Chemistry 562
Intermediary Metabolism
Spring 2025

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Zoom Office Hours: Mondays at 9 a.m. and Thursdays at 4 p.m.
Zoom link: https://sdsu.zoom.us/j/85446508832
Call or e-mail if you wish to make an appointment to discuss anything one-on-one with the instructor.

Textbooks: Fundamentals of Biochemistry, Fifth Edition (2016)
D. Voet, J. Voet & C.W. Pratt (John Wiley & Sons, Inc.)

NOTE: By enrolling in the course, you are automatically permitted access to an enhanced eBook version of the text (ISBN: 9781119435006) and Packback through the Day1Ready program. If you prefer to use an alternative method for acquiring the textbook and Packback, then you must opt out of Day1Ready by 11:59 p.m. on February 3 for a full refund.

The course:

Prerequisites-General Biochemistry (Chem 560) OR Fundamentals of Biochemistry (Chem 365)

Course description-This is one of three upper division biochemistry lecture courses, with Chem 563 (Nucleic Acid Function and Protein Synthesis) and Chem 564 (Receptor Biochemistry and Protein Modification), that complete an advanced undergraduate education in biochemistry. Metabolism refers to the complete set of chemical reactions that sustain life. Metabolism begins with the extraction of energy from environmental sources such as sunlight and reduced organic compounds and its conversion to more useful chemical forms such as ATP and the reductive potential of NADH and NADPH. It also encompasses all of the synthetic processes required to build up and maintain a cell (anabolism) as well as the breakdown of complex cellular structures into simpler biomolecules with the concomitant release of energy (catabolism). Therefore, metabolism resides at the interface between organic chemistry, physical chemistry (thermodynamics and energy transfer), and enzymology. The entire process is highly regulated and its disruption often leads to disease. Thus, a solid understanding of metabolism is vital for professionals working in medicine and pharmacy. The goal of this course is to provide advanced students of biochemistry with a detailed understanding of the fundamental metabolic biochemistry that supports all living things.

Online course-This course is being offered as a fully online course. The course is organized into seven modules, the content of each of which is designed to be completed more or less asynchronously, with pre-recorded lectures, homework problem sets, and online assessments (quizzes) that students will be able to access through the Canvas website (https://canvas.sdsu.edu). Students will also have the option of meeting together with the instructor twice weekly via Zoom during scheduled meeting times (Mondays at 9 a.m. and Thursdays at 4 p.m.) to discuss questions and work together through practice problems. The link to these biweekly Zoom Office Hours is: https://SDSU.zoom.us/j/85446508832.

Expected student learning objectives-
Each student who successfully completes this course will be able to:

(i) show familiarity with the global concepts of metabolism and its regulation, homeostasis, and organ specialization
(ii) express in chemical detail the core metabolic pathways of glycolysis, the citric acid cycle, and electron transport/oxidative phosphorylation;
(iii) describe in chemical detail the light and dark reactions of photosynthesis;
(iv) detail the anabolic and catabolic processes that regulate the synthesis and breakdown of fatty acids
(v) communicate with their peers about how best to learn metabolism and how what they are learning positively affects their lives and plans for the future

***Please note*-To be successful in this course, you must develop a working familiarity with a vast amount of material. Be prepared to dedicate sufficient time each week to stay current with your reading and studying. You will need to read an average of 10-20 pages of text each week. However, not all of the chapters will be covered in their entirety. Please consult the "Reading" column in the lecture schedule at the end of this syllabus to identify chapter pages from which exam material will be taken.**

Resources available to students- The text is the primary resource for this course. Lectures will closely follow the sequence and organization of the textbook. Lectures will be pre-recorded and students will be able to earn up to 4 points per lecture by viewing them and answering questions as they appear. The slides used during lecture will also be posted to the Canvas website. A short list of "lecture goals" will be highlighted at the beginning of each lecture. The purpose of outlining the lecture goals is to aid students in studying for online assessments and the cumulative final exam. Attendance via Zoom during Zoom Office Hours is not mandatory, but affords students with opportunities to discuss the material with their instructor and ask for clarification on problem solving.

Packback-In order to stimulate involvement of students in active discussion of the topics being covered, there will be 9 graded Packback discussion board assignments. Students can access each Packback assignment through the Modules link at Canvas. For full credit, students will be required to post one question in response to the prompt and provide two answers to questions posted by their classmates. Both the questions and their answers are graded by AI on the basis of the quality of writing (not necessarily the correctness) and students can return to improve both their question and answers until they are happy with the score they have earned. A minimum "curiosity score" of 70 is required to earn points for each question (worth up to 4 points) and

response (3 points each) for a total of 10 points available per Packback assignment. An additional 10 points will be awarded to students who complete all nine Packback assignments. Packback assignments are due by 11:59 p.m. Pacific Time on Wednesdays (see course Schedule below). The goal of this exercise is to practice putting into words the thoughts and ideas that the course material evokes and learn to employ online tools to draw students closer together as a community interested in learning about cellular metabolism.

Homework-There will be eight graded "Problem Sets" with challenging sample questions posted on the Canvas website. The purpose of these problem sets is to give students the opportunity to work with the course material and help them identify areas in which they need to improve their understanding in preparation for assessments and the final exam. It is highly recommended that students attempt these problems first on their own and then work together in groups and bring their questions to the instructor during Zoom Office Hours. Completed homework problem sets should be converted into .pdf format and uploaded through Canvas. Your instructor will grade them and provide you with critical feedback. Each problem set is worth up to 10 points and an additional 10 points will be awarded to students who turn in all eight of the problem sets on time.

Exams and grading-There will be six chapter assessments and a cumulative final exam. The assessments will be available online through the course Canvas site for 24 hours beginning at 6:00 a.m. Pacific Time on the day indicated in the Schedule (see below). Each student will have 75 minutes from the time they begin to complete each assessment. The cumulative final exam will be 120 minutes and will be available online on Wednesday, May 14 between 8:00 - 10:00 a.m. PDT.

The point distribution is as follows:

- Lectures #1-30: 4 points each, **120** points total
- Packback Discussions #0-8 (9 total): 10 points each + 10 points for completing all of them, **100** points total
- Problem Sets #0-7 (8 total): 10 points each + 10 points for completing all of them on tim, **90** points total
- Assessments #1-6 (75 min each): 50 points each, **300** points total
- Final exam (120 min): **140** points – the final exam is cumulative

Course grades will be assigned based on total points earned out of 750 points possible. A standard grading curve (90% or above for an A, 80-89.99% is a B, etc.) is expected for this course.

Chemistry 562, Spring 2025

Schedule

Module 0	**Jan 21-24**			
Introduction to the course-Jan. 21 at 9:00 – 9:50 a.m. (https://SDSU.zoom.us/j/85446508832)				
Packback	0	Due: Jan 29		
Problem Set	0	Due: Jan 30		
Assessment	None			

Module 1	**Jan 27-Feb 7**		**Reading**	
Lectures		Due: Feb 6		
Introduction to metabolism (1)			Ch. 14 (442-452)	
"High-energy" compounds (2)			Ch. 14 (452-461)	
Oxidation-reduction reactions (3)			Ch. 14 (462-467)	
Experimental approaches to metabolism (4)			Ch. 14 (468-474)	
Packback	1	Due: Feb 5		
Problem Set	1	Due: Feb 6		
Assessment	**Feb 7**	**Assessment #1**	Chapter 14	50 points

Module 2	**Feb 10-28**		**Reading**
Lectures		Due: Feb 27	
The reactions of glycolysis: Phase I (5)			Ch. 15 (478-488)
The reactions of glycolysis: Phase II (6)			Ch. 15 (489-497)
Fermentation (7)			Ch. 15 (497-501)
Regulation of glycolysis (8)			Ch. 15 (502-507)
Metabolism of alternative hexoses (9)			Ch. 15 (508-512)
The pentose-phosphate pathway (10)			Ch. 15 (512-519)

Packback	2	Due: Feb 26		
Problem Set	2	Due: Feb 27		
Assessment	**Feb 28**	**Assessment #2**	Chapter 15	50 points

Module 3	**Mar 3-Mar 14**		**Reading**	
Lectures		Due: Mar 13		
Glycogen breakdown (11)			Ch. 16 (523-531)	
Glycogen synthesis (12)			Ch. 16 (532-536)	
Regulation of glycogen metabolism (13)			Ch. 16 (536-544)	
Gluconeogenesis (14)			Ch. 16 (545-551)	
Packback	3	Due: Mar 12		
Problem Set	3	Due: Mar 13		
Assessment	**Mar 14**	**Assessment #3**	Chapter 16	50 points

Module 4	**Mar 17-28**		**Reading**	
Lectures		Due Mar 27		
Generation of acetyl-CoA (15)			Ch. 17 (558-568)	
The citric acid cycle (16)			Ch. 17 (568-575)	
Regulation of the citric acid cycle (17)			Ch. 17 (575-579)	
Other roles for citric acid cycle intermediates (18)			Ch. 17 (579-582)	
Packback	4	Due: Mar 26		
Problem Set	4	Due: Mar 27		
Assessment	**Mar 28**	**Assessment #4**	Chapter 17	50 points

Module 5	**Apr 7-Apr 18**		**Reading**	
Lectures		Due: Apr 17		
Mitochondria structure (19)			Ch. 18 (588-593)	
The electron transport chain (20)			Ch. 18 (593-609)	
Q cycle chemistry (21)			Ch. 18 (602-607)	
Oxidative phosphorylation (22)			Ch. 18 (609-620)	
Packback	5	Due: Apr 16		
Problem Set	5	Apr 17		
Assessment	**Apr 18**	**Assessment #5**	Chapter 18	50 points

Module 6	**Apr 14-25**		**Reading**	
Lectures		Due: Apr 24		
Chloroplast structure (23)			Ch. 19 (630-635)	
Prokaryotic photosystems (24)			Ch. 19 (635-639)	
Photosynthesis: the light reactions (25)			Ch. 19 (639-651)	
Photosynthesis: the dark reactions (26)			Ch. 19 (651-655)	
Packback	6	Due: Apr 23		
Problem Set	6	Due: Apr 24		
Assessment	**Apr 25**	**Assessment #6**	Chapter 19	50 points

Module 7	**Apr 28-May 9**		**Reading**
Lectures		Due: May 8	
Lipid digestion, absorption, and transport (27)			Ch. 20 (664-671)
Fatty acid oxidation (28)			Ch. 20 (671-684)
Ketone bodies (29)			Ch. 20 (684-686)
Fatty acid biosynthesis (30)			Ch. 20 (686-697)

Packback	7	Due: May 7
Problem Set	7	Due: May 9
Assessment	None	

May 14 **Final exam** (Lectures 1-30)
8:00 a.m. – 10 a.m. PDT