Course syllabus and information

Course information

Biochemistry and Molecular Biology 461 (BMB461) - Advanced Biochemistry I
11:30 a.m. – 12:20 p.m. MWF
Spring semester 2026
In-person; 101 Biochemistry
Course website via D2L (d2l.msu.edu)

Contact Information

Instructor Information	**Lectures**	**Office and Office Hours**
Dr. Kevin Haudek Course coordinator haudekke@msu.edu *(must include "BMB461" in subject line)*	1-19	219 Biochemistry Bldg. Office hours: Mondays 1-2 p.m. Wednesdays 10:15-11:15 a.m. Or by email appointment *Zoom link by request*
Dr. Sophia Lunt sophia@msu.edu *(must include "BMB461" in subject line)*	20-29	522A Biochemistry Office hours during unit 3: By email appointment *Zoom link by request*
Dr. Michaela TerAvest teraves2@msu.edu *(must include "BMB461" in subject line)*	30-38	209A Biochemistry Office hours during unit 4: Mondays & Thursdays 1-2 p.m. Or by email appointment *Zoom link by request*
Tianqi Wang wangti73@msu.edu *(must include "BMB461" in subject line)*	Teaching Assistant	*Review sessions*: TBA

Course Materials

All course materials are used in BMB462 as well.

Required

- Nelson, D.L. and Cox, M.M. Lehninger's Principles of Biochemistry, 7th or 8th ed. (2017 / 2021). W.H. Freeman, New York. 1172 pages.
- Access to Macmillan Achieve (www.achieve.macmillanlearning.com); an online homework system integrated with an electronic version of the textbook.

Using the older version of the textbook is an option, but if you elect to do so, you are responsible to match the required reading pages/sections appropriately. Alternatively, you may elect to purchase an electronic version of the textbook directly from the publisher.

- i>clicker Cloud account

Recommended

- The study guide associated with the Lehninger textbook (*The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry: Study Guide and Solutions Manual* by Marcy Osgood and Karen Ocorr) is an optional resource for this course, but many students have found it helpful in the past.
- Previous students have found another book that explains the chemistry and sequence of reactions in biochemical pathways very helpful:
  Wilkins, Carol A. Understanding Biochemical Pathways: A Pattern-Recognition Approach., 2nd ed. (2021) Cognella, Inc. 226 pages.

Course Objectives

BMB 461 is the first semester of the undergraduate series, BMB 461 & 462, which provides students with an introduction to biochemistry at the advanced undergraduate level. It is designed primarily for students majoring in Biochemistry or closely related fields. BMB 461 is a three credit course that reintroduces basic biochemistry concepts including protein structure and function and focuses on carbohydrate and energy metabolism. The following topics will be discussed during this term:

- •Buffers, pH
- •Protein Structure
- •Protein Purification
- •Protein-Ligand Binding
- •Enzyme Catalysis and Mechanism
- •Enzyme Kinetics
- •Carbohydrates
- •Glucose Metabolism
- •Pentose Phosphate Pathway
- •Glycogen metabolism and regulation
- •Citric Acid Cycle, Glyoxylate Cycle
- •Electron Transport, Oxidative Phosphorylation
- •Photosynthesis

For each of these topics you will be expected to apply basic biochemical principles to explain biological systems and processes and predict how alterations will impact these systems or processes.

Course Expectations of Students

BMB461 is a rigorous, fast-paced, advanced biochemistry course. Students that complete the course routinely comment that it is one of the most challenging and rewarding classes at MSU. Habits of previously successful students include studying before or after every lecture, completing homework assignments regularly before the posted deadline, forming study groups and attending review sessions. By examining the textbook and course schedule, you will find that the course covers a lot of material each lecture and week. Be forewarned that academic success in this course will likely take a large amount of effort. The instructors are aware of the challenging nature of this course and have devised a course structure to accommodate these challenges (see appropriate sections below for specifics). For example, we enforce weekly homework deadlines to encourage you to keep up with the course content. The grading scale for each grade level is already lowered to accommodate the difficulty of exams and align with past semester performances of this course. Some notecards and calculators are permitted on exams in order to assist you with challenging exam questions. These aspects of the course are intended to help you be successful in this course. We encourage you to prepare yourself for success by devoting the required effort and time necessary for this course.

Assessments

Your final grade in BMB 461 will be calculated based on the assessment types listed in the table below, weighted according to the indicated percentages. Detailed descriptions of each assessment are provided in subsequent sections. Students may earn up to 0.5% extra credit by completing optional online quizzes or surveys available during the last week of class. Information about these assessments will be posted in D2L. The purpose of this bonus is to allow students who are within 0.5% of a specific grade cutoff an opportunity to achieve a higher grade. No other extra credit opportunities will be offered in the course.

Assessment	**Weight**	**Date or information**
Exam I	20%	
Exam II	20%	
Exam III	20%	
Exam IV	20%	April 30; per University Final Exam schedule
In class clickers and/or assignments	5%	Used during every lecture session with each day weighted equally; drop lowest 10 scores at end of semester
Online homework	15%	Weekly assignments; drop lowest 3 scores at end of semester

Exams

Exams will contain a mixture of multiple choice, true/false, calculation and free response questions at the instructor's discretion. Each exam contributes to your final course score based on the percentage of indicated above. Exam answer sheets will be provided for all students. Midterm exams will be held in the same room and class time as lectures. Check the university's final exam schedule for details on the final exam location, day and time.

To ensure fairness, we have developed a set of rules. You will enter the room through the specified door(s) and will be assigned to a seat by the instructor or test proctor. Once you are in the room, refrain from talking to your classmates. You must not open the exam until instructed to do so. You will get warnings approximately 15 min and 5 min prior to the end of the exam. Filling in any part of the exam after time has been called is considered cheating and will be dealt with accordingly! When finished, you should put all portions of the exam into the appropriate boxes at the front of the room. You should not talk until you have left the room and/or all of the exams are collected. A copy of the exam with key will be posted when grades are available. Deadlines for reviewing your exam for errors will be given after each exam.

Calculators without Wi-Fi capabilities *will be allowed* on all exams. Calculators with Wi-Fi capabilities, cellphones, and other Wi-Fi devices *may not be used* during the exams. To encourage higher order learning, you may bring one handwritten, double-sided 5 in. x 8 in. notecard to the exams with notes or equations you deem important. <u>You will be provided with the proper notecard in the week preceding an exam by the instructor. You must use the notecard provided to write your exam notes.</u> The notes must

be hand written (i.e. not typed or photocopied), and you must prepare your own note card. Thus, exams will de-emphasize simple memorization of facts. However, you should realize that your note sheets are limited in size and that there is a tradeoff between the amount of material written on those sheets and your ability to efficiently locate it during exams. A well-organized note sheet is a supplement to a solid understanding of the material rather than a replacement for it.

In class clickers or assignments

This course will use the iClicker Cloud app during lecture both to assess your knowledge of some basic course content and to facilitate active learning. The iClicker app should be registered to your MSU email account. If you do not register your clicker before the first midterm exam, you will not receive credit for previous clicker questions. *There are no make ups for points associated with clickers, for any reason including failed connection by the iClicker Cloud app.* You must attend class and use your iClicker to receive points. Having a friend use your iClicker app/device or participating in clicker questions while not in the classroom is a breach of academic integrity and will be treated as such. Through the semester, there may be unannounced attendance checks to verify in-person attendance and participation via clickers.

During a typical lecture you will have one or more opportunities to answer questions using the clicker. You will receive ½ of a point for sending in any answer and an additional ½ of a point for sending in the correct answer. Some questions are designed to generate discussion and may not have a single correct answer. In this case, you will receive one point for any answer. Each day of clicker points counts the same in your final grade, regardless of the number of questions in that day. At the end of the semester your lowest ten days will be dropped from your grade. Because of this, you can miss class occasionally for emergencies, illness, religious days, or other commitments without seriously impacting your clicker scores. These drops also cover technological problems, like poor connection and app or battery failure. Clicker points for the entire semester are worth 5% of your final grade. It is your responsibility to understand the feedback lights on your clicker or app and verify that your answers are received. If you need to re-register your clicker app or there are problems with your clicker grade in D2L, please notify the TA immediately.

Online homework

Homework for BMB 461 is delivered through Achieve. Information about how to register for this site and find the correct course will be delivered during the first week of class. Make sure to follow registration instructions closely. These homework assignments cover some of the key concepts you need to know but are not designed to be exhaustive.

The homework problems over the course of the entire semester are worth a total of 15% of your final grade. Weekly homework assignments will typically be due on Monday evenings. Due dates may vary during exam weeks, holidays or academic breaks. Please check Achieve regularly to confirm assignment deadlines. At the end of the semester, your three lowest homework scores will be dropped. Your overall homework grade will be based on the average percentage correct from the remaining assignments. Because of this policy, no deadline extensions or make up opportunities for homework will be offered for any reason, including illness, technical issues or personal commitments.

You are encouraged to work together on homework problems and help each other learn how to solve these problems but you must log on and solve your own homework problems to receive credit. Posting or sharing of homework answers, at any website, is not allowed, is a breach of academic integrity, and will be treated as such.

There may also be *optional* homework assignments that will neither be collected nor graded, but completing them will help you prepare for the exams. There are also questions in the textbook at the end of each chapter, and you should incorporate these questions into your studies. The answers to these questions are provided in the back of the book. Working in groups on all of the optional problem sets is encouraged as a highly valuable study strategy.

Make-up Policy

There will be no makeup or adjustments to clicker scores or online homework for days you miss class or deadlines, except in the case of an unexpected and extended illness. There will be no makeup or adjustments to clicker scores or online homework for any technological problem that is not system wide. Each of the assignments (e.g. clickers & homework) has several low scores dropped at the end of the semester to address occasional student absences (for any reason, including occasional illness). Students do not need to provide documentation in order to receive these dropped scores. In the case of an extended (>7 day) illness, including absences due to COVID-19 or required isolation, students must notify the instructor before or during the absence and must be able to supply relevant documentation as requested by the instructor. When these extended absences have been verified, instructors will suggest possible accommodations for these cases. With the exception of extended technical problems originating in the Macmillan Achieve system, there are no extensions on homework deadlines. For observances of religious holidays, certain adjustments can be made to move a scheduled exam date, or exemptions for in-class clicker points and, occasionally, homework assignments. You must notify an instructor of conflicting religious observances for the semester during the first two weeks of the semester and meet to discuss what exemptions may be possible in a given case.

Exam absence

Scheduled exam dates are provided in the course schedule. If you will miss an exam due to travel to/from an academic or professionally-related event, an MSU sponsored event or religious observance which can be anticipated in advance you must contact your instructor at least one week prior to the exam date to determine if you are eligible for alternate exam arrangements.

If you unexpectedly miss an exam due to extenuating and unforeseen circumstances, such as significant illness (e.g. COVID-19) or death of a loved one, you must contact your instructor within 24 hours of the missed exam.

In order to be considered for make up exam arrangements, it is your responsibility to provide adequate documentation as requested by the instructor. This may include medical documentation of medical testing results and/or medical visits. You may or may not be eligible for a make up exam based solely on the discretion of the instructor(s). In some cases, a point penalty may be assessed to your make up exam score for absences without sufficient documentation, absences without sufficient notice or a delay in taking the make-up exam beyond the original date suggested by the instructor. If the instructor determines that you are not eligible for alternate exam arrangements and you do not/did not take the exam, you will earn a 0 on the exam. Multiple missed exams in a semester without proper documentation and/or arranged planning will result in increased point penalties, including being assigned a score of 0 on a missed exam.

For grief absences students should complete: https://reg.msu.edu/StuForms/Stuinfo/GriefAbsenceForm.aspx to notify the Associate Dean or designee

of their college. The associate dean or designee will work with the student to determine the length of the absence and will notify faculty of the absence period.

Make-up exams are administered at the instructor's convenience, typically within 48 hours of the original exam or as soon as medically allowed and may be scheduled without consulting students. Make-up exams typically are somewhat similar to classroom exams, although make up exams may consist of more free response, essay and calculation questions or vary point distribution between question types. Instructors retain the right to offer completely multiple choice question or completely essay question makeup exams.

Grading Criteria

This grading scale shows the percentage you must earn at the end of BMB461 to guarantee a particular grade. We have used this scale in previous semesters with good success. If there is a significant disruption or change to the course due to an unforeseen disruption in the semester, the instructors may revisit or adjust the scale. This will be done on a class-wide basis, not for individual students. Your overall course grade percent will be rounded to the nearest tenth. Grades for graduate students will be determined from the undergraduate distribution.

Grade	Percentage
4.0	≥ 85.0
3.5	≥ 79.0
3.0	≥ 72.0
2.5	≥ 65.0
2.0	≥ 57.0
1.5	≥ 48.0
1.0	≥ 40.0
0.0	< 40.0

Honors option

Students may elect to take BMB461 with an H-option provided they obtain a grade of 3.0 or higher in the course. The honors option consists of a term paper that addresses an unsolved biochemical question related to a topic and research article provided by the instructors. Students interested in the honors option should check D2L during the first week of class for more information and deadlines.

Attendance policy

This course follows the General University Attendance Policy. If you feel sick, have symptoms of illness, or have a confirmed case of a communicable disease (e.g. COVID-19), *please stay home and isolate*. Attendance itself is not a required component of the course, although students that attend class regularly perform better in the course and students are able to earn in-class clicker points on every non-exam day. There may be unannounced attendance checks to verify clicker participation. If you miss a class, it is expected that students learn the material covered in class that day on their own. See the Make-Up Policy section for information about missing graded assessments and class days missed due to illness.

Course Management Software

We will use D2L to post lecture handouts, lecture recordings, grades, and other general course information. We will use the news feature and the e-mail feature in D2L to provide information about the course. It is expected that students are regularly checking D2L for updates about the course.

Achieve will be used for online homework assignments. There are help resources within this system to help you learn how to use and navigate the assignments. More information about how to register for the system will be delivered during the first week of class.

Resources

This course extensively uses Desire2Learn (D2L) for the posting of lecture material. Students are expected to check these sites regularly for newly posted material. As members of a learning community, students are expected to respect the intellectual property of course instructors. All course materials presented to students are the copyrighted property of the course instructor and/or textbook publisher. As such you may not post the recordings or other course materials online or sell or distribute them to anyone not enrolled in the class without the advance written permission of the course instructor and, if applicable, any students whose voice or image is included in the recordings. Any student violating this restriction may face academic disciplinary sanctions.

Lecture Learning Materials

Learning materials for a given day in the course will be posted on D2L in advance of each day. These learning resources are designed to aid your study of the material, note taking during lecture and reading the text. They are not a substitute for reading the textbook. It is highly recommended that you bring these materials to class and read the assigned reading in the text prior to lecture.

Course Recordings

Audio-video recordings of lectures may be posted when available. However, **BMB 461 is not an online course, and these recordings are not a substitute for attending class** or taking notes. Recordings may be incomplete, poor in quality, or entirely unavailable due to technical issues or instructor discretion. Additionally, recordings may begin only after announcements (e.g., exam details) have been made.

Previous Exams

Exams from a few previous semesters will be posted on D2L. Please note that some of these exams may be from semesters when exam policies or course schedule differed from the current semester. The exam keys will be posted no later than three days prior to each exam date.

Instructor review sessions

There will be scheduled exam review sessions led by a course instructor before each scheduled exam. These review sessions take the form of "question and answer" sessions, where students should come prepared to ask questions about course material. The exact dates, times and locations of these review sessions will be announced before each exam.

Extra course help

Students are strongly encouraged to use the optional TA-led review sessions, instructor-led exam review sessions and visit the regularly scheduled office hours for help in the course. For students desiring additional help, potential course tutors can be found at:
https://bmb.natsci.msu.edu/undergraduate/tutoring.aspx

Accommodations

Michigan State University is committed to providing access and inclusion in all programs, services and activities. Disabled persons should contact the Resource Center for Persons with Disabilities at 517-884-RCPD or by visiting RCPD's website to request accommodations. RCPD analyzes disability related barriers the student experiences as well as course objectives and design when making

determinations. Additional communication between the student, instructor, and RCPD specialist may be necessary to ensure an accessible classroom experience. Please send your Accommodation Letter to the course coordinator as soon as possible so we can ensure proper facilitation of accommodation. Letters for this class should be submitted by email during the first week of class or within one week of receiving an accommodation letter. Accommodations are not required to be provided prior to course faculty receiving the letter.

Academic Honesty

The Spartan Code of Honor states, "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." In addition, Article 2.III.B.2 of the Student Rights and Responsibilities (SRR) states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." This course adheres to and strictly enforces the policies on academic honesty as specified in General Student Regulations 1.0: Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. Students found cheating on an exam will receive a zero for that exam and an academic misconduct report will be filed with the university. Course faculty may decide to impose additional penalties (e.g. zero in the course) or conditions (e.g. assigned seat) based on the severity or situational context of the misconduct on an exam.

Therefore, unless authorized by your instructor, you are expected to complete all course assignments, with the exception of homework and in-class clicker questions, without assistance from any source. Students who violate MSU academic integrity rules may receive a penalty grade, including a failing grade on the assignment or in the course. In extremely rare cases, faculty may consider a make up assignment to replace (in part or in whole) the original assignment on which cheating was discovered. *Using multiple clicker apps/devices to send in answers for classmates who are not present or using the clicker app while not in-person attendance is considered academic dishonesty.*

SPLS

Michigan State University takes seriously the opinion of students in the evaluation of the effectiveness of instruction and has implemented the SPLS (Student Perception of Learning Survey) process to gather student feedback. This course utilizes the SPLS system, and you will receive an e-mail sometime near the end of semester reminding you fill out the survey at your convenience. You have the option on the online SPLS form to decline to participate in the evaluation of the course.

Possible changes to course during semester

Instructors may adjust the order or coverage of topics due to time constraints, with updates communicated via D2L and/or email. In the event of major disruptions, course policies, structure, or schedule may change in accordance with university guidelines. A revised syllabus and/or schedule will be provided, and instructors will promptly communicate changes and be available to answer questions.

Date	Lec. #	Topic	Reading Pages	Instructor
12-Jan	1	Aqueous solutions and pH & buffers	43-64	Haudek
14-Jan	2	Buffers; acid/base problems	43-64	Haudek
16-Jan	3	Amino acids and peptides	70-83	Haudek
19-Jan		MLK Jr. Day - University Closed		
21-Jan	4	Proteins: Primary structure & evolution	90-92; 96-100	Haudek
23-Jan	5	Proteins: Secondary structure	107-116	Haudek
26-Jan	6	Proteins: Three-dimensional structure	116-128	Haudek
28-Jan	7	Proteins: Structure and Folding	128-136	Haudek
30-Jan	8	Protein-ligand binding: Myoglobin and hemoglobin	148-164	Haudek
2-Feb	9	Introduction to enzyme catalysis	177-188	Haudek
4-Feb	10	Enzyme catalysis and mechanism	177-188; 203-210	Haudek
		Optional Q and A by Instructor TBA		
6-Feb		**Exam I:** Lectures 1-9		
9-Feb	11	Enzyme kinetics: Introduction	188-197	Haudek
11-Feb	12	Enzyme kinetics: Michaelis-Menten	188-197	Haudek
13-Feb	13	Enzyme kinetics: Inhibition	197-203	Haudek
16-Feb	14	Enzyme kinetics: Regulation and allostery	213-223	Haudek
18-Feb	15	Bioenergetics: Principles	465-478	Haudek
20-Feb	16	Bioenergetics: High-energy compounds and phosphoryl transfers	479-488	Haudek
23-Feb	17	Bioenergetics: Redox reactions and energy balance	488-496	Haudek
25-Feb	18	Carbohydrates I	229-241	Haudek
27-Feb	19	Carbohydrates II	241-253	Haudek
		Optional Q and A by Instructor TBA		
3/2 to 3/6		Spring Break		
9-Mar		**Exam II:** Lectures 10-19		
11-Mar	20	Introduction to metabolism	461-464	Lunt
13-Mar	21	Glucose metabolism: Glycolysis I	510-521	Lunt
16-Mar	22	Glucose metabolism: Glycolysis II	521-525	Lunt
18-Mar	23	Glucose metabolism: Fermentation	525-533	Lunt
20-Mar	24	Glucose metabolism: Gluconeogenesis	533-539	Lunt
23-Mar	25	Regulation: Glycolysis & gluconeogenesis	539-546	Lunt
25-Mar	26	Glucose metabolism: Pentose phosphate pathway	546-552	Lunt
27-Mar	27	Glycogen metabolism	556-565	Lunt
30-Mar	28	Regulation: Glycogen metabolism	565-571	Lunt
1-Apr	29	Pyruvate dehydrogenase complex	574-578	Lunt
3-Apr	30	Citric acid cycle	578-589	TerAvest
		Optional Q and A by Instructor TBA		
6-Apr		**Exam III:** Lectures 20-29		
8-Apr	31	Citric acid cycle and Glyoxylate cycle	590-596; 735-736	TerAvest
10-Apr	32	Mitochondrial electron transport I	659-674	TerAvest
13-Apr	33	Mitochondrial electron transport II	659-674	TerAvest
15-Apr	34	Oxidative phosphorylation	674-689	TerAvest
17-Apr	35	Photosynthesis: Light-driven ATP synthesis I	700-719	TerAvest
20-Apr	36	Photosynthesis: Light-driven ATP synthesis II	700-719	TerAvest
22-Apr	37	Photosynthesis: Carbon fixation I	719-740	TerAvest
24-Apr	38	Photosynthesis: Carbon fixation II	719-740	TerAvest
		Optional Q and A by Instructor TBA		
4/30/2026		**Exam IV:** Lectures 30-38 **(12:45-1:45 pm) 101 Biochemsitry**		