to 1) provide you with the best possible undergraduate course in introductory biochemistry and 2) inspire you to think of biochemistry as a powerful, unifying approach to understanding the incredible phenomenon that we call life. These objectives are, admittedly, lofty. Since there are no nationally standardized exams that are appropriate for a one-semester biochemistry course, it will be difficult to assess the first objective. There is, however, an American Chemical Society (ACS) nationally standardized exam that is meant to be given after a General, Organic, and Biochemistry (GOB) course that normally is taken by students who need one year of chemistry. Incidentally, the University of Oklahoma does not offer this course, but the exam is the closest thing I have found that meets reasonably well my criteria for a proper, nationally standardized examination over concepts that I regard as fundamental principles of biochemistry. I first offered this exam at the end of the fall, 2009 semester. Overall, the class performed very well on this exam, which leads me to believe that I am approaching the first objective but not necessarily meeting it. I also will use cumulative exams throughout the semester to track student progress in meeting the above course objectives. Success in meeting the course objectives should provide the foundation for students to perform well on any additional national standardized exams that they are likely to encounter (e.g., MCAT, GRE). With regards to assessing the second objective, I will have to rely on your feedback. This feedback can take the form of you keeping me informed of your progress toward meeting your educational and career objectives. I look forward to hearing how well (or, and I hope this is not the case, how not so well) this course helps (or does not help) in meeting your goals and helping you to see the biochemical unity of life.

The **TEXTBOOK** for this class is:

*Essential Biochemistry*, 1st Ed., Charlotte W. Pratt & Kathleen Cornely John Wiley & Sons Inc. Hoboken, New Jersey, 2004. Please note that you can purchase the custom “binder-ready” version at a substantial savings off of what would be the traditional price of a hard-cover book; however, you will not be able to sell this binder-ready version back to the University bookstore at the end of the semester. In addition, the binder-ready version that is for sale at the University bookstore comes with an access code to the WileyPlus website, which we will use extensively for homework assignments. If you scratch off the film to reveal the access code for the WileyPlus website, you will not be able to return the book if you later decide to drop the course. If you bought/buy the book from some other source (e.g., Amazon) it likely will not come with an access code, and you will have to purchase the access code separately. Your cheapest option that I am aware of is to purchase the text directly from Wiley at the following URL:

http://he-cda.wiley.com/WileyCDA/Section/id-380912.html

The Wiley Plus site includes access to an on-line, electronic version of the text, so you can get started reading and using the text right away while the hard copy ships to your address. When you access the WileyPlus site you will need to register. When you register make sure you enter the email address you currently use and enter your student ID without any spaces or dashes between the numbers. The URL for the WileyPlus site is as follows:

http://edugen.wiley.com/edugen/class/cls160196/

Please note that you will be able to print out assignments so that you can work on them away from the computer, but you need to give yourself enough time to re-access the website to enter your answers before the allotted time expires. It will be your responsibility to get your answers submitted on time; I will not accept the excuse that the website was down and that is why your assignment was not submitted. To receive credit for the homework you need to have your student ID entered into the WileyPlus site without any
spaces or dashes between the numbers as stated above, and you need to submit at least one hour before the indicated time the assignment is due. The reason why one needs to submit one hour before the indicated time is to cover oneself for the time-zone difference between the Eastern Standard Time, which is where the WileyPlus people are, and Central Standard Time, which is where we are. So, if the assignment due time is 11 pm, make sure you submit your answers before 10 pm. You should note that even though the assignment is not technically due until 10 pm our time, I will consider noon on the day that an assignment is due to be the cut off for when I will provide help or respond to questions about the homework.

GENERAL

As mentioned, this course is designed to provide you with a broad introduction to biochemistry, which is an immense subject. Research in the field of biochemistry literally fills thousands of journal pages on a weekly basis, so the challenge to the student (and educator) is formidable. Also as mentioned, I will try to emphasize principles and fundamentals of biochemistry so that you will gain a broad perspective of the interworkings of life at the molecular level. Again, this broad perspective should serve you well in whatever discipline you pursue.

In the lectures I will highlight relevant portions of each chapter and supplement the text as appropriate, but I will not provide an abbreviated rephrasing of the material in each chapter. Accordingly, students are expected to read the text, attend lectures, and keep up with the material on a regular basis. My mantra, which you will hear frequently, is “Do not mistake recognition for mastery.” To begin to master the material you will have to become an active learner. You will have to grapple with the concepts and work through problems related to the material. Please note that a general rule-of-thumb in college is that a student should plan to study 3 hours for every hour of class time. I realize that many students roll their eyes when they hear this time estimate. Nonetheless, this time estimate is reasonable and necessary in Introduction to Biochemistry. Look at the size of the text book. We will cover most of the text during CHEM 3653. We will go fast, and it will really seem fast—too fast—if you do not keep up with your reading. Despite this warning, some students will get behind and then complain that I am going too fast. Basically, it is out of my hands. I am required to offer a rigorous Introduction to Biochemistry class that compares to other similar classes across the country and thus I have to stick the schedule. So, do not get behind. I do not feel that the material we will cover is inherently difficult conceptually. What is difficult is managing the sheer volume of material. That is part of what makes this class challenging. You will need to take in, organize, and integrate/synthesize quite a bit of information. Again, this task can be daunting if you get behind, so do not get behind.

Also, you should not presume to know what topics are important or what topics you will need to know. Sorry, but that is part of my job. I will have very little patience for comments such as, “Why do we need to know this?” or “I am interested in medicine and so I do not care about photosynthesis.”

A final elephant in the room that needs to be mentioned: math. Many aspects of biochemistry are quantitative. Depending on your orientation/background, this may or may not be good news to you. Again, there is no way around it. So comments such as, “I didn’t like the math part of biochemistry” are not likely to win you any sympathy points. Treating some aspects of biomolecules quantitatively is part of the nature of the course. We will derive some equations and we will use math to help us solve problems throughout the course, so the best way to handle this is to practice by solving lots and lots of problems (see below).
GRADING

The grade you earn will be based on your performance in the following categories:

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<tr>
<th>Category</th>
<th>Points</th>
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<tr>
<td>Homework</td>
<td>100 pts.</td>
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<tr>
<td>Clicker points</td>
<td>25 pts.</td>
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<tr>
<td>Lecture exams (3 worth 100 points each)</td>
<td>300 pts.</td>
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<tr>
<td>Final exam (2 exams: 100 points ACS; 100 points mine)</td>
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<td>Total</td>
<td>625 pts.</td>
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Grades will be assigned as follows:

- 90 – 100% = A
- 80 – 89% = B
- 70 – 79% = C
- 60 – 69% = D
- <60% = F

As mentioned, we will cover most of the textbook, which requires that we cover about 25 – 35 pages of text per lecture. We will start with Chapter 1 and proceed sequentially for the most part. We will skip some chapters and parts of others. I will give detailed reading assignments in class. Exams will be given on the following dates:

- Exam I (100 pts.) Thursday, 25 Feb.
- Exam II (100 pts.) Thursday, 25 Mar.
- Exam III (100 pts.) Thursday, 22 Apr.
- Final Exam (200 pts.) Tuesday, 11 May, 1:30 pm – 3:30 pm.*

*As noted above, the final exam will consist of two exams. The first will be the 60 question ACS exam, which will be worth 100 points; the second will be an exam that I write, which also will be worth 100 points. The second part of the final will be comprehensive in nature, but it will emphasize material covered since the third, lecture exam.

Based on the Course Objectives you undoubtedly have noted that I place a strong emphasis on solving problems. I do so because I am convinced that a person gains significant insight into a discipline by solving problems related to that discipline. Furthermore, I feel that merely trying to amass a body of facts does not constitute learning; rather, the ability to work from a core set of knowledge to solve problems is, in my view, an expression of learning and a highly desired outcome of education. Accordingly, my intent is to structure the class in a manner that focuses on solving biochemical problems. These problems will range from ones that require you to become familiar with the molecular scale of objects to ones that require you to interpret experiments, draw conclusions, make predictions, and, it is hoped, get a sense for how some of the great discoveries in biochemistry were made.

You have probably heard the saying that anything worth pursuing is likely to require diligence, persistence, and patience. In other words, you have to “work at it.” Unfortunately, the time allotted for class meetings is not enough for you to attain mastery of the subject. To address this concern, I will assign homework problems to provide you with the necessary practice and thus facilitate your learning of the subject. Homework will be submitted via the WileyPlus online system. For each assignment the percentage of correct answers will be recorded (e.g., 27/30 = 90%), and your overall homework grade will be the average of these percentage-correct scores, minus your lowest percentage-correct score. Thus, your lowest percentage-correct score will be dropped, which should help out if you had a low score as a result of some unforeseen emergency or if you simply forgot to submit an assignment on time. See attached Class Schedule for lecture topics and due dates of homework.) Students who consistently do well on the homework assignments should earn a majority of the 100 points possible for the homework portion of the grade, and such effort should help them prepare for the hourly exams (see below). I encourage you to form small groups to work on the homework, provided that everyone in the group contributes equitably. If you find that a person consistently does not contribute to your group’s effort on
the homework, then I strongly discourage you from allowing that person to obtain your group’s answers to the
homework. The TA will be available to help with homework problems during Action Centers, during her office
hours, or through email. The agreed upon office hours of the TA can and should be treated as informal
recitation sections to help you complete homework assignments. Again, late homework assignments will not be
accepted, so you need to make sure that you submit your answers before the due date.

My cousin teaches physics, and in her syllabus she states that the majority of the learning in the class will come
from the homework. I could not agree more. While attendance at lectures is extremely important, the time spent
doing homework, actually struggling with the material, is essential. Because I place such an emphasis on the
homework, I will construct the lecture exams in such a way that if one has diligently done the homework they
should do well on the exams. I cannot guarantee that one will perform well, but it is my intention that one will
see the rewards of their hard effort. Of course, if a student has relied on their peers for homework answers but
has not taken the time to master the concepts, then I do not anticipate that such students will perform very well
on the lecture exams.

Class meetings will be used to highlight/supplement/complement the material in the text (see attached
schedule); however, you should not expect me to “read” the text for you. To encourage you to keep up with the
class (i.e., not fall behind in the reading, homework, etc…) I will break-up the lectures to some extent by asking
“clicker” questions via the PRS system. I will likely start class meetings with a clicker question or two. Based
on the responses to the clicker questions I can and will adjust my coverage of the material. During the middle of
the class meeting I will ask another clicker question (or questions), and toward the end of class I will ask yet
another clicker question (or questions). My plan initially is to provide students with credit for that day’s clicker
points on the basis of participation rather than on necessarily getting the correct response. In general, if a
student participates (i.e., enters a response for all of the questions asked from the beginning, middle, and end of
class) then that student will get credit for participation at that class meeting. If a student arrives late or leaves
class early and does not enter responses for the questions asked during the beginning, middle, or end of the class
meeting, then that student will not get credit for that class period. For each lecture period in which a student
participates by entering answers when “clicker” questions are asked, a point will be entered into D2L.

At the end of the semester, the total number of possible “clicker” points will be totaled, and if a student earns
credit for participating in 90% of the class meetings, then they will earn 25 out of 25 points in this category. If a
student earns 80% of the possible clicker points they will earn 20 out of 25 points in this category. If a student
earns 70% of the possible clicker points they will earn 15 out of 25 points in this category. If a student earns
less than 70% of the possible clicker points they will “earn” 0 out of 25 points in this category. Thus, this grade
category accounts for 4.3% of the overall grade, and a student who does not earn any of these clicker-
participation points can still earn an “A” in the course, but it will be more difficult to do so. There will be no
make-ups for clicker participation points. The above point structure allows for the occasional absence due to
illness, car not starting, oversleeping, forgetting one’s clicker, clicker battery running out, etc…. For example,
by meeting for lecture twice per week we will have approximately 25 lectures during which clicker questions
will likely be asked. If a student misses one, two, or possibly even three lectures (or if they forget their clicker
or are unable to answer due to a low battery in their clicker), they should still be close to the 90%
attendance/participation mark and thus will earn 25 out of 25 clicker points. To reiterate: you must make every
effort to attend lecture, and you need to bring your PRS clicker with you to every lecture so that you can earn all
of the clicker points. If you forget your clicker, please do not ask if you can have credit for that day. This
quickly becomes an administrative nightmare on my part, so I will have to tell you “no” and you will not get
credit for that particular day.

Please note: Because I feel strongly that cooperative learning is helpful, I will allow and even encourage group
effort in solving the clicker questions. If, however, I get the impression that students are not diligently trying to
solve the questions then I will require individual effort and I will place more emphasis on correct responses in
order to earn the clicker points. Such a change in format will be modeled after the approach used in Dr. Blank’s
General Chemistry class.
You will take three, full-length lecture exams during the course of the semester. A week before the first scheduled exam I will announce what material will be covered on the exam. The questions on the second and third exams will emphasize the most recently covered material since the previous exam; however, any material from the previous exam(s) also will be fair game. Thus, each exam is in a sense cumulative, which will greatly help you prepare for the final exams, which also are cumulative. There are no make-up exams for missed lecture exams. If a student has a legitimate medical or family emergency or a legitimate activity associated with the University of Oklahoma (which requires that the student notify the instructor prior to the absence), then he or she will be allowed to have the average of the other lecture exams (or possibly the score on the final) count for the legitimately missed lecture exam. Please note that e-mails or telephone messages are not considered sufficient notification. I have included EXAM INSTRUCTIONS below; please read these and note, among other important considerations, that only non-graphing/non-programmable calculators are allowed. You can buy scientific but non-programmable/non-graphing calculators for about $10. My recommendation is to buy one and bring it to every lecture and use it on all homework assignments so that you are familiar with it when exam-time comes.

In general I want to stress that the grade a student earns in this class will be based on their performance in this class. CHEM 3653 is an upper-level chemistry course and as such it is not an easy “survey” of the material. To be successful in this course you likely will need to work hard, but hard work in and of itself is not the basis for receiving a desired grade. In other words, I will not respond favorably to comments such as, “But I worked so hard in this class I should get a C (or B or A).”

Also, keep in mind that this class is not a grade factory. I realize that many of you want to get into very competitive professional schools and, accordingly, your GPA is very important. If you want to get an A in this course then fine; earn it! I will be very happy if the majority of you earn A’s or B’s in this course, but again, you likely will have to work hard and you will have to perform very well on exams etc….Again, I will not respond favorably to comments such as, “This class is too hard”, “You are going too fast”, “I am earning A’s in all my other classes so my low grade is obviously your fault” (often implied but not spoken). Despite repeated requests of persistent students over the years, I am unable to “learn” the material for you. I will do my best to help, but ultimately your learning of the material is up to you. That may be a hard fact to digest, but it is true. (As an aside, I am often amazed when I hear a student—who wants to go to medical school—complain that I am going too fast or that there is too much information for them to learn; I am often tempted to ask these students what they think medical school will be like.)

Finally, I will have very little patience (i.e., zero tolerance) for requests for “special consideration.” By special consideration I mean requests such as: “Well, since I am not planning on going to medical school I should get a C instead of a D” or “Since I am so close to an A can’t you just raise my grade to an A” or “The job I have lined up after the semester depends on me getting a passing grade in Introduction to Biochemistry, so I have to pass the class.” Again, if you have to pass the class then you better make sure that you earn a passing grade. The above requests are particularly infuriating because they are unfair to the majority of the class. What are these people thinking? They deserve an A or B or C but the poor schmuck who has the same average doesn’t? Basically, the persons who make these requests want something for nothing, and they are going to be sad to find that things do not work that way.

**EXAM INSTRUCTIONS**

**CHEM 3653 Spring 2010 Exam ____ Ver. ____ Name/ID: ____________________________**

**Instructions:**

1) Write your name (legibly) and your student ID on this cover sheet and on the answer sheet.
2) You should have a working (i.e., new batteries) non-programmable, scientific calculator (i.e., no graphing calculators) and your student ID. You will not be allowed to “borrow” another student’s calculator. Any students who do so (both the borrower and the lender) will receive an F on this exam and will be charged with academic misconduct.

3) No cell phones or any other electronic communication devices such as pagers, FM receivers, headphones etc... will be allowed. Any students who are observed having such a device will receive an F for this exam and will be charged with academic misconduct subject to sanctions in accordance with the Norman Campus Academic Misconduct Code. I routinely recommend "F" for the course and expulsion from the University for any such violations.

4) You will record your answers to the exam questions by: 1) writing your answers on the exam and 2) writing your answers on the answer sheet. The answers on the answer sheet will be graded, but the work that led to the answers (which you will record on the exam) may be checked as well. Any discrepancies between the work shown on the exam and the answers written on the answer sheet will be counted as incorrect. Make sure that the work you record on the exam does in fact lead to the answer that you record on the answer sheet. Any patterns of inconsistencies will be grounds for academic misconduct, as discussed above in #3.

⇒ Fold your answer sheet vertically down the center such that your answers are not visible. Keep your answer sheet folded in this manner at all times except when you are recording an answer.

5) When you are done with the exam, turn in to the TA the completed exam and the completed answer sheet. Also, show the TA your student ID. Any students who do not follow these instructions will receive an F for this exam and will be charged with academic misconduct as discussed above.

KEYS TO SUCCESS

1. Attendance
2. Set objectives
3. Study regularly and consistently
   a) read ahead
   b) do something class-related ASAP after class
   c) outline the chapter
   d) correlate material from chapter to chapter
   e) prepare notecards
   f) work homework problems on your own to the extent possible and jointly with study groups so that you can help others and receive help yourself
   g) form study groups
   h) discuss biochemistry in context of current events
   i) work through (on your own) returned exams
   j) spread out study time – don’t cram before tests
4. Participate in class

BEFORE EXAMS

1. Rest before the test
2. Distribute time wisely during the test
3. Learn techniques to overcome test anxiety
4. PMA – positive mental attitude

If a student misses a class, they are responsible for obtaining the information/material from their fellow students. The instructor will not redeliver missed course material.

Students are expected to abide by the “Students Guide to Academic Integrity at the University of Oklahoma.” Academic dishonesty will not be tolerated, and the procedures in the “Academic Misconduct Code” will be
followed when necessary. Students engaging in academic misconduct (including cheating, plagiarism, and any other action that may improperly affect evaluation) will be subject to sanctions in accordance with the Norman Campus Academic Misconduct Code. I routinely recommend "F" for the course and expulsion from the University for all such violations.

The University of Oklahoma is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with the instructor as early in the semester as possible. Students with disabilities must be registered with the Office of Disability Services prior to receiving accommodations in this course. The Office of Disability Services is located in Goddard Health Center, Suite 166, phone 405/325-3852 or TDD only 405/325-4173.

It is the policy of the University of Oklahoma to excuse absences of students that result from religious observances and to provide without penalty for the rescheduling of examinations and additional required class work that may fall on religious holidays.

Each student should acquaint her or his self with the University's codes, policies, and procedures involving academic misconduct, grievances, sexual and ethnic harassment, and discrimination based on physical handicap.

The instructor reserves the right to change this syllabus by modification, addition and/or subtraction of assignments, course content, due dates, and grading policies, as she deems necessary.

Class Schedule for CHEM: 3653, Sec. 001, Spring, 2010

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<td>Syllabus, Overview, Ch. 1,</td>
<td>Finish Ch. 1, Begin Ch. 2</td>
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<td>February</td>
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<td>2 Continue Ch. 3</td>
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<td>4 Finish Ch. 3</td>
<td>5 HW 2 Due</td>
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<td>9 Continue Ch. 4</td>
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<td>22</td>
<td>23 Finish Ch. 5</td>
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<td>25 Exam I</td>
<td>26 HW 5 Due</td>
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<td>2 Continue Ch. 6</td>
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<td>4 Finish Ch. 6</td>
<td>5 HW 6 Due</td>
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<td>9 Continue Ch. 7</td>
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<td>11 Finish Ch. 7</td>
<td>12 HW 7 Due</td>
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<td>16 Spring Break</td>
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<td>23 Continue Ch. 8</td>
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<td>25 Exam II</td>
<td>26 HW 8 Due</td>
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<td>30 Finish Ch. 8</td>
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<td>Begin Ch. 9</td>
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