Chemistry 562
Intermediary Metabolism
Spring 2023

Instructor: Tom Huxford
Department of Chemistry & Biochemistry
Office: CSL 325
Phone: (619) 594-1597 (Lab)
(619) 594-1606 (Office)
e-mail: thuxford@sdsu.edu

Zoom Office Hours: Mondays and Wednesdays, 6 – 7 p.m.
Zoom link: https://SDSU.zoom.us/j/88587156128
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 assigned to purchase an enhanced eBook version of the text (ISBN: 9781119435006) at a significant discount to the price of the print version of the text. If you prefer to use an alternative method for acquiring the textbook, you must opt out of the optional eBook by 11:59 p.m. on January 31 for a full refund (https://www.shopaztecs.com/t-immediateaccess-faq.aspx)

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 and Wednesdays, 6 – 7 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/88587156128.

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. An active "Discussion Board" will be maintained for each chapter of material in the Canvas module to which it corresponds. Use the Discussion Board to post questions and commnets about the course material. The topics that appear in the Discussion Board will serve as jump off points for our Zoom discussions on Mondays and Wednesdays from 6 – 7 p.m. You are expected to follow rules of "netiquette" (https://its.sdsu.edu/learning-managemet-system/student-netiquette) when communicating with your classmates and instuctor on the Discussion Board.

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
- Problem Sets #0-7: 5 points each + 5 points for completing all of them, **40** 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 600 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 2023

Schedule				**Reading**
Module 0	**Jan 18-20**			
Lectures	Introduction to the course-TBD			
Problem Set	0	Due: Jan 27		
Assessment	None			
Module 1	**Jan 23-Feb 3**			
Lectures	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)
Problem Set	1	Due: Feb 2		
Assessment	**Feb 3**	**Assessment #1**	Chapter 14	50 points
Module 2	**Feb 6-24**			
Lectures	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)
Problem Set	2	Due: Feb 23		
Assessment	**Feb 24**	**Assessment #2**	Chapter 15	50 points

Module 3	**Feb 27-Mar 10**			
Lectures	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)
Problem Sets	3	Due: Mar 9		
Assessment	**Mar 10**	**Assessment #3**	Chapter 16	50 points

Module 4	**Mar 13-24**			
Lectures	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)
Problem Set	4	Due Mar 23		
Assessment	**Mar 24**	**Assessment #4**	Chapter 17	50 points

Module 5	**Apr 3-Apr 14**			
Lectures	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)
Problem Set	5	Apr 13		
Assessment	**Apr 14**	**Assessment #5**	Chapter 18	50 points

Module 6	**Apr 17-21**			
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)
Problem Set	6	Apr 20		
Assessment	**Apr 21**	**Assessment #6**	Chapter 19	50 points

Module 7	**Apr 24-May 5**			
Lectures	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)
Problem Set	7	May 5		
Assessment	None			

TBD **Final exam** (Lectures 1-30)
TBD