

Chemistry 560

General Biochemistry

Spring 2016
Schedule Number 20731

COURSE INFORMATION

Class Days: Tuesdays & Thursdays
Class Times: 11 am – 12:15 pm
Class Location: PSFA-325

Office Hours: Tuesdays & Thursdays 12:30-1:30 pm or email me to make an appointment, mswairjo@mail.sdsu.edu or stop by my office.

Office Hour Location: My office CSL-340

INSTRUCTOR INFORMATION

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Office location: Chemical Sciences Laboratory, room 340 (SDSU map coordinates K3).

Course Overview

Course Description: Biochemistry is an experimental science that brings together biology and chemistry. In one facet of the field, Biochemistry explores the natural chemical processes within living organisms. In another facet, it is the science of using chemical knowledge and techniques to understand and solve biological problems. This course is an upper-level undergraduate course intended to introduce students of chemistry to the basic concepts required for advanced study in biochemistry including the molecular makeup of life, enzymes, signal transduction, metabolism and molecular biology. Biochemistry is an enormous and still rapidly growing field and its study requires two semesters. Therefore, while this course offers a substantial survey of biochemistry, it will emphasize learning of core facts and provide advanced learning skills and resources for continued study. Furthermore, students with interests in biotechnology, life sciences, pharmacology, and molecular medicine will gain a working vocabulary and understanding of the biomolecules that drive these fields.

- Course structure:** This one semester course will be delivered over 16 weeks; 13 weeks of instruction, 1.5 weeks of assessment, and 1.5 weeks of break. The course is structured in three learning modules, separated by 2 assessments and followed by a final exam (**see course schedule below**). In the middle of each learning module, a concept check (quiz) is conducted for which the students will earn a partial grade. Class meets twice a week for 1 hour and 15 minutes. A homework assignment is due each week, except assessment weeks. The assessments (exams) consist of problems probing critical thinking, depth of knowledge, and application skills. The homework assignments are in themselves learning opportunities designed for a variety of learning styles and will include conceptual problem solving activities, building illustrative models, experimental design, interpretation of experimental data, fact finding, and memory drills.
- Student Learning Outcomes:**

Upon completing this course, students should be able to

 - 1) compare the structures of a prokaryotic and a eukaryotic cell.
 - 2) match the structures with the chemical properties of important biomolecules. These include nucleotides and nucleic acids; amino acids and proteins, carbohydrates and polysaccharides, and lipids and membranes.
 - 3) dissect the processes of DNA replication, DNA transcription and protein translation.
 - 4) match the molecules of gene expression with their biochemical functions.
 - 5) classify protein structural hierarchy and illustrate how it relates to protein function.
 - 6) write an accurate description of the three dimensional structure of a protein.
 - 7) illustrate the structure of biological membranes.
 - 8) describe the principles that govern membrane structure and function.
 - 9) quantitatively characterize enzymes (protein catalysts), calculate enzymatic constants, and classify mechanisms of enzyme regulation.
 - 10) interpret enzyme kinetic data.
 - 11) describe the biochemical basis of at least 5 human diseases.
- Real Life Relevance:**

This course is designed to entice students of biochemistry to pursue deep study in the field. It gives a looking glass view of the chemical and molecular underpinnings of Biology, placed in the context of evolution, human health and disease, and ecology. Students see how it is that understanding nature and advancing medicine is impossible without in-depth biochemical knowledge. Therefore, a major outcome of the course is the promotion of interest in the work of biochemists and a curiosity toward modern research approaches in molecular medicine and biotechnology.

Enrollment Information

Prerequisites:

General chemistry, organic chemistry, physical chemistry
(Chemistry 232, 232L, and credit or concurrent registration in Chemistry 410A, 432, 432L).

Dropping class:

You can drop the class within the first 10 days of the semester (university policy).

Course Materials

Required Materials:

- **Fundamentals of Biochemistry, Fourth Edition (2012)
D. Voet, J. Voet & C.W. Pratt (John Wiley & Sons, Inc.).**
- Laptop with internet connection.

Additional Resources: Your textbook is the primary resource for this course. Lectures will follow closely the sequence and organization of the text. Specific learning objectives will be listed at the beginning of each lecture. This list should guide the students in studying for exams. The lectures will introduce additional, specific, online resources for certain topics.

Course Structure and Mode of Delivery

- Course structure: This one semester course will be delivered over 16 weeks; 13 weeks of instruction, 1.5 weeks of assessment, and 1.5 weeks of break. The course is structured in three learning modules, separated by 2 assessments and followed by a final exam (**see course schedule below**). Class meets twice a week for 1 hour and 15 minutes. The mode of delivery includes lecture, standardized patients demonstrations, guided online applications, videos.
- Technology Utilized in the Course: Blackboard, PowerPoint.

Course Assessment and Grading

Scoring:

12 Homework assignments: 3 points each, total 36 points.

3 Quizzes: 3 points each, total 9 points.

2 Midterm exams: 18 points each, total 36 points.

Final exam: 19 points.

TOTAL POINTS: 100

Grading scale:

Score	Grade
≥ 93.33	A
90 to < 93.33	A-
86.66 to < 90	B+
83.33 to < 86.66	B
80 to < 83.33	B-
76.66 to < 80	C+
73.33 to < 76.66	C
70 to < 73.33	C-
66.66 to < 70	D+
60 to < 66.66	D
< 60	F

Exams and weekly assignments instructions

I plan to post the assignments and exams on blackboard, depending on how the course unravels. In case I do, I recommend that you check your access to SDSU's Blackboard server and become familiar with it <https://blackboard.sdsu.edu/>. Ask the IT helpdesk in the library if you need help.

REMINDER: **The best browser for Blackboard is Firefox.** There are known problems with using other browsers to take tests and quizzes in Blackboard. [Download Firefox for free:](http://www.mozilla.com/en-US/) <http://www.mozilla.com/en-US/>

Estimated time commitment

Modules and Estimated Hours

Module	Estimated hours
How is energy conserved and used by the cell? How is genetic information stored, transmitted, expressed, and experimentally gathered?	14
The structures and functions of proteins.	10.5
Membrane structure and function. Enzymes.	13.5

Guidelines for student participation

- 1) Do not miss class. Some homework assignments require working in groups. If you miss class, you run the risk of disconnecting from your group.
- 2) Be ready to read 20-30 pages a week. Do your work weekly on time. This is not a course for cramming at the last minute.
- 3) All homework assignments are given on a Thursday and are due by 11 am on the following Tuesday. See course schedule below.

Course Schedule

Date	Activity (lectures are numbered)	Reading	Assignment given out that day
Thurs, Jan 21	<i>Understanding the course syllabus.</i> 1) Introduction to the Chemistry of Life	Syllabus & powerpoint.	Homework 1, due 1/26/2015 at 11 am.
Tues, Jan 26	2) Energy in biological systems	Ch. 1 (1-19)	
Thurs, Jan 28	3) Water, acids, bases and buffers <i>Clinical case</i>	Ch. 2 (22-37)	Homework 2, due 2/2/2016 at 11 am.
Tues, Feb 2	4) Nitrogenous bases, nucleosides, and nucleotides	Ch. 3 (40-43)	
Thurs, Feb 4	5) Nucleic acids and the Central Dogma	Ch. 3 (44-51)	Homework 3, due 2/9/2016 at 11 am.
Tues, Feb 9	6) Polymerases and nucleic acid synthesis. Quiz 1 (in material covered in Lectures 1-5, last 20 minutes of class).	Ch. 3 (51-62)	
Thurs, Feb 11	7) Recombinant DNA technology	Ch. 3 (62-72)	Homework 4, due 2/11/2016 at 11 am
Tues, Feb 16	8) Amino Acids and proteins	Ch. 4 (76-90)	
Thurs, Feb 18	9) Protein purification and analysis	Ch. 5 (93-105)	Homework 5, due 2/23/2016 at 11 am
Tues, Feb 23	10) Protein sequencing, molecular evolution	Ch. 5 (106-122)	
Thurs, Feb 25	Exam 1 (in material covered in Lectures 1-10)		

Date	Activity (lectures are numbered)	Reading	Assignment given out that day
Tues, Mar 1	11) Protein secondary structure	Ch. 6 (127-141)	
Thurs, Mar 3	12) Protein tertiary and quaternary structure	Ch. 6 (142-156)	Homework 6, due 3/8/2016 at 11 am
Tues, Mar 8	13) Protein stability and folding	Ch. 6 (156-172)	
Thurs, Mar 10	14) Protein function: myoglobin and hemoglobin	Ch. 7 (176-196)	Homework 7, due 3/15/2016 at 11 am
Tues, Mar 15	15) Protein function: Antibodies. Quiz 2 (in material covered in Lectures 11-14)	Ch. 7 (208-213)	
Thurs, Mar 17	16) Monosaccharides	Ch. 8 (217-223)	Homework 8, due 3/22/2016 at 11 am
Tues, Mar 22	17) Polysaccharides and glycoproteins. <i>Catch up review.</i>	Ch.8 (224-238)	
Thurs, Mar 24	Exam 2 (in material covered in Lectures 11-17)		
Tues, Mar 29	Spring Break		
Thurs, Mar 31	Spring Break Viva César Chávez!		
Tues, April 5	18) Lipids	Ch. 9 (241-254)	
Thurs, April 7	19) Lipid bilayers and membrane proteins	Ch. 9 (255-264)	Homework 9, due 4/12/2016 at 11 am
Tues, April 12	20) Biological membranes	Ch. 9 (265-285)	
Thurs, April 14	21) Facilitated transport across membranes	Ch. 10 (288-303)	Homework 10, due 4/19/2016 at 11 am
Tues, April 19	22) Active transport across membranes	Ch. 10 (304-311)	
Thurs, April 21	23) Enzyme catalysis Quiz 3 (in material covered in Lectures 18-22, last 20 minutes of class)	Ch. 11 (315-323)	Homework 11, due 4/26/2016 at 11 am
Tues, April 26	24) Catalytic mechanisms: Serine proteases	Ch. 11 (323-332) (339-351)	
Thurs, April 28	25) Enzyme kinetics	Ch. 12 (355-366)	Homework 12, due 5/3/2016 at 11 am

Date	Activity (lectures are numbered)	Reading	Assignment given out that day
Tues, May 3	26) Enzyme inhibition	Ch. 12 (366-376)	
Thurs, May 5	<i>Catch up review</i> (last class)		
Tues, May 10	No class		
Thurs, May 12	Final Exam (in material covered in Lectures 18-26)		

Students with Disabilities

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have presented your instructor with an accommodation letter from Student Disability Services. Your cooperation is appreciated.

Academic Honesty

The University adheres to a strict [policy regarding cheating and plagiarism](http://www.sa.sdsu.edu/srr/conduct1.html). These activities will not be tolerated in this class. Become familiar with the policy (<http://www.sa.sdsu.edu/srr/conduct1.html>). Any cheating or plagiarism will result in failing this class and a disciplinary review by Student Affairs.

Examples of Plagiarism include but are not limited to:

- Using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work)
- Copying and pasting work from an online or offline source directly and calling it your own
- Using information you find from an online or offline source without giving the author credit
- Replacing words or phrases from another source and inserting your own words or phrases
- Submitting a piece of work you did for one class to another class.

If you have questions on what is plagiarism, please consult the [policy](http://www.sa.sdsu.edu/srr/conduct1.html) (<http://www.sa.sdsu.edu/srr/conduct1.html>) and this [helpful guide from the Library](http://infodome.sdsu.edu/infolit/exploratorium/Standard_5/plagiarism.pdf): (http://infodome.sdsu.edu/infolit/exploratorium/Standard_5/plagiarism.pdf)

Turnitin

Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will

be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. You may submit your papers in such a way that no identifying information about you is included. Another option is that you may request, in writing, that your papers not be submitted to Turnitin.com. However, if you choose this option you will be required to provide documentation to substantiate that the papers are your original work and do not include any plagiarized material.