Chemistry 560

General Biochemistry

Spring 2017
Schedule Number 20753

COURSE INFORMATION

Class Days: Tuesdays & Thursdays
Class Times: 11 am – 12:15 pm
Class Location: AL 105

Office Hours: Tuesdays and Thursdays 12:30-1:30 pm or email me to make an appointment, mswairjo@mail.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/study module prepared specifically for this course by Sapling Learning. All students are required to purchase access to the online homework program.

Go to the Sapling Learning page at macmillanlearning.com and click **US Higher Ed** to log in or create an account.

Instructions on how to enroll are at:
http://cmg.screenstepslive.com/s/Student_Help/m/52447/l/553738-registering-for-courses

Select the course: "San Diego State University - Chem 560 - Spring17 - SWAIRJO".
Once you are enrolled, please take time to go through the "Introduction to Sapling Learning" and "Drawing Tips and Practice" tutorials. Assignments will be made available as we proceed through each of the first twelve chapters in the Voet, Voet & Pratt text.

If you have any issues signing up for Sapling or using it throughout the course, contact Sapling support at http://www.macmillanlearning.com/Catalog/techsupport to get help.

There will be 11 homework assignments. The homework problems of a given week may span topic from that week and the next week. Homework will be in the form of Sapling assignments. All homework assignments are given on a Thursday and are due by 11 am on the following Tuesday.

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. You are encouraged to study in groups.
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 chapter (pages)	Assignment given out that day
Tues, Jan 17	*Understanding the course syllabus and homework system.* 1) Lecture: Introduction to the Chemistry of Life.	Syllabus & Ch. 1 (pp. 1-10)	Form your group (3-5 students per group). Sign up for Sapling.
Thurs, Jan 19	2) Lecture: Energy in biological systems.	Ch. 1 (11-19)	Homework 1, due 1/24 at 11 am.
Tues, Jan 24	3) Water, acids, bases and buffers.	Ch. 2 (22-37)	
Thurs, Jan 26	4) Lecture: Nitrogenous bases, nucleosides, and nucleotides	Ch. 3 (40-43)	Homework 2, due 1/31 at 11 am.
Tues, Jan 31	5) Nucleic acids and the Central Dogma.	Ch. 3 (44-51)	

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment given out that day
Thurs, Feb 2	6) Lecture: Polymerases and nucleic acid synthesis. *Video demonstrations.*	Ch. 3 (51-62)	Homework 3, due 2/7 at 11 am.
Tues, Feb 7	7) Recombinant DNA technology.	Ch. 3 (62-72)	
Thurs, Feb 9	8) Lecture: Amino Acids and proteins.	Ch. 4 (76-90) Ch. 5 (93-105)	Homework 4, due 2/14 at 11 am
Tues, Feb 14	9) Protein primary structure. Protein purification and analysis.	Ch. 5 (106-122)	
Thurs, Feb 16	**Exam 1** (in material covered in Lectures 1-9).		
Tues, Feb 21	10) Lecture: Protein sequencing. Protein secondary structure.	Ch. 6 (127-141)	
Thurs, Feb 23	11) Lecture: Protein tertiary structure.	Ch. 6 (142-156)	Homework 5, due 2/28 at 11 am
Tues, Feb 28	12) Quaternary structure. Molecular Evolution. Protein stability.	Ch. 6 (156-172)	
Thurs, March 2	13) Lecture: Protein function, chaperones, myoglobin and hemoglobin.	Ch. 7 (176-196)	Homework 6, due 3/7 at 11 am.
Tues, March 7	14) Protein function: hemoglobin disease. Antibodies.	Ch. 7 (208-213)	
Thurs, March 9	15) Lecture: Monosaccharides.	Ch. 8 (217-223)	Homework 7, due 3/14 at 11 am
Tues, March 14	16) Polysaccharides and glycoproteins.	Ch.8 (224-238)	
Thurs, March 16	**Exam 2** (in material covered in Lectures 10-16).		

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment given out that day
Tues, March 21	17) Lecture: Lipids.	Ch. 9 (241-254)	
Thurs, March 23	18) Lecture: Lipid bilayers and membrane proteins.	Ch. 9 (255-264)	Homework 8, due 4/4 at 11 am
March 27-31	Spring Break		
Tues, April 4	19) Biological membranes 1	Ch. 9 (265-285)	
Thurs, April 6	20) Lecture: Biological membranes 2	Ch. 9 (265-285)	Homework 9, due 4/11 at 11 am
Tues, April 11	21) Facilitated transport across membranes.	Ch. 10 (288-303)	
Thurs, April 13	22) Lecture: Active transport across membranes.	Ch. 10 (304-311)	Homework 10), due 4/18 at 11 am
Tues, April 18	23) Enzyme catalysis	Ch. 11 (315-323)	
Thurs, April 20	24) Lecture: Catalytic mechanisms: Serine proteases.	Ch. 11 (323-332) (339-351)	Homework 11, due 4/25 at 11 am
Tues, April 25	25) Lecture: Enzyme kinetics.	Ch. 12 (355-366)	
Thurs, April 27	26) Enzyme inhibition and structure based design.	Ch. 12 (366-376)	
Tues, May 2	27) *Catch up review* (last class).		
Thurs, May 4	28) No class		
Any day May 5 to May 11 (exact date TBD)	**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.

Anti-discrimination Policy

The CSU has affirmed its commitment to protecting access, affordability, intellectual freedom, inclusivity, and diversity for all students, including students qualified under the Deferred Action for Childhood Arrivals (DACA) program. Discrimination, harassment, or retaliation against students, faculty, and staff on the basis of race, religion, gender, sexuality, disability, nationality, immigration status and other categories of identity is prohibited. If you have concerns about your status at the university, please visit http://studentaffairs.sdsu.edu/EOP/ for information or contact the Dean of Students or the Assistant Dean for Student Affairs in your College.

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.