BMB 401 Fall 2026

Comprehensive Biochemistry

Important dates

Class begins on **08/31/2026**.

- Exams are online on **Fridays at 4:00 PM Eastern Standard Time** on the following dates:
  - Friday, September 25
  - Friday, October 23
  - Friday, November 20
  - Friday, December 11

- Other important dates:
  - Open add period ends: September 4 at 11:59 PM ET
  - University closed for holiday: Sept. 7, Oct. 26 - 27, and Nov. 26 - 27
  - Tuition refund period ends: September 24
  - Last day to drop with no grade reported: October 19

Faculty

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

Course Materials

The following is **required** for this course:

- A computer with reliable internet access that is compatible with Respondus lockdown browser and monitor
  - Requires functioning web camera and microphone

The following materials are **optional** for this course:

- *Biochemistry: Tenth Edition,* Berg, Tymoczko & Stryer W. H. Freeman & Co, ed
  - Copies are on reserve in the main library to access for free
- Achieve from Macmillan
  - Provides e-book access and access to additional, ungraded practice problems

Welcome to BMB 401!

The knowledge you will gain in this course is invaluable. A basic understanding of how the human body operates can help you make more informed decisions about your health and lifestyle. This class is challenging, but if done properly, you will level up your critical thinking skills and become a more efficient, effective learner. These are transferrable skills that will help

you for the remainder of your academic career and in the workplace. Oh – and you'll learn biochemistry, which is pretty awesome, too. Here are some tips for getting the most out of the course.

Tips for Success

- **Check your email and D2L regularly.** This is our primary means of communication.
- **Actively participate in office hours.** We walk through practice problems that aren't posted online and you get real-time feedback on your answers.
- If you rely heavily on memorization alone, you will need to **add active recall to your bag of learning tricks**. I'm happy to help you adjust your learning strategy.
- **Make time for practice problems** and attempt questions without your notes to see what you *really* know versus what you can look up.
- **The big picture and the small details are important.** Starting with the big picture and filling in the details is one way to make sure you have a good grasp at both levels.
- **Make a consolidated version of your notes to use on exams.** It makes your notes easier to use and helps you learn in the process.
- **Learn & study like you won't have access to your notes.** The time limit for exams requires you to be selective in how you use your notes.

Campus Resources

This can be an overwhelming course because of the large 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.

Communication

This is an asynchronous, online course. **All communication is through D2L and email.** I send a weekly update 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. **Please check your email and D2L announcements regularly to stay up to date.**

Office hour details are posted on D2L and individual meetings are available with me (Dr. E) by appointment via email. All office hours and meetings are on Zoom unless otherwise specified.

My normal work hours are Monday – Friday from 9AM – 5PM (5:30 PM on exam days) 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. If you email me on the weekend, keep in mind that you may not get a response until the next business day.

Course Overview & Learning Outcomes

In this course, we will cover the structures and functions of major biomolecules to understand the roles of these molecules in metabolism and other major cellular processes. We will also

cover the regulation and coordination of these processes. Though we primarily focus on humans, much of what we cover will provide foundational vocabulary and biochemical reasoning applicable to many different organisms.

Successful completion of this class will:

- Improve your ability to utilize higher order thinking skills (e.g. analyzing and evaluating)
- Strengthen time management for self-driven tasks
- Instill and improve biochemical reasoning skills
- Expand your toolkit for learning, organizing and retaining a high volume of information

By the end of the semester, you will know the main principles of protein folding & structure, enzyme catalysis, thermodynamics, and pH. You will also recognize the structures and know the functions of important biomolecules, including amino acids, proteins, carbohydrates, nucleic acids, 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 understand the function, overall chemical logic and crucial steps of the following pathways and processes:

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

Class resources

The following are available 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 (posted 1 week before each exam)

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
    - Contact the MSU IT Service Desk - (517) 432-6200 (local) or (844) 678-6200 (toll-free), or e-mail at ithelp@msu.edu

If you want a head start…

Reviewing these topics will help you to hit the ground running with the first section of the course, but this 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, and translation)

Exams

- All four exams must be taken using Respondus Lockdown monitor and browser.
- All exams have **42 questions** that will consist of an assortment of multiple choice, multiselect, matching, and true/false questions. Two of these questions will be "bonus questions" that only affect your score if you get them correct.
- All exams have a **75-minute time limit** unless specified by an accommodations letter. The 75-minute synchronous timer on D2L starts counting down at 4PM ET.
- **Exams are open note.** Use of other electronic devices (cell phones, tablets, etc.) aside from a calculator is not permitted. Please do not access internet resources or contact others while completing the exam.
- **Grades are available upon submission, but questions will not be immediately 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.
- **Make sure you are connected to a reliable internet connection** and that your electronic device is fully charged and plugged in to avoid interruptions.

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** to obtain a letter that states the accommodations required. This accommodations letter should be uploaded to D2L for Dr. E 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 of the Eastern Time zone may request accommodations for purposes of alternate exam timing.

Time Conflicts & Missed Exams

In the event you need to request a makeup exam, **please complete the appropriate exam makeup request form on D2L.** If you have a time conflict (work, class, or internship) 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 on the Monday prior to the 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.

Extra credit

There are extra points available on each exam (two bonus questions for a total of 5 extra credit points per exam). In addition, there will be one additional opportunity to earn extra credit. This opportunity and any additional opportunities are 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. This is another reason why reading your email is important – you don't want to miss out on opportunities for extra credit!

Grading Scale:

Below 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. 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.

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 me 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.** Honor yourself and your peers by following the code of academic honesty.

Using resources outside of those approved by the instructor, including internet searches, accessing generative AI tools (e.g. Chat GPT, Gemini, etc.), and asking others for assistance is cheating. Students who violate this policy 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.**

My goal is for every student to succeed in this course. There are no "gotcha" questions or hidden expectations. If you need help, please email me, attend virtual office hours, or schedule an individual meeting. **I would much rather work with you to overcome challenges than have you jeopardize your academic record through academic dishonesty.**

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 complex lectures, reading the textbook (if you're into that kind of thing), etc. I strongly recommend that you watch one lecture about every other day. On days you are not watching a lecture, complete activities (practice problems, drawing pathways, writing big picture summaries, etc.) to apply your knowledge. Cramming increases your likelihood of frustration, fatigue, and poor performance in this class. Do your best to avoid it! If you made it this far in the syllabus, congratulations! Here's your secret mission if you choose to accept – send me an email with your answer to this question: if you could take any book or show that isn't currently a movie and make it into one, what would it be? I'll respond with my answer :)

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