GENERAL BIOCHEMISTRY– CHEM 560

SPRING 2025
CLASS NUMBER 3890

COURSE INFORMATION

Class Days: TTh Jan 21 – May 8, 2025
Class Times: 11:00 am – 12:15 pm
Class location: LH439
Lamden Hall (formerly the Education & Business Adminitration Building), room 439

Instructor: Manal Swairjo, PhD.
Office Hours Times: Thurs 1-2 pm, or by appointment mswairjo@sdsu.edu
Office Hours Zoom link:
https://SDSU.zoom.us/j/86943139479

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 solve biological problems. This course is intended to introduce students of chemistry to the molecular makeup of life. While it offers a substantial survey of biochemistry, the course emphasizes learning of core facts and provides 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.

Real Life Relevance:

In general, this course is an entry way to understanding modern medicine and biotechnology, and is essential for any career in these fields, including job placements in the biotechnology industry and health professions.

Relation to Other Courses:

This course lays the foundation for concepts covered in CHEM 562 (Intermediary Metabolism), CHEM 563 (Nucleic Acids Function), CHEM 563b (Advanced Nucleic Acids Biochemistry), CHEM 564 (Receptor Biochemistry and Protein Modification) and CHEM 567 (Biochemistry Laboratory).

Student Learning Outcomes:

Student learning outcome	Course activity	Assessment
Match the chemical compositions and structures of important biomolecules with their chemical and physical properties and biological functions. These include nucleotides and nucleic acids; amino acids and proteins, carbohydrates and polysaccharides, lipids and membranes.	Read assigned textbook material, guided by instructor Powerpoints. Homework assignments.	In midterm exams, students will be asked to identify biomolecules from their structures and match them to biological function and chemical properties.

Describe and illustrate the biomolecules and biochemical processes that govern the flow of genetic information in living organisms, methods for isolation and analysis of DNA and proteins, and acquisition and utility of genomic information.	Read assigned textbook material, guided by instructor Powerpoints. Homework assignments.	In midterm exam, students will be asked to define named biochemical processes underlying gene expression, and identify appropriate methods for isolation and analysis of relevant biomolecules.
Illustrate the structure of biological membranes and describe the principles that govern membrane structure and function. Describe select examples of membrane proteins.	Read assigned textbook material, guided by instructor Powerpoints. Homework assignments.	In midterm exam, students will be asked to illustrate various biological membranes and identify their protein, lipid and carbohydrate components. In homework assignment, students will display and analyze structures of membrane proteins and answer relevant questions.
Describe the kinetic behavior of enzymes, and their catalytic, regulatory and inhibition mechanisms. List select examples.	Read assigned textbook material, guided by instructor Powerpoints. Homework assignments.	In midterm exam, students will be asked to annotate structural and functional components of enzyme active sites, interpret kinetic data and inhibition plots, and identify cofactors of select enzymatic reactions.
Describe the molecular basis of at least 5 human diseases.	Read assigned textbook material, guided by instructor Powerpoints. Homework assignments.	In midterm exams, students will be asked to match several human diseases with their underlying biomolecules or chemical basis.
List three examples of gender inequity in the recent history of Biochemistry, and detail the story of one of them.	Read assigned textbook material, guided by instructor Powerpoints. Discuss examples in class.	In midterm exams, students are asked at least one question related to gender inequity in science.

ENROLLMENT INFORMATION

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

- Adding/Dropping Procedures:
  You can drop the class by 11:59 pm on 02/03/2025 (SDSU's schedule adjustment deadline).

COURSE MATERIALS

Required Materials:

- Laptop with internet connection **and Respondus LockDown Browser installed**. For help installing it go to Student IT Helpdesk in the library: https://it.sdsu.edu/get-help or call 619-594-4357.
- Access to **SDSU Canvas.** For SDSU student support on Canvas: https://its.sdsu.edu/software/canvas

- We will use the electronic textbook "Fundamentals of Biochemistry" by Voet, Voet, and Pratt, 5th Edition, Wiley, 2016. ISBN 978-1118918432. **The digital version of the textbook is provided within the course Canvas site.**

- For homework, we will use the "Achieve" online homework system from McMillan Learning. **All homework assignments are integrated in the course on Canvas**. **Just click on an assignment in Canvas to access it.**
- **SDSU's Day1Ready and/or Immediate Access**: The e-textbook and the Achieve Homework assignments for this class are provided in digital format within Canvas. You should see them inside the CHEM560-01-Spr2025 course Canvas site. They are available by the first day of classes and are free until **the university add/drop deadline at 11:59 pm February 3rd**. After this date, your SDSU student account will be charged a flat rate of $21.50/unit, unless you drop out of Day1Ready/Immediate Access program. To understand Day1Ready go here, and for Immediate Access go here. For questions related to these programs, visit here.
- **If you have a problem accessing McMillan Learning Homework,** please let me know in class or by email mswairjo@sdsu.edu.
- **If you need to borrow a computer**, go here.

Recommended Materials:

Lecture PowerPoints will serve as a study guide and will be posted on Canvas.

COURSE STRUCTURE AND CONDUCT

Technology Utilized in the Course: Canvas, MacMillan Achieve online homework system. If time allows, I may ask you to download the student free version of Pymol https://pymol.org/edu/?q=educational/

Expectations: This is a rich course. Plan on viewing 2 PowerPoint lectures and reading on average 20-30 pages every week. It is not the kind of course that one can cram the week before the exam.

Homework: All homework assignments are due by midnight on a Sunday, except for Homework 10 (the last homework) which is due on a Friday. Pay attention to the due dates on Canvas, which are roughly represented in the course schedule below.

Exams: All exams will be available on Canvas on the specific dates shown in the course schedule below. You must be present in the classroom during the exam time. Exam duration may vary but it never exceeds 1 hour and 15 minutes for midterms and 2 hours for the final exam. **All exams will be offered on Canvas but they are to be taken in real time in person in the classroom on your laptop**. **Important! You must have Respondus LockDown Browser working on your laptop, no exceptions. Do not use an iPad, Respondus does not work there. For help installing Respondus LockDown Browser on your laptop, talk to IT in the Love library 2nd floor (https://it.sdsu.edu/get-help). Make sure your laptop battery is fully charged before the exam, or bring your charger. Do not use Safari browser. All other browsers will work.**

How to study: Your textbook and lecture PowerPoints are the two major resources for this course. Use the lecture PowerPoints as your study guide, by following the specific learning objectives listed at the beginning of each lecture. Guided by this list, read the pertinent sections in the book chapter for that lecture.

COURSE ASSESSMENT AND GRADING

10 MacMillan Achieve homework assignments: 5 points each, total 50 points.
3 Midterm exams on Canvas: 12.5 points each.
Noncumulative final exam on Canvas: 12.5 points.
TOTAL COURSE POINTS: 100

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

Grade Point Conversion Chart		
A = 4.0	C + = 2.3	D - = 0.7
A - = 3.7	C = 2.0	F = 0
B + = 3.3	C - = 1.7	WU = 0
B = 3.0	D + = 1.3	I = 0
B - = 2.7	D = 1.0	IC = 0

COURSE SCHEDULE

Date	Lecture	Reading chapter (pages)	Assignment due on Sunday 11:59pm that week
Tues, 1/21	1) Introduction & syllabus. Introduction to the Chemistry of Life.	Syllabus Ch. 1 (pp. 1-10)	Homework 1 Due Sun 2/2
Thurs, 1/23	2) Energy in biological systems.	Ch. 1 (11-21)	
Tues, 1/28	3) Water, acids, bases and buffers.	Ch. 2 (24-38)	
Thurs, 1/30	4) Nitrogenous bases, nucleosides, and nucleotides.	Ch. 3 (42-45)	Homework 2 Due Sun 2/16
Tues, 2/4	5) Nucleic acids and the Central Dogma.	Ch. 3 (46-53)	
Thurs, 2/6	6) Polymerases and DNA sequencing.	Ch. 3 (54-66)	
Tues, 2/11	7) Recombinant DNA technology.	Ch. 3 (66-77)	
Thurs, 2/13	8) Amino Acids and proteins.	Ch. 4 (80-95)	Homework 3 Due Sun 2/23
Tues, 2/18	**Exam 1 (in material covered in Lectures 1-7).**		
Thurs, 2/20	9) Protein purification and analysis.	Ch. 5 (97-109)	
Tues, 2/25	10) Protein sequencing. Protein primary and secondary structure.	Ch. 6 (110-135)	Homework 4 Due Sun 3/2

Date	Lecture	Reading chapter (pages)	Assignment due on Sunday 11:59pm that week
Thurs, 2/27	11) Protein tertiary and quaternary structure.	Ch. 6 (146-159)	Homework 5 Due Sun 3/9
Tues, 3/4	12) Protein stability and folding, chaperones. Protein folding disease.	Ch. 6 (159-169)	
Thurs, 3/6	13) Protein function. Myoglobin and hemoglobin, hemoglobin disease.	Ch. 7 (170-177) Ch. 7 (180-201)	Homework 6 Due Sun 3/16
Tues, 3/11	14) Protein function. Antibodies.	Ch. 7 (212-216)	
Thurs, 3/13	15) Monosaccharides.	Ch. 8 (217-228)	Homework 7 Due Sun 3/23
Tues, 3/18	**Exam 2 (in material covered in Lectures 8-14).**		
Thurs, 3/20	16) Polysaccharides and glycoproteins.	Ch.8 (229-243)	
Tues, 3/25	17) Lipids.	Ch. 9 (244-259)	Homework 8 Due Sun 4/13
Thurs, 3/27	18) Lipid bilayers and membrane proteins.	Ch. 9 (255-269)	
Tues, 4/1	No class. Spring break		
Thurs, 4/3	No class. Spring break		
Tues, 4/8	19) Biological membranes 1.	Ch. 9 (270-277)	
Thurs, 4/10	20) Biological membranes 2.	Ch. 9 (277-290)	
Tues, 4/15	21) Facilitated transport across membranes - Passive transport.	Ch. 10 (291-310)	Homework 9 Due Sun 4/20
Thurs, 4/17	22) Facilitated transport across membranes - Active transport.	Ch. 10 (310-319)	
Tues, 4/22	**Exam 3 (in material covered in lectures 15-22). In class.**		
Thurs, 4/24	23) Enzyme catalysis.	Ch. 11 (322-329)	Homework 10 Due Fri 5/9
Tues, 4/29	24) Catalytic mechanisms of enzymes. Serine proteases.	Ch. 11 (330-339) (339-355)	
Thurs, 5/1	25) Enzyme kinetics.	Ch. 12 (361-373)	
Tues, 5/6	26) Enzyme inhibition and drug design.	Ch. 12 (373-383)	
Thurs, 5/8	Review		
Tues 5/13 10:30am-12:30pm	**Exam 4 (in material covered in lectures 23-26). In class**		

ESTIMATED TIME COMMITMENT

Module	Estimated hours
Energy conservation and use by the cell? Storage, transmission and expression of genetic information.	14
The structures and functions of proteins. Carbohyrates.	10.5
Membrane structure and function. Enzymes.	13.5

EXCUSED ABSENCE MAKE-UP POLICIES:

You are required to take exams on the scheduled dates. Make up exams are offered only with a valid, documented medical emergency to be assessed at my discretion, AND a written excuse from the Office of Student Life.

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 and what constitutes plagiarism (http://studentaffairs.sdsu.edu/srr/cheating-plagiarism.html). Any cheating or plagiarism will result in failing this class and a disciplinary review by the University. These actions may lead to probation, suspension, or expulsion.

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

For more information on plagiarism, consult the SDSU policy (http://www.sa.sdsu.edu/srr/conduct1.html).

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 www.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.

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. You can also learn more about the services provided by visiting the Student Disability Services website.
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.

STUDENT SERVICES

Finding Help on Campus:

Need help finding help -- an advisor, tutoring, counselling, or emergency economic assistance? The SDSU Student Success Help Desk is here for you. Student assistants are available via Zoom Monday through Friday, 9:00 AM to 4:30 PM to help you find the office or service that can best assist with your particular questions or concerns.

- College of Arts and Letters Student Success Center: https://cal.sdsu.edu/academics/student-success
- College of Education Student Success Center: https://education.sdsu.edu/oss
- Center for Student Success in Engineering: https://csse.sdsu.edu/advising/advising
- College of Sciences Student Success Center: https://cossuccess.sdsu.edu/
- FCB Student Success Center: https://business.sdsu.edu/undergrad/advising
- CHHS Advisors: https://chhs.sdsu.edu/academics/advising
- SDSU Imperial Valley Student Success and Retention:https://imperialvalley.sdsu.edu/about/departments/student-affairs/retention
- PSFA Advisors: https://psfa.sdsu.edu/resources/student_advisors
- Math & Science Learning Center: https://mslc.sdsu.edu/

SDSU Economic Crisis Response Team:

If you or a friend are experiencing food or housing insecurity, technology concerns, or any unforeseen financial crisis, it is easy to get help! Visit https://sacd.sdsu.edu/ecrt for more information or to submit a request for assistance. SDSU's Economic Crisis Response Team (ECRT) aims to bridge the gap in resources for students experiencing immediate food, housing, or unforeseen financial crises that impacts student success. Using a holistic approach to well-being, ECRT supports students through crisis by leveraging a campus-wide collaboration that utilizes on and off-campus partnerships and provides direct referrals based on each student's unique circumstances. ECRT empowers students to identify and access long term, sustainable solutions in an effort to successfully graduate from SDSU. Within 24 to 72 hours of submitting a referral, students are contacted by the ECRT Coordinator and are quickly connected to the appropriate resources and services.
For students who need assistance accessing technology for their classes, visit our ECRT website https://sacd.sdsu.edu/ecrt to be connected with the SDSU library's technology checkout program. The technology checkout program is available to both SDSU and Imperial Valley students.

CLASSROOM CONDUCT STANDARDS

SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.

- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
    1. physical abuse, threats, intimidation, or harassment.
    2. sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

MEDICAL-RELATED ABSENCES LONGER THAN 5 DAYS

Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact of an absence, as well as any arrangements for making up work, rest with the instructors. Student Health Services (SHS) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student's consent, communicate with the student's instructors via the Vice President for Student Affairs and may communicate with the student's Assistant Dean and/or Student Disability Services.

Student Privacy and Intellectual Property

The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Blackboard to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Religious observances

According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

COPYRIGHT POLICY

SDSU respects the intellectual property of others and we ask our faculty & students to do the same.

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