BMB 401 Spring 2022

Comprehensive Biochemistry:

Important dates

- **Class begins: 1/10/22**
- **Midterm Exams Fridays 3:00-4:00 PM Eastern Standard Time ONLY**
  - **February 4th**
  - **March 4th**
  - **April 1st**
  - **April 29th**

  There is no final exam.

Faculty

Course Instructor of Record: Assistant Professor **Dr. Kathleen Foley**:
email: foleyk@msu.edu This is the preferred form of communication as I am not in my office.

Office hours with Dr. Foley and our GLSA are by Zoom meeting only this semester.
Dr. Foley: Tuesdays 12-1 PM Additional meetings available by appointment

Course 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.
- This is an online course and a computer with internet access is needed
- The Mozilla Firefox or Google Chrome browsers tend to work best with this course.
- **Textbook:** *Biochemistry: ninth Edition,* Berg, Tymoczko & Stryer W. H. Freeman & Co, ed, but other, earlier editions are allowed, to save you money. **There are copies of the 9th edition of our textbook on reserve in the on-campus Main Library.**

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.
- All exams in the continental US *must* be taken at the posted time of 3:00 PM Eastern Time (ET) *This means that persons living time zones other than ET must test at the same time as persons who are testing in MI. (such as 2:00 PM Central Time)*
- Anyone late by more than 15 minutes may be refused an exam.
- 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.
- **No collaborating of any kind on exams is allowed and is considered to be academic dishonesty. This will be reported.**

Spartan Code of Honor: The Associated Students of Michigan State University (ASMSU) adopted the following Spartan Code of Honor:
"As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do."

Grading Scale:

This is the grading scale that will be used to determine your grade.

- 4.0 85-100
- 3.5 78.5-84.99
- 3.0 71-78.49
- 2.5 64.5-70.99
- 2.0 58-64.49
- 1.5 50.5-57.99
- 1.0 44-50.49
- 0.0 Below 44

Students requiring accommodations for exams:

- Persons requiring accommodations due to disability 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. This VISA should be sent to Dr. Foley. To make an appointment with a specialist at RCPD, call: (517) 353-9642 Or TTY: (517) 355-1293 or visit the RCPD website: **https://www.rcpd.msu.edu/**
- Persons living outside the continental US may request accommodations for purposes of alternate exam timing.

Accessing Course Materials

- All course materials, and all grades will be online at **https://d2l.msu.edu**
- Video lectures are streamed online via YouTube links posted in Exam Content on d2l
- All video lectures are close captioned.
- Lecture notes are present in PowerPoint (PPT), PDF format for download.
- Transcripts of the lectures are also posted and may be downloaded to use as notes, so you do not have to write down every word from the lectures yourself.
- If you have trouble accessing course content or concerns regarding course content, please contact Dr. Foley by email.
- If you have general technical trouble either accessing d2l, or email, contact the appropriate help desk listed here:
  - Visit the MSU Help site for general problems http://help.msu.edu
  - Visit the Desire2Learn Help Site for d2l problems http://help.d2l.msu.edu
  - Call the MSU IT Service Desk, which is available 24 hours a day for any IT issue. These numbers are (517)432-6200, (844)678-6200, or e-mail at ithelp@msu.edu (Note: my experience is that calling is generally faster and easier than email)

Class Schedule

Please Note: it is strongly advised to watch lectures regularly to keep up with this course as you would for any in-person course. This means to watch 1 lecture per day or 1 per every other day to finish the lectures by the weekend before each exam. Then you can use the week of the exam to do the practice exams, and review lectures as needed. ***Please do not fall behind– do not attempt to cram this class, it's the best way to experience maximal aggravation and certain failure.***

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

Exam IV, Covering Lectures 31-40

Notes to help you do well in this class

The following are supplied on d2l to help you:

- Closed Captioned lecture videos
- Transcripts of every word spoken in the lecture videos
- Lecture notes in PPT and PDF form
- Self-assessments for each lecture (think of this as homework that is not-for-credit and make sure to do it!)
- Practice exams and keys (Word docs)
- Online Mock Exams in d2l (in the Quizzes section under assessments) These open at 9 AM the Tuesday before each exam and will close, and remain closed at 9 AM on exam day.

Previous Students' Advice to reduce the time it takes to watch a lecture and take notes – Students have said that this method is actually faster in the long run, and makes it easier to understand the overall concepts better.

1) Watch each lecture all the way through once without taking notes to follow along and get an idea of what is being said, and what is most important to know.
2) Watch the lecture again to take notes, (or highlight the lecture transcript).

Most importantly: Please do not try to just memorize! It's important to understand *what* is happening and *why*. Memorization without understanding is a ticket to exam failure, and retaining this course information.

Please think about the following when watching lectures:

- What is the overall purpose of this pathway or cycle?
- What kind of reaction is happening at each step?

    - Is carbon lost or gained?
    - Is ATP used or produced?
    - Are electrons lost or gained from the substrate – and if so, which electron carrier is being used?
    - Are there cofactors needed in this reaction? Which ones? Why?
- Where and when does this pathway happen?
    - Why does this make sense?
- Which enzymes are regulated in this pathway?
    - Why does the regulation of these enzymes make sense?
    - Why do the effectors of this enzyme (positive or negative regulators) make sense for this enzyme and this pathway?

By <u>understanding</u> these things, biochemistry may become much easier for you. Rote memorization alone is <u>not</u> the way to succeed in this course. Understanding the <u>*what and why*</u> is critical for understanding and retention.
I hope this helps!

I look forward to having you in class! This is a challenging course 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, so please do not hesitate to contact me!
With best regards and hopes for an excellent and safe semester,
Dr. Kathleen M. Foley