

BMB 401 Spring 2021

Comprehensive Biochemistry

Class begins 1/11/20

Midterm Exam Times are 3-4 PM Eastern on these Fridays ONLY (Exam Rooms TBA):

February 5, February 26, March 26, and April 23 from 3-4pm EST.

*The 2-hour Comprehensive 5th exam is scheduled for Friday April 30th 3-5pm.
Exam rooms TBD.*

Overview

In this course, we will cover the structures and functions of major biomolecules, to understand the roles of these molecules in metabolism. We will also cover the regulation and coordination of major metabolic pathways. This course has an emphasis on human metabolic pathways; other systems are covered when appropriate.

Goals

Students are expected to know the important principles of inter and intramolecular interactions, enzyme catalysis, thermodynamics, and pH. Students are also expected to know the structures and functions of important biochemical metabolites, including amino acids, monosaccharides, nucleic acids and the general structures of fatty acids, triacylglycerols, membrane lipids and cholesterol.

Students are expected to know the following pathways in depth:

- Glycolysis
- Gluconeogenesis
- TCA cycle
- Glycogen synthesis and catabolism
- Urea cycle
- Replication
- Transcription
- Translation

And have an appreciation for the function and the committed and regulated steps of the following pathways and processes:

- Major buffering systems
- Heme synthesis and catabolism
- Pentose phosphate pathway
- Fatty acid synthesis and catabolism
- Amino acid synthesis and catabolism
- Nucleic acid synthesis and catabolism
- Membrane lipid formation, including cholesterol synthesis and derivatives
- Lipid transport

Requirements

- **All four mid/term exams must be taken. The final is optional.**
 - o The final may be used to substitute for **one** missed exam.
- **Computer with internet access:**
 - o Mozilla Firefox browser
 - o QuickTime media player
- **Textbook: *Biochemistry: Eighth Edition*, Berg, Tymoczko & Stryer W. H. Freeman & Co, ed, but other, earlier editions are allowed, to save you money.**

- **Academic Honesty:** It is expected that all students follow the code of academic honesty. **No cheating of any kind will be tolerated.** Students found to be cheating on an exam, will receive a zero for that exam, and will be reported. Further actions may include dismissal from the university.

University policy regarding academic honest can be found here:

<https://www.msu.edu/~ombud/academic/integrity/index.html>

No request for a grade increase, other than that due to grading error, will be honored. Your final grade will be that which you have fairly earned.

- **Persons living off campus in remote areas, those over 1.5 hours away, may identify an alternate testing center, at another university or college to proctor your exams. Please note that some proctors charge a fee for exam proctoring, and not all proctors charge the same fee.**
 - o Persons requesting alternate testing accommodation must fill out the **Proctor Survey for Students in Remote Locations** by the end of the second week of classes. This survey asks for the following:
 - your name and email address
 - your proctor's name, email address, phone number and mailing address.
 - o Proctors are contacted before the first exam to ensure validity and ability to comply with testing procedure.
 - o Proctors not accepted as valid must be changed.
 - o Any change in proctor or their contact information must be put into the **Proctor Survey for Students in Remote Locations at least a week in advance of the next exam.**
 - o If you need help in finding a proctor, or if you are having problems with your proctor, please let the instructor know as soon as possible, as there are usually many proctoring options, and we can help to find a good fit for you.

Assessment

- **All exams are administered in-person, in paper and pencil format.**
 - All exams ***must*** be taken at the posted time (given in Eastern time)
 - **Persons living in other time zones must test at the same time as persons who are testing in MI. Eastern time)**
- All midterm exams will consist of 43 questions that may consist of multiple choice, or true/false questions. Alternate exams may also contain short answer questions.
- All midterm exams have a one-hour time limit
- The final exam will consist of at least 53 questions that may consist of multiple choice, or true/false questions.
- The final exam will have a two-hour time limit
- If a question or problem arises during an exam, on campus students may approach the instructor directly to discreetly ask questions or communicate concerns.
- Off campus students should request that proctors contact me with questions or concerns during an exam.
- **My cell phone will be on during all exams to provide a direct link to off- campus testing centers.**
- **All bags, backpacks and other personal items will be placed at the front of the room for exams.**
- **Students must arrive on time for exams. Anyone late by more than 15 minutes may be refused to take the exam.**
- No headphones will be allowed. All cell phones, (besides mine) and other electronic equipment that may beep, ring, etc. must be silenced and put away. We will not be held accountable for lost items.
- **Calculators may NOT be used in these exams.**
- The beauty of taking the final is this: If your final exam grade itself is higher than the average of your 4 highest exam scores, your final exam grade will be used as the entire grade for the class. ***Taking the final can only help you.***

I continue this practice in honor of my predecessor, ***Dr.-Dave-McConnell***, who is a great believer in the power of the second chance.

“The optional cumulative final exam is intended to allow any student to improve her/his grade: if you score a 4.0 on the final, you will receive a 4.0 for the course. However, if you do better in the course than on the final, you will receive the better of the two grades. While this may sound a little like blackjack, it is designed to sustain your motivation, even when things look bleak! Students learn subjects at different speeds. Some who learn rapidly remember very little in the end, while some who learn slowly retain a great deal and understand more.”

[Thanks to "Dr." David McConnell, "Course" syllabus "for" MSU's "BMB" 401, "Summer" 2006]

- **The final can substitute for ONE exam only. All other missed exams will be scored as a zero.**

Students requiring accommodations for exams:

- Persons requiring accommodations should contact the **Resource Center for Persons with Disabilities (RCPD)** at Michigan State University prior to the beginning of class to obtain a VISA form that states the accommodations required. The website for RCPD is: <https://www.rcpd.msu.edu/>

Missed Exams: Make up exams are given SOLELY at the discretion of the instructor. The final may be used to make up for ONE missed exam.

Accessing Course Materials

- All course materials are online at <https://d2l.msu.edu/>
 - Video lectures are present in the Lessons tab
 - Lectures may be streamed online
 - Lectures may be downloaded to watch on your computer or mobile device.
 - You are encouraged to **download** the file to have for later review, although it may be possible for you to play the lecture movie directly from the MSU server, **this may be a slower process.**
 - Lecture notes in PowerPoint (PPT), PDF, or Keynote (KEY) format are present for download. It is recommended that you watch the lectures with these notes in hand.
- **Please note: it is strongly advised to watch lectures regularly to keep up with this course as you would for any in-person course. Please do not fall behind.**



I look forward to having you in class! This is a challenging topic that provides great insight into many fundamental biochemical processes. Have a great semester, and please let me know if you have questions. I am here to help, and I especially enjoy answering questions!

So please do not hesitate to contact me!

Onward to a great semester!

With best regards and hopes for an excellent semester,

Dr. Kathleen Foley

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Class Schedule

The following schedule is given as a guide to the topics that will be discussed. Please plan to watch one video per day, or per every other day – do not attempt to cram this class...

Lecture Topics

- 1 Introduction to the Course, Basic Biochemical Concepts
- 2 Basic Principles II Four classes of Macromolecules, Inter- and Intra-molecular Interactions
- 3 Polar Nature of Water, Acid Base Chemistry, Buffers
- 4 Basic Thermodynamics
- 5 The Central Dogma
- 6 Amino Acids Structure and function
- 7 Protein Structure Hierarchy
- 8 Protein Folding, Degradation, Amyloidosis
- 9 Exploring Topics in Homology
- 10 Myoglobin and Hemoglobin Structure, Function, Pathology

Exam I, Covering Lectures 1-10

- 11 Heme Synthesis, Degradation, Clinical Importance Of Bilirubin
- 12 Enzymes I: Nomenclature, Kinetics
- 13 Enzymes II: Kinetics continued, Profile of Carbonic Anhydrase, Enzyme Regulation
- 14 Vitamins, Coenzymes, Cofactors
- 15 Carbohydrate Structure and Nomenclature
- 16 Glycolysis I: Glucose as a Fuel Source
- 17 Glycolysis II: The Use of Other Fuel Sources
- 18 Gluconeogenesis,
- 19 The Pyruvate Dehydrogenase Complex, Overview of the TCA Cycle

Exam II, Covering Lectures 11-19

- 20 TCA Cycle, Enzymes and Regulation
- 21 Electron Transport Chain
- 22 ATP Synthesis, Mitochondrial poisons
- 23 Glycogen Metabolism I
- 24 Glycogen Metabolism: Regulation
- 25 Pentose Phosphate Pathway
- 26 Lipids I: Fatty Acid Catabolism
- 27 Lipids II: Additional topics in Fatty Acid Oxidation
- 28 Lipids III: Steroid Synthesis
- 29 Lipids IV: Cholesterol Transport
- 30 Lipids V: TAG and Phospholipid Synthesis

Exam III, Covering Lectures 20-30

- 31 Protein Metabolism; The Urea Cycle
- 32 Amino Acid Metabolism
- 33 Nucleic Acid Metabolism I: Nucleotide Structure, Function and Synthesis I
- 34 Nucleic Acid Metabolism I: Synthesis II; Pathology
- 35 DNA Structure II; Replication I
- 36 Replication II: Mutation and Repair
- 37 Transcription
- 38 Transcriptional Regulation
- 39 Translation
- 40 Metabolism Overview – Material in this lecture will be on Exam IV.

Exam IV, Covering Lectures 31-40

Exam V Optional Cumulative Exam