BMB 401 Summer 2026

Comprehensive Biochemistry

Important dates

Class begins on **05/11/2026**.

- Exams are online on **Thursdays at 4:00 PM Eastern Standard Time** on the following dates:
  - Thursday, May 28
  - Thursday, June 18
  - Thursday, July 16
  - Thursday, August 13

- Other important dates:
  - Open Add Period Ends: Fri., May 15
  - University closed for holiday: May 25, June 19, and July 3
  - Tuition Refund Period Ends: Wed., June 3

Faculty

Course Instructor of Record **Dr. Elia Wright** (feel free to call me Dr. E)
email: hefnerel@msu.edu
Graduate Teaching Assistant: **TBD**

Office hours are posted on D2L and individual meetings are available by appointment via email. All office hours are meetings are on Zoom unless otherwise specified.

I look forward to having you in class! Although this is an asynchronous course, I strongly encourage you to **make time for office hours** on a regular basis or email me for an individual meeting if you want to discuss more personal matters like grades, hardship, etc.

Class Communication

This is an asynchronous, online course. All communication is through D2L and email. I send a weekly update once per week to help you navigate the course, keep up with important dates, etc. I also send reminders, helpful tips, and other information on an as-needed basis. **It is your responsibility to check your email and D2L announcements regularly to stay up to date.**

My normal work hours are Monday – Friday from 9AM – 5PM and I observe all University holidays. Please allow *one full business day* for me to return your email before you send a follow up email. Remember, there are many of you but only one of me. **If you email me on the weekend, keep in mind that I likely will not see or respond to your email until the next business day.** The only exception to this is when we have an exam. In those instances, I will respond to exam-related emails that are time sensitive until ~5:30PM on exam day, but responses may still be delayed over the weekend.

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.

As this is an asynchronous course, **reliable access to an internet-connected computer that is compatible with Respondus Lockdown monitor and browser is necessary for success**. Mozilla Firefox and Google Chrome work best for this course. The textbook that accompanies this course is *Biochemistry: Tenth Edition,* Berg, Tymoczko & Stryer W. H. Freeman & Co, ed, but other, earlier editions are allowed, to save you money. **There are copies of our textbook on reserve in the on-campus Main Library (textbook and e-book options).** You may also rent the textbook or purchase access to the e-book from Macmillan. The textbook is not required, but it may be a helpful tool for understanding the material. Check out https://libguides.lib.msu.edu/textbooks for more information regarding reserved textbooks from the library.

Achieve from Macmillan is also **recommended** but not required for this course. Additional practice problems are available on this platform. Completion of these practice problems will not directly contribute to your grade; however, students who complete more practice problems tend to perform better on exams. Previous students who used Achieve in the course appreciated the hints and feedback available. Again, **you are not required to purchase any materials for the course, and you can earn an A solely using the resources on D2L.**

Campus Resources

This can be an overwhelming course because of the sheer amount of information you are required to learn, retain, and apply. If you feel overwhelmed, stressed, or anxious at any point during the semester, please reach out to me, the graduate learning assistant, or Counseling & Psychiatric Services (also known as CAPS; https://caps.msu.edu/). There are resources to help you do your best in the course and take care of your mental health.

Class resources

The following are supplied on D2L to help you:

- Closed captioned lecture videos
- Blank and annotated lecture slides in PPT format
- Ungraded self-assessments
- Achieve practice problem sets (if you choose to purchase access)
- Practice exams and answer keys
- Online mock exams

Accessing Course Materials

- All course materials and grades will be online at **https://d2l.msu.edu**
- If you have trouble accessing course content or concerns regarding course content, please contact Dr. E by email (hefnerel@msu.edu).
- 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

Topics that are helpful to review before the semester begins

Reviewing these topics will help you to hit the ground running with the first section of the course, but it is not a requirement.

- Functional groups (e.g., ketone, aldehyde, carboxylic acid, etc.)
- pH
- Thermodynamics
- Reaction types (e.g., condensation, hydration, oxidation, etc.)
- Central dogma (replication, transcription, translation)

Goals

In this course, you will be responsible for learning a LOT of material. The goals of this course are outlined below. By the end of the semester, you will have gained a lot of knowledge that will be applicable to the fields of human health, medicine, and biochemical research.

By the end of the semester, you will know the important principles of inter- and intramolecular interactions, enzyme catalysis, thermodynamics, and pH. You will also 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.

You will know the following pathways and their regulation in depth:

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

You will have an understanding of the function, overall chemical logic and crucial 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

Exams

- All four exams must be taken using Respondus Lockdown monitor and browser.
- 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 will consist of 42 questions that will consist of an assortment of multiple choice, multiselect, matching, or true/false questions. Two of these questions will be "bonus questions."
- All exams have a 75-minute time limit unless specified by an accommodations letter.
- A mock exam will be posted to D2L approximately one week prior to each exam *and become unavailable at 9AM on exam day*. You will not be able to view your mock exam results after it becomes unavailable. There are no exceptions.

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 letter that states the accommodations required. This accommodations letter should be uploaded to D2L for Dr. Hefner to review. 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.

Exam Day Details

- **Exams are open note.** Please still make sure you **study as if the exam is closed note**. You will not have enough time to look up every question. You may access any notes you have made, but you must complete the exam on your own. **Use of other electronic devices outside of a calculator (cell phones, tablets, etc.) is not permitted. Please do not access internet resources or contact others while completing the exam. Respondus Lockdown browser is required.**

- **Exams begin at 4PM ET.** You will have a total of 75 minutes to complete the exam. The 75-minute timer will begin counting down at 4PM ET. For example, if you log on to D2L at 4:15 PM, you will only have 60 minutes to complete your exam instead of the full 75 minutes. If you have submitted a valid accommodations letter, your exam time will reflect your accommodations.

- Make sure you are connected to a **reliable internet connection** and that your electronic device is fully charged. *Make up exams will not be given for loss of internet or laptop/computer/tablet dying.*

- **Each exam contains 42 questions for a total of 105 points.** Exams are graded out of 100 points. Extra credit is built into each exam as you can score higher than 100 points on each exam.

- Grades are available upon submission, but questions will not be viewable. An approximately 48-hour window will be announced via email and D2L for you to review each exam. After this window, you will not be able to view exam questions.

Time Conflicts & Missed Exams

In the event you need to request a makeup exam, **please complete the exam makeup request form on D2L.** If you have a time conflict (work or class) or emergency, complete the exam makeup request form on D2L. **Completing the form does not guarantee approval.** The form will become unavailable at 11:59 PM ET the day before each exam. While I empathize with you, having multiple exams on the same day or in a short period of time is not a valid reason for an exam to be moved. That is part of the life of a student. Likewise, neither are vacations, weekend getaways, etc. Just like an in-person class, you are responsible for appropriately managing your time, and sometimes that means making sacrifices.

Extra credit

There are extra points available on each exam, which is one form of extra credit. In addition, there will be one additional opportunity to earn extra credit. This opportunity is up to the discretion of the instructor and will be announced during the semester. Late submissions will not be accepted, and extensions will not be made.

Grading Scale:

This is the grading scale that will be used to determine your grade. Points are not rounded at the end of the course, and there is no grading curve. The course is graded out of 400 points.

Points Earned	Course Grade
> 340.00	4.0
314.01 – 340.00	3.5
285.00 – 314.00	3.0
260.01 – 285.00	2.5
235.01 – 260.00	2.0
210.01 – 235.00	1.5
180.00 – 210.00	1.0
Below 180.00	0.0

Honors Option

An honors option assignment is typically offered in the Fall and Spring semesters but not the Summer. ***This is subject to change.*** Please check D2L for further details on whether the honors option is being offered during the semester you are taking the course.

Academic Honesty:

There are many ways to get help and be successful in this course. If you are struggling for any reason, including personal/family reasons, please reach out to Dr. E or the graduate teaching assistant. **Assistance is readily available to help you become a better learner and critical thinker, not just a good test taker. There is no valid reason to cheat.** Honor yourself and your peers by following the code of academic honesty.

With that said, no cheating of any kind will be tolerated. **Using resources outside of those approved by the instructor, including searching Google for answers and AI such as Chat GPT, is cheating.** 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.**

Again, please use all your resources to do well instead of cheating. I want everyone to do well, and there are no "gotchas" in this course. **If you are having a hard time for any reason, please email me, stop by virtual office hours, or set up an individual appointment.**

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."

Class Schedule

Cramming is not advised for this class. Exams are spaced approximately 3 weeks apart. Each exam covers ~10 lectures which average 1 hour each. Watching the lecture is only part of the work necessary to ~~survive~~ be successful. You also need to factor in time for completing practice problems, rewatching lectures that were confusing or complex, reading the textbook (if you're into that kind of thing), etc. I strongly recommend that you watch one lecture at least every other day. On days you are not watching a lecture, you should be completing practice problems, drawing pathways, writing summaries, or some other activity to increase your understanding of the presented material. If, however, you choose to cram all the material for this class, understand that you are increasing your likelihood of failure and the level of frustration and anxiety you experience.

Lecture Topics

1 Why Study Biochemistry? / Four Classes of Macromolecules
2 Molecular Forces, Properties of Water, and Thermodynamics
3 Weak acids & bases, Buffers, and Blood pH Regulation
4 Amino Acids - Structure and Function
5 Basic Principles of Biochemistry
6 The Central Dogma
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: TAG and Fatty Acid Catabolism
27 Lipids II: Additional topics in Fatty Acid Oxidation
28 Lipids III: Fatty Acid Synthesis
29 Lipids IV: TAG and Phospholipid Synthesis
30 Lipids V: Cholesterol Synthesis and Transport

Exam III. Covering Lectures 20-30

31 Protein Degradation, The Urea Cycle, and Amino Acid Catabolism
32 Amino Acid Metabolism
33 Higher Order Structure of DNA
34 DNA Replication
35 DNA Repair and Recombination
36 Transcription Part I
37 Transcription Part II
38 Transcriptional Regulation
39 Translation Part I
40 Translation Part II

Exam IV. Covering Lectures 31-40

Study Tips

Please do not just memorize! It's important to understand *what* is happening and *why*. Practice *applying* your knowledge. Understanding the *what and why* is critical for retaining and applying knowledge. Below are some questions to consider as you watch lectures, take notes, and study.

What kind of reaction is happening?

- Is carbon lost or gained?
- Is ATP used or produced?
- Are electrons lost or gained from the substrate – and if so, what is the electron carrier?
- Are there cofactors needed in this reaction? Why?
- Where and when does this reaction happen?
- Why does this reaction make sense?
- Why are specific enzymes regulated?
- Why does the regulation of these enzymes by these effectors make sense?
- Why do things happen as they do in this pathway or cycle?
- What is the overall purpose of this pathway or cycle?

The knowledge you will gain in this course is valuable. A basic understanding of how the human

body operates can help you make more informed decisions about your health. Be sure to share your knowledge with friends and family to help them take better care of themselves and their loved ones, too. Whatever your next step is after this course, I hope it leads to greatness!

All the best,
Dr. Elia Wright