Chemistry 562
Intermediary Metabolism
Spring 2024

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Zoom Office Hours: Mondays at 10 a.m. and Thursdays at 5 p.m.
Zoom link: https://SDSU.zoom.us/j/85344681335
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 assigned to an enhanced eBook version of the text (ISBN: 9781119435006) through the Equitable Access program. If you prefer to use an alternative method for acquiring your textbooks, then you must opt out of Equitable Access by 11:59 p.m. on January 30 for a full refund (https://www.shopaztecs.com/equitableaccess).

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 (catabolism). The entire process is highly regulated. Therefore, metabolism resides at the interface between organic chemistry, physical chemistry (thermodynamics and energy transfer), and enzymology. The goal of this course is to provide advanced students of biochemistry with a detailed understanding of the fundamental biochemistry that supports all living things. Students with an interest in pharmaceuticals and medicine will gain an understanding of the biochemical processes that underly metabolic diseases.

Online course-This course is being offered as a hybrid online course with pre-recorded lectures that students will be able to access through the Canvas website (http://canvas.sdsu.edu). We will also be meeting via Zoom during scheduled meeting times (Mondays 10 a.m. and Thursdays at 5 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/85344681335.

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

***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 15-30 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 on pages 4-6 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 quizzes and the final exam. Attendance via Zoom during classroom hours is not mandatory, but affords students the opportunities to discuss the material with their instructor and ask for clarification on problem solving.

Packback discussion board-In order to stimulate involvement of students in active discussion of the topics being covered, there will be 15 weekly graded Packback discussion board assignments. Students can access each weekly Packback discussion board through the Modules link at Canvas. For full credit, students will be required to post one question relevant to the course material 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 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. The goal of this exercise is to practice putting into words the questions 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 help students 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. An additional 5 extra credit 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 pages 3-6). Each student will have 75 minutes from the time they begin to complete each assessment. The cumulative final exam will be available online TBD.

The point distribution is as follows:

- Lectures #1-30: 4 points each, **120** points total
- Packback Discussions (15): 7 points each, **105** points total
- Problem Sets #0-7: 10 points each + 5 points for completing all of them, **85** 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.

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Schedule				**Reading**
Module 0	**Jan 17-19**			
Lectures	Introduction to the course-Wednesday, Jan. 17 at 10:00 a.m. https://SDSU.zoom.us/j/85197021372			
Packback Discussion Board 1		Due: Jan 19		
Problem Set	0	Due: Jan 26		
Assessment	None			
Module 1	**Jan 22-Feb 2**			
Lectures	Introduction to metabolism (1)			Ch. 14 (442-452)
	"High-energy" compounds (2)			Ch. 14 (452-461)
Packback Discussion Board 1		Due: Jan 26		
	Oxidation-reduction reactions (3)			Ch. 14 (462-467)
	Experimental approaches to metabolism (4)			Ch. 14 (468-474)
Packback Discussion Board 1		Due: Feb 1		
Problem Set	1	Due: Feb 1		
Assessment	**Feb 2**	**Assessment #1**	Chapter 14	50 points
Module 2	**Feb 5-23**			
Lectures	The reactions of glycolysis: Phase I (5)			Ch. 15 (478-488)
	The reactions of glycolysis: Phase II (6)			Ch. 15 (489-497)
Packback Discussion Board 2		Due: Feb 9		
	Fermentation (7)			Ch. 15 (497-501)
	Regulation of glycolysis (8)			Ch. 15 (502-507)
Packback Discussion Board 2		Due: Feb 16		

	Metabolism of alternative hexoses (9)			Ch. 15 (508-512)
	The pentose-phosphate pathway (10)			Ch. 15 (512-519)
Packback Discussion Board 2		Due: Feb 22		
Problem Set	2	Due: Feb 22		
Assessment	**Feb 23**	**Assessment #2**	Chapter 15	50 points

Module 3	**Feb 26-Mar 8**			
Lectures	Glycogen breakdown (11)			Ch. 16 (523-531)
	Glycogen synthesis (12)			Ch. 16 (532-536)
Packback Discussion Board 3		Due: Mar 1		
	Regulation of glycogen metabolism (13)			Ch. 16 (536-544)
	Gluconeogenesis (14)			Ch. 16 (545-551)
Packback Discussion Board 3		Due: Mar 7		
Problem Sets	3	Due: Mar 7		
Assessment	**Mar 8**	**Assessment #3**	Chapter 16	50 points

Module 4	**Mar 11-22**			
Lectures	Generation of acetyl-CoA (15)			Ch. 17 (558-568)
	The citric acid cycle (16)			Ch. 17 (568-575)
Packback Discussion Board 4		Due: Mar 15		
	Regulation of the citric acid cycle (17)			Ch. 17 (575-579)
	Other roles for citric acid cycle intermediates (18)			Ch. 17 (579-582)
Packback Discussion Board 4		Due: Mar 21		
Problem Set	4	Due: Mar 21		
Assessment	**Mar 22**	**Assessment #4**	Chapter 17	50 points

Module 5	**Mar 25-Apr 12**			
Lectures	Mitochondria structure (19)			Ch. 18 (588-593)
	The electron transport chain (20)			Ch. 18 (593-609)
Packback Discussion Board 5		Due: Mar 29		
	Q cycle chemistry (21)			Ch. 18 (602-607)
	Oxidative phosphorylation (22)			Ch. 18 (609-620)
Packback Discussion Board 5		Due: Apr 11		
Problem Set	5	Apr 11		
Assessment	**Apr 12**	**Assessment #5**	Chapter 18	50 points

Module 6	**Apr 15-19**			
Lectures	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 Discussion Board 6		Due: Apr 18		
Problem Set	6	Apr 18		
Assessment	**Apr 19**	**Assessment #6**	Chapter 19	50 points

Module 7	**Apr 22-May 3**			
Lectures	Lipid digestion, absorption, and transport (27)			Ch. 20 (664-671)
	Fatty acid oxidation (28)			Ch. 20 (671-684)
Packback Discussion Board 7		Due: Apr 26		
	Ketone bodies (29)			Ch. 20 (684-686)
	Fatty acid biosynthesis (30)			Ch. 20 (686-697)

Packback Discussion Board 7		Due: May 3
Problem Set	7	May 3
Assessment	None	

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