

Metabolic Biochemistry (BIBC 102)

Syllabus

Spring 2023

Professor:

Alexandra Jazz Dickinson, PhD
Section of Cell and Developmental Biology
Division of Biological Sciences

Office: Muir Biology Building #3258.

E-mail: adickinson@ucsd.edu (please use the subject line: 'BIBC 102'). Note that emails will be generally answered within 24 hours on week days.

Office hours: Thursdays 1:15 – 2:45 PM (US Pacific Time), online.

Zoom: <https://ucsd.zoom.us/j/95117564966> (Meeting ID: 951 1756 4966)

Textbook: D. L. Nelson and M. M. Cox, *Lehninger-Principles of Biochemistry* (8th Edition)

Class website: <https://canvas.ucsd.edu>

Purpose of the course: Metabolic Biochemistry is the study of the chemistry of life. In this class, we will touch on the creation of life, evolution of living organisms, and critical diseases that affect the basic processes that cells depend on to live. We will deeply examine the concepts of energy and metabolism, how they are harnessed, and how they are regulated at the molecular, cellular, and organismal level. We will start by looking in detail at enzymes: how they function and how that function can be interrupted. Then, we will focus on metabolism: the pathways by which molecules are broken down or created to provide energy for the cell, and how these pathways are regulated.

Lectures: In person MWF 2:00 – 2:50 pm in Center Hall 101 (CENTR 101)

Lectures will be podcast and uploaded to podcast.ucsd.edu.

Exams:

FINAL EXAM (In person), June 16th from 3-6 pm, Location TBA.

Midterm Review Session (In person), Monday, May 8 from 7:00 pm – 7:50 pm (YORK 2722). Participation will be worth **10%** of your final grade.

Discussion Sections:

Section	Time	Location	IA
A01	Monday 12:00 PM - 12:50 PM	HSS 2150	Tyler Diep
A02	Monday 5:00 PM - 5:50 PM	WLH 2208	Angela Liu
A03	Monday 6:00 PM - 6:50 PM	WLH 2208	Jerick Kim
A04	Monday 7:00 PM - 7:50 PM	WLH 2208	Linh Lam
A05	Monday 8:00 PM - 8:50 PM	WLH 2208	Lina Lew
A06	Wednesday 8:00 AM - 8:50 AM	HSS 1128A	Bridget Bai
A07	Wednesday 9:00 AM - 9:50 AM	HSS 1128A	Bridget Bai
A08	Wednesday 10:00 AM - 10:50 AM	APM 2301	Hanh Nguyen

Discussion sections will begin the second week of the course (April 10th). There will be discussion sections held after the last class, to review the material before the final. The goal of discussions sections is to prepare you for the quizzes and the final exam. Each discussion section will be interactive and focused on a problem set. Problem sets are designed to review the material from the week (so, Problem Set 1, for example, reviews all of Week 1 material). All discussion sections are highly recommended.

You may only attend the section in which you are enrolled, unless you have been granted permission to attend a different section *ahead of time*. Permission should be granted from *both your IAs* (from your enrolled section the section you are planning to attend).

Note that there will be extra credit points for discussion section attendance. There will be extra credit points that will be granted based on discussion section attendance (5 pts per discussion section up to a maximum of 25 pts).

Assessments:

Quiz 1 (4/21): 50 pts

Quiz 2 (5/12): 100 pts

Quiz 3 (6/2): 100 pts

“Midterm” Review Session Participation (5/5/22): 50 pts

Final Exam (6/16/23): 200 pts

Total Points: 500

Extra Credit: Discussion Section Participation up to 25 pts (5 pts for each discussion). Extra credit questions will also be provided for each quiz and for the Final.

Notes: Bring calculators, No. 2 pencils, and your student IDs to all exams and quizzes!

Also, if you have an illness, injury or emergency situation that you believe will prevent you from participating in or performing adequately on any in-person assessment, you must contact the instructor **before** the exam to discuss your options.

485 – 500 pts: A+

450 – 484 pts: A

435 – 449 pts: B+

400 – 434 pts: B

385 – 399 pts: C+

350 – 384 pts: C

300 – 349 pts: D

Below 300 pts: F

If necessary, these cutoffs will be adjusted downward so that at least 50% of students in the class receive a B or above, but they will not be adjusted upward for any reason.

Course Schedule

Week	Start Date	Concepts	Reading (Online/PDF)	Reading (8 th Edition)
1	Apr 3	Course Introduction: The Chemistry of Life Protein Structure and Enzyme Function Thermodynamics and Enzyme Catalysis	<u>Chapter 1:</u> Section 1.3 "Physical Foundations." <u>Chapter 3:</u> Section 3.1 "Amino Acids." (Read up to "Uncommon Amino Acids"). Section 3.2 "Peptides and Proteins." (Read the section "Peptides are chains of amino acids.") Section 3.4 "The Structure of Proteins: Primary Structure." (Read up to "Protein Structure is studied using methods that exploit protein chemistry"). <u>Chapter 13:</u> Section 13.1 "Bioenergetics and Thermodynamics."	1 (19 -27) 3 (70-76; 81; 90-91) 13 (465-472) Problem Set 1
2	Apr 10	Michaelis-Menten Enzyme Kinetics Enzyme Inhibition and Activation	<u>Chapter 6:</u> Read from beginning up until Section 6.4 Problem Set 1	6 (177-200) Problem Set 2
3	Apr 17	Metabolism: Coupling of Endergonic and Exergonic RXNs Metabolism: Electron Carrier Cofactors	<u>Chapter 13:</u> Review Section 13.1 "Bioenergetics and Thermodynamics." Section 13.3 "Phosphoryl Group Transfers and ATP." Problem Set 2	13 (review 465-472; read 479-494) Problem Set 3
	Friday, April 21	Quiz 1 – in class (on Problem Sets 1-2)		
4	April 24	Electron Carriers Glycolysis	<u>Chapter 14:</u> Section 14.1 "Glycolysis." Problem Set 3	14 (510-521) Problem Set 4
5	May 1	The Pyruvate Dehydrogenase Complex The Citric Acid Cycle	<u>Chapter 16:</u> All Problem Set 4	16 (All) Problem Set 5
6	May 8	The Mitochondrial Electron Transport Chain	<u>Chapter 19:</u> Read from beginning up until Section 19.4 Problem Set 5	19 (659-689) Problem Set 6
	May 8	"Midterm" Review Session – Monday, May 8 7 – 8 pm (Problem Sets 1-5)		

	Friday, May 12	Quiz 2 – in class (on Problem Sets 3-5)		
7	May 15	Oxidative Phosphorylation and ATP Synthase The Malate- Aspartate Shuttle	Review <u>Chapter 19</u> : Section 19.1 through 19.3 Problem Set 6	Review 19 (659-689) Problem Set 7
8	May 22	Gluconeogenesis The Pentose Phosphate Pathway	<u>Chapter 14</u> : Sections 14.4 through 14.6 Problem Set 7	14 (533-551) Problem Set 8
9	May 29	Glycogen Metabolism Oxidation of Fatty Acids; Ketone Bodies	<u>Chapter 15</u> : Sections 15.1 through 15.2 <u>Chapter 10</u> : Section 10.1 “Storage Lipids.” <u>Chapter 17</u> : Read from beginning up until “Acetyl-CoA can be further oxidized in the citric acid cycle.” Read Section 17.3 “Ketone Bodies.” Problem Set 8	15 (556-565) 10 (341-346) 17(601-609; 619-621) Problem Set 9
	Friday, June 2	Quiz 3 – in class (on Problem Sets 6-8)		
10	June 5	Synthesis of Fatty Acids	Chapter 21: Read from beginning up until “Fatty Acid Biosynthesis is Tightly Regulated.” Problem Set 9	21 (744-752) Problem Set 10
	June 12	Last Discussion Sections – details to follow	Problem Set 10	
	June 16	Final Comprehensive Exam 3-6 pm		

Academic integrity: Students are expected to do their own work, as outlined in the UCSD Policy on Academic Integrity. **Academic misconduct** is broadly defined as any prohibited and dishonest means to receive course credit, a higher grade, or avoid a lower grade. Academic misconduct misrepresents your knowledge and abilities, which undermines the instructor's ability to determine how well you're doing in the course. Please do not risk your future by cheating.

Disabilities: Students requesting accommodations and services due to a disability for this course need to provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD), prior to eligibility for requests. Receipt of AFAs in advance is necessary for appropriate planning for the provision of reasonable accommodations.

Please note that instructors are unable to provide accommodations unless they are first authorized by OSD. For more information, contact the OSD at (858) 534-4382 (voice), osd@ucsd.edu, or visit osd.ucsd.edu.

Responsibilities:

It is my (and the IAs) responsibility to come to class well prepared and to provide students with multiple pathways to learning the topics, including lecture slides, explanations on the board, assignments, discussion sections, and office hours.

It is your responsibility to put a significant effort into the class, by coming to class in person when you can, taking notes, actively participating in discussions, reading the textbook, working through problem sets, and asking questions when you need it.

Together, I hope we can establish a foundation for you to continue exploring (and maybe someday even revolutionize) the field of metabolic biochemistry!

UCSD Principles of Community

The University of California, San Diego is dedicated to learning, teaching, and serving society through education, research, and public service. Our international reputation for excellence is due in large part to the cooperative and entrepreneurial nature of the UC San Diego community. UC San Diego faculty, staff, and students are encouraged to be creative and are rewarded for individual as well as collaborative achievements.

To foster the best possible working and learning environment, UC San Diego strives to maintain a climate of fairness, cooperation, and professionalism. These principles of community are vital to the success of the University and the well-being of its constituents. UC San Diego faculty, staff, and students are expected to practice these basic principles as individuals and in groups.

Discrimination, Harassment, and Title IX Compliance

The University of California, in accordance with applicable federal and state laws and university policies, does not discriminate on the basis of race, color, national origin, religion, sex, gender, gender identity, gender expression, pregnancy (including pregnancy, childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition, genetic information, ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services (including membership, application for membership, performance of service, application for service, or obligation for service in the uniformed services). The university also prohibits harassment based on these protected categories, including sexual harassment, as well as sexual assault, domestic violence, dating violence, and stalking.

The Office for the Prevention of Harassment & Discrimination (OPHD) provides assistance to students, faculty, and staff regarding reports of bias, harassment, and discrimination. OPHD is the UC San Diego Title IX office. Title IX of the Education Amendments of 1972 is the federal law that prohibits sex discrimination in educational institutions that are recipients of federal funds. Students have the right to an educational environment that is free from harassment and discrimination.

Students have options for reporting incidents of sexual violence and sexual harassment. Sexual violence includes sexual assault, dating violence, domestic violence, and stalking. Information about reporting options may be obtained at OPHD at (858) 534-8298, ophd@ucsd.edu or <http://ophd.ucsd.edu>. Students may receive confidential assistance at CARE at the Sexual Assault Resource Center at (858) 534-5793, sarc@ucsd.edu or <http://care.ucsd.edu> or Counseling and Psychological Services (CAPS) at (858) 534-3755 or <http://caps.ucsd.edu>.

Students may feel more comfortable discussing their particular concern with a trusted employee. This may be a faculty member, department Chair, or other University official. Any faculty member has an obligation to report incidents of sexual violence and sexual harassment to OPHD. This does not necessarily mean that a formal complaint will be filed.

Health and Well-being

Throughout your time at UC San Diego, you may experience a range of issues that can negatively impact your learning. These may include physical illness, housing or food insecurity, strained relationships, loss of motivation, depression, anxiety, high levels of stress, alcohol and drug problems, feeling down, interpersonal or sexual violence, or grief. These concerns or stressful events may lead to diminished academic performance and affect your ability to participate in day-to-day activities. If there are issues related to coursework that are a source of particular stress or challenge, please speak with us so that we are able to support you. UC San Diego provides a number of resources to all enrolled students, including:

Counseling and Psychological Services (858-534-3755) | caps.ucsd.edu)

Student Health Services (858-534-3300) | studenthealth.ucsd.edu)

CARE at the Sexual Assault Resource Center (858-534-5793 | care.ucsd.edu)

The Hub Basic Needs Center (858-246-2632) | basicneeds.ucsd.edu)