Chemistry 562
Intermediary Metabolism
Spring 2021

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Course time: 9:30-10:20 a.m., Tues. & Thurs.
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.)

The course:

Prerequisites-General Biochemistry (Chem 560) OR Biochemistry, Cell & Molecular Biology I (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. We will also be meeting via Zoom during the schedules course times (Tues./Thurs. 9:30-10:20 a.m.) to discuss questions and work together through practice problems.

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 3-5 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 exams. 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.

Homework-There will be seven graded "Problem Sets" with challenging sample questions will be 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 on Tues. and Thurs. at 9:30-10:20 a.m.

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 between 8:00-10:00 a.m. Pacific Time on Thursday, May 13, 2021.

The point distribution is as follows:

- Lectures #1-30: 4 points each, **120** points total
- Problem Sets #1-7: 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.

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Schedule				**Reading**
Module 0	**Jan 21-22**			
Lectures	Introduction to the course-Zoom Jan. 21 9:30 – 10:20 a.m.			
Problem Set	0			
Assessment	None			
Module 1	**Jan 25-Feb 5**			
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			
Assessment	**Feb 5**	**Assessment #1**	Chapter 14	50 points
Module 2	**Feb 8-26**			
Lectures	The reactions of glycolysis: Phase I (5)			Ch. 15 (478-488)
	The reactions of glycolysis: Phase II (6)			Ch. 15 (489-497)
	Note: Friday, Feb 12 is a campus mandated "Rest and Recovery" day.			
	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			
Assessment	**Feb 26**	**Assessment #2**	Chapter 15	50 points

Module 3	**Mar 1-12**			
Lectures	Glycogen breakdown (11)			Ch. 16 (523-531)
	Glycogen synthesis (12)			Ch. 16 (532-536)
	Note: Monday, Mar 8 is a campus mandated "Rest and Recovery" day.			
	Regulation of glycogen metabolism (13)			Ch. 16 (536-544)
	Gluconeogenesis (14)			Ch. 16 (545-551)
Problem Sets	3			
Assessment	**Mar 12**	**Assessment #3**	Chapter 16	50 points

Module 4	**Mar 15-26**			
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			
Assessment	**Mar 26**	**Assessment #4**	Chapter 17	50 points

Module 5	**Mar 29-Apr 9**			
Lectures	Mitochondria structure (19)			Ch. 18 (588-593)
	The electron transport chain (20)			Ch. 18 (593-609)
	Note: Tuesday, Mar 30 is a campus mandated "Rest and Recovery" day.			
	Q cycle chemistry (21)			Ch. 18 (602-607)
	Oxidative phosphorylation (22)			Ch. 18 (609-620)
Problem Set	5			
Assessment	**Apr 9**	**Assessment #5**	Chapter 18	50 points

Module 6	**Apr 12-23**	
Lectures	Chloroplast structure (23)	Ch. 19 (630-635)
	Prokaryotic photosystems (24)	Ch. 19 (635-639)
	Note: Thursday, Apr 15 is a campus mandated "Rest and Recovery" day.	
	Photosynthesis: the light reactions (25)	Ch. 19 (639-651)
	Photosynthesis: the dark reactions (26)	Ch. 19 (651-655)
Problem Set	6	
Assessment	**Apr 23** **Assessment #6** Chapter 19	50 points

Module 7	**Apr 26-May 7**	
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	
Assessment	None	

May 13 **Final exam** (Lectures 1-30)
8:00 a.m. - 10:00 a.m.