Chemistry 560

General Biochemistry

Fall 2016
Schedule Number 20805

COURSE INFORMATION

Class Days: Tuesdays & Thursdays
Class Times: 11 am – 12:15 pm
Class Location: Hardy Tower 183

Office Hours: Mondays and Tuesdays 12:30-1:30 pm or email me to make an appointment, mswairjo@maill.sdsu.edu.
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; 13.5 weeks of instruction, 1.5 weeks of assessment, half a week of review, and half a week 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 course includes 11 homework assignments due on set dates (see course schedule below). 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.
- Access to Wiley Plus online homework and study module. See "Assignment instructions" below.

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; 13.5 weeks of instruction, 1.5 weeks of assessment, half a week of review, and half a week 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, in-class problem-based assignments, guided online applications, videos.

- Technology Utilized in the Course: Blackboard, PowerPoint, Wiley Plus student website.

Course Assessment and Grading

Scoring:

11 Homework assignments: 5 points each, total 55 points.

2 Midterm exams: 12.5 points each, total 25 points.

Final exam: 20 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

Assignments instructions

We will be making use of an online homework and study module prepared specifically for this course by Wiley Plus. For instructions on how to enroll:

Go to WileyPlus.com. Enter **course ID 527451**. Then, create an account if you don't have one already. To register for online access, you have two options: 1) with a registration code you get inside the textbook you bought in the SDSU bookstore. 2) purchase just the online access and find the book used elsewhere.

If you have any issues signing up or using it throughout the course, go to the Wiley technical support https://www.wileyplus.com/WileyCDA/Section/id-828818.html.

1) There are 11 homework assignments, shown in different colors in the course schedule below. The course content pertaining to each assignment will be covered in the classes indicated in the same color. All homework assignments are given on a Thursday and are due by 11 am on the following Tuesday. See course schedule below.

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

2) Do not miss class. Some homework assignments require working in groups. If you miss class, you run the risk of disconnecting from your group.
3) 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.
4) 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 chapter (pages)	Assignment given out that day
Tues, Aug 30	*Understanding the course syllabus and homework system. Class survey.* 1) Lecture: Introduction to the Chemistry of Life.	Syllabus & Ch. 1 (pp. 1-10)	Form your group (3-5 students per group) and choose a group leader.
Thurs, Sept 1	2) Lecture: Energy in biological systems.	Ch. 1 (11-19)	Homework 1 (case study 1) due 9/6/2016 at 11 am.
Tues, Sept 6	3) Water, acids, bases and buffers. *Discussion of case study 1.*	Ch. 2 (22-37)	
Thurs, Sept 8	4) Lecture: Nitrogenous bases, nucleosides, and nucleotides	Ch. 3 (40-43)	Homework 2 (case study 2), due 9/13/2016 at 11 am.

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment given out that day
Tues, Sept 13	5) Nucleic acids and the Central Dogma. *Discussion of case study 2.*	Ch. 3 (44-51)	
Thurs, Sept 15	6) Lecture: Polymerases and nucleic acid synthesis. *Video demonstrations.*	Ch. 3 (51-62)	Homework 3 (case study 3), due 9/20/2016 at 11 am.
Tues, Sept 20	7) Recombinant DNA technology. *Discussion of case study 3.*	Ch. 3 (62-72)	
Thurs, Sept 22	8) Lecture: Amino Acids and proteins.	Ch. 4 (76-90) Ch. 5 (93-105)	Homework 4 (case study 4), due 9/27/2016 at 11 am
Tues, Sept 27	9) Protein primary structure. Protein purification and analysis. *Discussion of case study 4.*	Ch. 5 (106-122)	
Thurs, Sept 29	**Exam 1** (in material covered in Lectures 1-9).		
Tues, Oct 4	10) Lecture: Protein sequencing. Protein secondary structure.	Ch. 6 (127-141)	
Thurs, Oct 6	11) Lecture: Protein tertiary structure.	Ch. 6 (142-156)	Homework 5 (case study 5: use of sequence and structural databases), due 10/11/2016 at 11 am
Tues, Oct 11	12) Quaternary structure. Molecular Evolution. Protein stability. *Discussion of case study 5.*	Ch. 6 (156-172)	
Thurs, Oct 13	13) Lecture: Protein function, chaperones, myoglobin and hemoglobin.	Ch. 7 (176-196)	Homework 6 (case study 6), due 10/18/2016 at 11 am.
Tues, Oct 18	14) Protein function: hemoglobin disease. Antibodies. *Discussion of case study 6.*	Ch. 7 (208-213)	

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment given out that day
Thurs, Oct 20	15) Lecture: Monosaccharides.	Ch. 8 (217-223)	Homework 7 (case study 7), due 10/25/2016 at 11 am
Tues, Oct 25	16) Polysaccharides and glycoproteins. *Discussion of case study 7.* *Catch up review.*	Ch.8 (224-238)	
Thurs, Oct 27	**Exam 2** (in material covered in Lectures 10-16).		
Tues, Nov 1	17) Lecture: Lipids.	Ch. 9 (241-254)	
Thurs, Nov 3	18) Lecture: Lipid bilayers and membrane proteins.	Ch. 9 (255-264)	Homework 8 (case study 8), due 11/8/2016 at 11 am
Tues, Nov 8	19) Biological membranes 1 *Discussion of case study 8.*	Ch. 9 (265-285)	
Thurs, Nov 10	20) Lecture: Biological membranes 2	Ch. 9 (265-285)	Homework 9 (case study 9), due 11/15/2016 at 11 am
Tues, Nov 15	21) Facilitated transport across membranes. *Discussion of case study 9.*	Ch. 10 (288-303)	
Thurs, Nov 17	22) Lecture: Active transport across membranes.	Ch. 10 (304-311)	Homework 10 (case study 10), due 11/22/2016 at 11 am
Tues, Nov 22	23) Enzyme catalysis *Discussion of case study 10.*	Ch. 11 (315-323)	
Thurs, Nov 24	Thanksgiving holiday. No class		
Tues, Nov 29	24) Lecture: Catalytic mechanisms: Serine proteases.	Ch. 11 (323-332) (339-351)	
Thurs, Dec 1	25) Lecture: Enzyme kinetics.	Ch. 12 (355-366)	Homework 11 (case study 11), due 12/6/2016 at 11 am
Tues, Dec 6	26) Enzyme inhibition and structure based design.	Ch. 12 (366-376)	

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment given out that day
	Discussion of case study 11.		
Thurs, Dec 8	27) *Catch up review* (last class).		
Tues, Dec 13	28) No class		
Thurs, Dec 15	**Final exam** (in material covered in Lectures 17-26).		

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. 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) and this helpful guide from the Library:(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.