
GENERAL BIOCHEMISTRY— CHEM 560

SPRING 2021
SCHEDULE NUMBER 20802

COURSE INFORMATION

Class Days: TTh Jan 21 – May 6, 2021

Class Times: 11:00 am – 12:15 pm

Class Zoom link:

<https://SDSU.zoom.us/j/85894688314>

Instructor: Manal Swairjo, PhD.

Office Hours Times: Thurs 12:30-1:30 pm, or by
appointment mswairjo@sdsu.edu

Office Hours Zoom link:

<https://SDSU.zoom.us/j/87456929973>

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.

To understand what humanity is going through right now, the Covid-19 pandemic, you must start with understanding the material make up of biological life at a molecular level (this course), then further build your knowledge of the chemical processes that govern gene expression and reproduction in cells and viruses (Nucleic Acids Function CHEM-563, 2 units, Fall 2021), and how this knowledge is harnessed for the development of therapies, tests and novel vaccines (Advanced Nucleic Acids Biochemistry CHEM-596, 1 unit, Fall 2021).

“Science is more than a body of knowledge; it is a way of thinking. I have a foreboding of an America in my children's or grandchildren's time—when the United States is a service and information economy; when nearly all the key manufacturing industries have slipped away to other countries; when awesome technological powers are in the hands of a very few, and no one representing the public interest can even grasp the issues; when the people have lost the ability to set their own agendas or knowledgeably question those in authority; when, clutching our crystals and nervously consulting our horoscopes, our critical faculties in decline, unable to distinguish between what feels good and what's true, we slide, almost without noticing, back into superstition and darkness.”

-Carl Sagan, The Demon-Haunted World: Science as a Candle in the Dark, 1995.

Relation to Other Courses:

This course lays the foundation for concepts covered in CHEM 562, CHEM 563, CHEM 596 (Nucleic Acids Biochemistry), CHEM 564 and CHEM 567.

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.

ENROLLMENT INFORMATION

Prerequisites:

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

- Adding/Dropping Procedures:

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

COURSE MATERIALS

Required Materials:

- Computer with internet connection.
- Access to **SDSU Zoom**, access to **SDSU Canvas**.
For SDSU student support on Zoom and Canvas:
<https://library.sdsu.edu/computers-technology>
call 619-594-3189
or email hub@sdsu.edu
or chat [Computing Hub Chat](#)
Monday–Thursday: 8am–7pm, Friday: 8am–5pm
- Textbook: Voet, Voet, and Pratt: “**Fundamentals of Biochemistry**”, 5th Edition, Wiley, 2016. ISBN 978-1118918432. This textbook will be used in CHEM 562, 563 and 564. Therefore, acquiring it now is a must for biochemistry majors.
- Access to **Sapling online homework**. See specific Sapling access instructions below.
- This is an Immediate Access course. The textbook and Sapling are provided in a digital format by the first day of classes and are free through the add/drop date (Feb 2, 2021). The eTextbook link is on Canvas, while Sapling is to be accessed on its own separate website (see instructions below). Your SDSU student account will then be charged a special reduced price for use of the materials for the remainder of the semester unless you opt-out of the content by 11:59 PM on the add/drop date. You may opt out of the eTextbook if you already have a physical copy, but you will need Sapling for this course. Please visit www.shopaztecs.com/immediateaccess for additional information about Immediate Access pricing, digital subscription duration, print add-ons, opting out and other frequently asked questions.

How to access Sapling online homework:

1. Go to www.saplinglearning.com/login to create an account. If you already have a Macmillan Learning account you can log in with your existing credentials and skip to step 3.
 - Create your password and set all three security questions.
 - Start typing in your institution to select from the options that appear in the Primary Institution or School name field. If your institution does not appear you can add it by typing in the full name.
 - Accept the terms of use and click “Sign Up”.
 - Check your email for the confirmation link to complete your registration and return to the login page.
2. Set your institution by searching using your institution’s full name and selecting the appropriate option from the menu that appears.
3. Under Enroll in a new course, you should see Courses at **San Diego State University**. Click to expand this list and see courses arranged by subject. Click on a subject to see the terms that courses are available.
4. Click on the term to expand the menu further (note that Semester 1 refers to the first course in a sequence and not necessarily the first term of the school year).
5. Once the menus are fully expanded, you’ll see a link to a specific course. If this is indeed the course you’d like to register for, click the link.
6. **Need Help?** Their technical support team can be reached by phone, chat, or by email via the Student Support Community. To contact support, please open a service request by filling out the webform: <https://macmillan.force.com/macmillanlearning/s/>
7. The following link includes more detailed instructions on how to register for your course: <https://macmillan.force.com/macmillanlearning/s/article/Sapling-Learning-Registering-for-courses>

Recommended Materials:

Lecture PowerPoints will serve as a study guide. Both lecture Powerpoints and lecture recordings will be posted on Canvas.

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.

TECHNICAL SUPPORT FOR CANVAS

Student support for Canvas is provided by the Library Computing Hub, located on the 2nd floor of Love Library. They can be reached at 619-594-3189 or hub@mail.sdsu.edu

COURSE STRUCTURE AND CONDUCT

Technology Utilized in the Course:

Zoom, Canvas, Sapling homework student website, Pymol software (free student version, Schrodinger). For some homework, you may find it necessary to download and install this free software on your computer. You may download the student free version <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.
- All homework assignments are due by midnight on a Sunday. Pay attention to the due dates on Sapling, which are roughly represented in the course schedule below.

COURSE ASSESSMENT AND GRADING

10 Sapling homework assignments: 5 points each, total 50 points.
2 Midterm exams on Canvas: 15 points each.
Noncumulative final exam on Canvas: 20 points.
TOTAL POINTS: 100

Exams: All exams will be available on Canvas for 24 hours on the day of the exam. They are open-book and open-notes exams. The duration of the exam will be 1.5 hr for midterms and 2 hours for the final exam. This means you have 24 hours to initiate taking the exam, but once you start it you have 1.5 hours (or 2 hours for the final exam) to finish it.

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

EXCUSED ABSENCE MAKE-UP POLICIES:

You are required to take exams on the scheduled dates. Make up exams are offered only with a 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](http://www.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.

Resources for students

A complete list of all academic support services--including the [Writing Center](#) and [Math Learning Center](#)--is available on the Student Affairs' [Academic Success](#) website. [Counseling and Psychological Services](#) (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

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

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 the [Student Ability Success Center](#).

SDSU ECONOMIC CRISIS RESPONSE TEAM

If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit sdsu.edu/ecrt, email ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.

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 the Student Abilities Success Center at (619) 594-6473. You can also learn more about the services provided by visiting the [Student Abilities Success Center](#) website.

To avoid any delay in the receipt of your accommodations, you should contact Student Abilities Success Center 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 Abilities Success Center. Your cooperation is appreciated.

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

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COURSE SCHEDULE

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment due on Sunday 11:59pm that week
Thurs, 1/21	1) Introduction, explanation of the syllabus. Introduction to the Chemistry of Life.	Syllabus Ch. 1 (pp. 1-10)	
Tues, 1/26	2) Energy in biological systems.	Ch. 1 (11-21)	Homework 1
Thurs, 1/28	3) Water, acids, bases and buffers.	Ch. 2 (24-38)	
Tues, 2/2	4) Nitrogenous bases, nucleosides, and nucleotides.	Ch. 3 (42-45)	Homework 2
Thurs, 2/4	5) Nucleic acids and the Central Dogma.	Ch. 3 (46-53)	
Tues, 2/9	6) Polymerases and nucleic acid synthesis.	Ch. 3 (54-66)	Homework 3
Thurs, 2/11	7) Recombinant DNA technology.	Ch. 3 (66-77)	
Tues, 2/16	Exam 1 (in material covered in Lectures 1-7).		
Thurs, 2/18	8) Amino Acids and proteins.	Ch. 4 (80-95)	

Date	Activity (lectures are numbered)	Reading chapter (pages)	Assignment due on Sunday 11:59pm that week
Tues, 2/23	9) Protein primary structure. Protein purification and analysis.	Ch. 5 (97-109)	Homework 4
Thurs, 2/25	10) Protein sequencing. Protein secondary structure.	Ch. 6 (110-135)	
Tues, 3/2	11) Protein tertiary structure.	Ch. 6 (146-159)	Homework 5
Thurs, 3/4	12) Protein quaternary structure. Protein stability and folding, chaperones.	Ch. 6 (159-169)	
Tues, 3/9	13) Protein function. Myoglobin and hemoglobin, hemoglobin disease.	Ch. 7 (170-177) Ch. 7 (180-201)	Homework 6
Thurs, 3/11	14) Protein function. Antibodies.	Ch. 7 (212-216)	
Tues, 3/16	15) Monosaccharides.	Ch. 8 (217-228)	Homework 7
Thurs, 3/18	16) Polysaccharides and glycoproteins.	Ch.8 (229-243)	
Tues, 3/23	Exam 2 (in material covered in Lectures 8-16).		
Thurs, 3/25	17) Lipids.	Ch. 9 (244-259)	
Tues, 3/30	No class. Rest and Recovery Day.		
Thurs, 4/1	18) Lipid bilayers and membrane proteins.	Ch. 9 (255-269)	
Tues, 4/6	19) Biological membranes 1.	Ch. 9 (270-277)	Homework 8
Thurs, 4/8	20) Biological membranes 2.	Ch. 9 (277-290)	
Tues, 4/13	21) Facilitated transport across membranes.	Ch. 10 (291-310)	Homework 9
Thurs, 4/15	No class. Rest and Recovery Day.		
Tues, 4/20	22) Active transport across membranes.	Ch. 10 (310-319)	Homework 10
Thurs, 4/22	23) Enzyme catalysis.	Ch. 11 (322-329)	
Tues, 4/27	24) Enzyme catalytic mechanisms: Serine proteases.	Ch. 11 (330-339) (339-355)	
Thurs, 4/29	25) Enzyme kinetics.	Ch. 12 (361-373)	
Tues, 5/4	26) Enzyme inhibition and structure based drug design.	Ch. 12 (373-383)	
Thurs, 5/6	No class.		
Tues 5/11	Exam 3 (Final exam in material covered in Lectures 17-26).		

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.	10.5
Membrane structure and function. Enzymes.	13.5