
FUNDAMENTALS OF BIOCHEMISTRY - CHEM 365

FALL 2022
SCHEDULE NUMBER 20917

COURSE INFORMATION

Class Days: TTh Aug 23 – Dec 13, 2022

Class Times: 12:30 pm – 1:45 pm PDT

Class location: Hardy Tower room 140 (HT-140)

Instructor: Manal Swairjo, PhD.

Office hours: Thursdays 2:30-4 pm PDT, or by appointment mswairjo@sdsu.edu

Office hour location: Come in person to CSL-340 or find me at zoom link

<https://SDSU.zoom.us/j/86915369583>

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 biology 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. 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).

“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 is the first in a series of integrated courses (Chem 365, Biol 366, Biol 366L, Biol 567, and Biol 567L). There are also two chemistry courses that you may consider to further your knowledge of the detailed chemical processes that govern gene expression and reproduction in cells and viruses, and how this knowledge is

harnessed for the development of therapies, tests and novel vaccines. These are Nucleic Acids Function CHEM-563 (2 unit), followed by Advanced Nucleic Acids Biochemistry CHEM-596 (1 unit).

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. Describe the molecular basis of at least 5 human diseases.	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. 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 the biochemistry field, and detail the story of one of them.	Read assigned textbook material, guided by instructor Powerpoints. Discuss examples in class.	In homework and midterm exams, students are asked at least one question related to gender inequity in science.

ENROLLMENT INFORMATION

Prerequisites:

General chemistry, organic chemistry, introductory physics or physical chemistry, and principles of cell biology. Specifically, SDSU courses Biology 203, 203L and Chemistry 232, 232L, or equivalent.

- 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 Canvas**.
 - For SDSU student support on Canvas:
 - <https://library.sdsu.edu/computers-technology>
or call 619-594-3189
or email hub@sdsu.edu
or chat Computing Hub Chat
Monday–Thursday: 8am–7pm, Friday: 8am–5pm
- 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 to access it.**
- **Equitable Access Material:** The e-textbook and the Achieve Homework assignments for this class are provided in digital format within Canvas. You should see them inside the CHEM-365 course Canvas site. The materials were made available to students on July 27. The Achieve Homework system is definitely required. As for the e-textbook, it is provided at the lowest price possible, but if you happen to own a copy already and want to opt out, go here <https://www.shopaztecs.com/eastart> ([Links to an external site.](#)). All materials are free until the add/drop date. The SDSU add/drop deadline is September 2 at 7:59 p.m. PDT, but you have until 11:59 p.m. PDT to opt out of Equitable Access. Unless you opt out of Equitable Access by 11:59 p.m. PDT on the add/drop date, your SDSU student account will be charged the special reduced price (I believe \$66 for both the e-textbook and the Achieve homework combined) for use of the materials for the remainder of the semester.
- If you encounter any problems or have questions about Equitable Access, you can visit <https://www.shopaztecs.com/t-studentfaqea.aspx> ([Links to an external site.](#)) or email them at ea@sdsu.edu.
- If you have a problem accessing McMillan Learning Homework, please let me know in class or by email mswairjo@sdsu.edu.

Recommended Materials:

Lecture PowerPoints will serve as an important 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. The course schedule at the bottom of this document lists the book sections relevant to each class.

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:

Canvas, Mediasite. Down the line I may ask you to install the molecular visualization and modeling software Pymol on your computer (the free student version) <https://pymol.org/edu/?q=educational/>

Expectations:

- This is a rich course. Plan on viewing 2 PowerPoint lectures and reading on average 20 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 11:59 pm on their respective due dates. Pay attention to the due dates on Canvas, which are also listed in the course schedule below. Some due dates are Sundays and some are Wednesdays.

COURSE ASSESSMENT AND GRADING

10 Achieve homework assignments: 5 points each, total 50 points.

4 noncumulative exams: 12.5 points each.

TOTAL POINTS: 100

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.

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](http://studentaffairs.sdsu.edu/srr/cheating-plagiarism.html). 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

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

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of copy written material in education as part of the [TEACH Act](#) and [Copyright Fair Use Guidelines](#). Whenever possible, you should attribute the original author of any work used under these provisions.

COURSE SCHEDULE

Date	Activity (lectures are numbered)	Reading chapter (pages)	Homework associated with topic & due date (@ 11:59 pm)
Tues, 8/23	1) Introduction, explanation of the syllabus. Introduction to the Chemistry of Life.	Syllabus Ch. 1 (pp. 1-10)	Homework 1 due 8/28 Sunday
Thurs, 8/25	2) Energy in biological systems.	Ch. 1 (11-21)	
Tues, 8/30	3) Water, acids, bases and buffers.	Ch. 2 (24-38)	Homework 2 due 9/4 Sunday
Thurs, 9/1	4) Nitrogenous bases, nucleosides, and nucleotides.	Ch. 3 (42-45)	Homework 3 due 9/14 Wednesday
Tues, 9/6	5) Nucleic acids and the Central Dogma.	Ch. 3 (46-53)	
Thurs, 9/8	6) Polymerases and nucleic acid synthesis. DNA sequencing.	Ch. 3 (54-66)	
Tues, 9/13	7) Recombinant DNA technology.	Ch. 3 (66-77)	
Thurs, 9/15	Exam 1 (in material covered in Lectures 1-7). In class.		
Tues, 9/20	8) Amino Acids and proteins.	Ch. 4 (80-95)	Homework 4 due 9/28 Wednesday
Thurs, 9/22	9) Protein primary structure. Protein purification and analysis.	Ch. 5 (97-109)	
Tues, 9/27	10) Protein sequencing. Protein secondary structure.	Ch. 6 (110-135)	
Thurs, 9/29	11) Protein tertiary and quaternary structure.	Ch. 6 (146-159)	Homework 5 due 10/5 Wednesday
Tues, 10/4	12) Protein stability and folding, chaperones.	Ch. 6 (159-169)	
Thurs, 10/6	13) Protein function. Myoglobin and hemoglobin, hemoglobin disease.	Ch. 7 (170-177) Ch. 7 (180-201)	Homework 6 due 10/12 Wednesday
Tues 10/11	14) Protein function. Antibodies.	Ch. 7 (212-216)	
Thurs 10/13	Exam 2 (in material covered in Lectures 8-14). In class.		
Tues 10/18	15) Monosaccharides.	Ch. 8 (217-228)	Homework 7 due 10/23 Sunday
Thurs 10/20	16) Polysaccharides and glycoproteins.	Ch.8 (229-243)	
Tues, 10/25	17) Lipids.	Ch. 9 (244-259)	

Date	Activity (lectures are numbered)	Reading chapter (pages)	Homework associated with topic & due date (@ 11:59 pm)
Thurs 10/27	18) Lipid bilayers and membrane proteins.	Ch. 9 (255-269)	Homework 8 due 11/6 Sunday
Tues 11/1	19) Biological membranes 1.	Ch. 9 (270-277)	
Thurs 11/3	20) Biological membranes 2.	Ch. 9 (277-290)	
Tues 11/8	21) Facilitated transport across membranes.	Ch. 10 (291-310)	Homework 9 due 11/13 Sunday
Thurs 11/10	22) Active transport across membranes.	Ch. 10 (310-319)	
Tues 11/15	Exam 3 (in material covered in lectures 15-22). In class.		
Thurs 11/17	23) Enzyme catalysis.	Ch. 11 (322-329)	Homework 10 due 12/11 Sunday
Tues 11/22	No class.		
Thurs 11/24	Thanksgiving Holiday. No class.		
Tues 11/29	24) Catalytic mechanisms of enzymes	Ch. 11 (330-339)	
Thurs 12/1	25) Catalytic mechanism of serine proteases	Ch. 11 (339-355)	
Tues 12/6	26) Enzyme kinetics.	Ch. 12 (361-373)	
Thurs 12/8	27) Enzyme inhibition and structure based drug design.	Ch. 12 (373-383)	
Tues 12/13 At 10:30 am	Exam 4 (in material covered in Lectures 23-27). 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.	10.5
Membrane structure and function. Enzymes.	13.5