

Biochem 645: Molecular Control of Metabolism and Metabolic Disease

LOCATION	2131 Biochemistry (420 Henry Mall)
DAY & TIME	1:00-2:15 Tuesdays & Thursdays,
SEMESTER	Fall Semester
INSTRUCTORS	Alan Attie, Adam Konopka, Dudley Lamming, Matt Merrins, Andrea Galmozzi, Roz Anderson
TA	Anna Frerichs

Guiding theme. Mammals go through fast-feed cycles. This requires adjustments in fuel utilization and in the regulation of metabolic pathways. The course will examine the various physiological states and how they affect metabolic pathways. We will also discuss a number of special topics related to the unique roles of various tissues and to metabolic pathways in disease states, including diabetes, cancer, inflammation, and age-related disease processes.

Class format. The class is taught in a “flipped” format. The primary material is available in online videos, each accompanied by an auto-graded online quiz. This format allows class time to be devoted to guided exercises and dialogue with the instructors and other members of the class.

Quizzes. You must take each quiz before the corresponding class for its topic. (Access to the quiz is available until the class meets.) You may take the quiz as many time as you wish. Only the best score will be recorded. You must work alone on the quiz.

Class exercises. You may work alone or with 1-2 fellow students on each class exercise. *Each student* must turn in a class exercise by the end of the class. Individual exercises will be graded.

Important note: The most important learning process of this class is the classroom exercises. It is critical for you to come prepared by learning the material on the videos and reviewing any supporting material in your Biochemistry textbook.

The classroom exercises are designed to make you think, speak, and sometimes struggle. *You are not permitted to look up any information on the Internet.* This is because finding the information on the Internet completely undermines our educational goals. You may consult a Biochemistry textbook, however and the instructors will circulate and answer any questions you have.

Oral summaries of assigned videos. At the start of each class, one student will give a very brief (1-2 minutes) summary of each video assigned for that class session. The student will field any questions from the class. You are encouraged to ask your fellow students questions during your presentation. We have prepared a schedule of the presentations.

Grading. The final grade in the course will be based on the 3 components of the class weighted as follows: Exams 50%, Quizzes 25%, Classroom exercises 25%.

ASSIGNED READING

Devlin's Textbook of Biochemistry with Clinical Correlations:
Chapter 21: Metabolic Interrelationships

CLASS SCHEDULE

Part 1 Intermediary Metabolism

- Thurs 09/07 Course Introduction & Carbohydrate Metabolism 1 (Attie)
Videos
• Welcome to Biochem 645!
• Carbohydrate Metabolism 1
- Tues 09/12 Carbohydrate Metabolism 2 (Attie)
Videos
• Review of Glycolysis
• PFK & Pasteur
- Thurs 09/14 Carbohydrate Metabolism 3 & ChREBP (Attie)
Videos
• Glucokinase, glucose transport
• ChREBP
- Tues 09/19 Fatty Acid to Glucose? Pyruvate Metabolism, Steady-States (Attie)
Videos
• Fatty Acid to Glucose?
• Pyruvate Dehydrogenase
• Steady State
- Thurs 09/21 Ketone Body Metabolism & β -oxidation (Attie)
Videos
• Ketone Body Metabolism
- Tues 09/26 TCA Cycle & Carbonyl Chemistry (Attie)
Videos
• TCA Cycle
• Carbonyl Chemistry
- Thurs 09/28 Lipogenesis & Lipoprotein Metabolism (Attie)
Videos
• Lipogenesis 1
• Lipogenesis 2
• Lipoprotein Metabolism
- Tues 10/03 Cholesterol Metabolism (Attie)
Videos
• Cholesterol Synthesis
• Discovery of the LDL Receptor
• SREBP

Part 2 Metabolic Flexibility

- Thurs 10/05 Glycogen Metabolism & Gluconeogenesis (Anderson)

MON 10/9

EXAM 1 (EVENING) EIGHT LECTURES (ALAN)

- Tues 10/10 Cycles, shuttles, and shunts (Anderson)
- Thurs 10/12 Metabolic signaling; primary & secondary messengers (Anderson)

Part 3 Mitochondrial Metabolism

- Tues 10/17 Mitochondrial metabolism 1 (Konopka)
- Thurs 10/19 Mitochondrial metabolism 2 (Konopka)
- Tues 10/24 Mitochondrial metabolism 3 (Konopka)

Part 4 Signaling and Regulation

- Thurs 10/26 Exercise (Konopka)
- Tues 10/31 Insulin signaling & insulin resistance (Lamming)
- Thurs 11/02 mTor & Regulatory Nodes (Lamming)
- Tue 11/07 β -cell biology and diabetes (Merrins)
- Thurs 11/09 GL/FFA cycle, hormonal regulation of lipolysis, lipid droplet biology (Merrins)
- MON 11/13 EXAM 2 (EVENING) (NINE LECTURES Anderson, Konopka, Lamming)**
- Tues 11/14 Cold exposure and sympathetic nervous system metabolism-1 (Merrins)
- Thurs 11/16 Hypothalamic control of metabolism and circadian rhythms (Galmozzi)

Part 5 Integrated Metabolism

- Tues 11/21 UCP-independent thermogenesis (Galmozzi)

Thanksgiving November 23th

- Tues 11/28 Cancer Metabolism (Lamming)
- Thurs 11/30 Epigenetics (Anderson)

Tues 12/05 Aging & metabolic disease (Lamming)

Thurs 12/07 Alzheimer's and other degenerative diseases (Anderson)

Tues 12/12 Inflammation (Anderson)

TBD FINAL EXAM (TEN CLASSES Merrins, Galmozzi, Lamming, Anderson)