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 2021
Online synchronous sessions via Zoom
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)*	1-15	219 Biochemistry Bldg. Office hours by Zoom (see D2L for link) Mondays 3-4 p.m. Tuesdays 9-10 a.m. Or by email appointment
Dr. Sophia Lunt sophia@msu.edu *(must include "BMB461" in subject line)*	16-25	522A Biochemistry Office hours by Zoom (see D2L for link) Thursdays 10-11 a.m. or by email appt.
Dr. Björn Hamberger hamberge@msu.edu *(must include "BMB461" in subject line)*	26-36	3230 Molecular Plant Sciences Office hours by Zoom (see D2L for link) Tuesdays & Thursdays 3-4 p.m. or by email appointment
Kiyoto Tanemura tanemur1@chemistry.msu.edu *(must include "BMB461" in subject line)*	Teaching Assistant	Reviews by Zoom (see D2L for link): Wednesdays 3-4 p.m. Fridays 3-4 p.m.

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 ed. (2017). W.H. Freeman, New York. 1172 pages.
- Access to Sapling Learning (www.saplinglearning.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 nicely explains the chemistry and sequence of reactions in biochemical pathways very helpful:
  Wilkins, Carol A. Understanding Biochemical Pathways: A Pattern-Recognition Approach., 1st ed (2018) Cognella, Inc. 167 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 field. 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. This course will be a fully online course which requires attendance of synchronous sessions. Important course content will be delivered at these sessions, as well as points earned for student participation. Portions of exams will be given during normally scheduled class times. Although class sessions will be recorded, this is not intended to be an asynchronous course. Asynchronous course activities include completing weekly homework assignments, completing weekly quizzes, personal studying and completing a take home portion of the exam.

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 grade in BMB 461 will be determined by your performance on the following assessments and weighted by the percentage indicated:

Assessment	**Weight**	**Date or information**
Exam I	17%	Feb 6-8
Exam II	17%	Feb 26-28
Exam III	17%	March 26-28
Exam IV	17%	Apr 25-27 & Apr 29
In class clickers	5%	Used during every synchronous lecture session with each day weighted equally; drop lowest 6 scores at end of semester
Online homework	10%	Weekly assignments; drop lowest 2 scores at end of semester
Weekly Quizzes	17%	About eleven over semester; drop lowest 2 scores at end of semester

Additional information about each of these assessments is given below. A total of 0.5% bonus can be earned for completion of optional online quizzes or surveys at the end of the course. The purpose of the extra credit is to give you the opportunity to ensure that if you are within 0.5% of a cutoff for a particular grade for the course that you will earn the higher grade. Please check D2L during the last week of class for these optional assessments. No other bonus opportunity or extra credit is offered in this course.

Exams

Exams will consist of two parts. One part will be taken online via D2L and consist of a mixture of multiple choice, true/false, matching, etc. This part of the exam will be given during a normal class session schedule at the course time. The other part of the exam will be a “take home” exam that can be worked on off-line over a few days. This part of the exam will contain calculation, drawing, free response, etc. questions. Both parts will contribute to your exam total. Check the university’s final exam schedule for details on the final exam day and time.

Online exams are expected to be individual efforts. No sharing of answers or questions is allowed; nor is consulting with other students. You **may** be allowed to work with one classmate on the take home exam, although each student is responsible for doing their own work and submitting their own exam. Exact polices for each exam will be announced in class and posted to D2L at least 24 hours before each exam.

Scientific calculators *will be allowed* on all exams. You can use either a stand alone calculator and/or an online calculator. To encourage higher order learning, you are encouraged to produce a one page summary of important points from each unit for use on the exam. 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

This course will use i-clickers via iClicker Cloud during lecture both to assess your knowledge of some basic course content and to facilitate active learning. Clickers may be registered through D2L; instructions are posted there. 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.*

During a typical lecture you will have one or more opportunities to answer questions using the clicker. You will receive one point for participating for each clicker question. 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 six days will be dropped from your grade. Because of this, you can miss class occasionally for emergencies, religious days, or other commitments without seriously impacting your clicker scores. These drops also cover technological problems, like poor connection and app 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 and verify that your answers are received. You must attend class and use your clicker to receive points: having a friend use your clicker is a breach of academic integrity and will be treated as such. If you need to replace or re-register your clicker or there are problems with your clicker grade in D2L, please notify the TA immediately.

Weekly Quizzes

There will be a weekly quiz given through D2L each week there is not an exam. These quizzes will cover material from the current week and help to gauge your mastery of the material for the exam. Each quiz will contain approximately 10 questions, of multiple choice, T/F, or matching formats, for example. Quizzes will be opened only for a little time each weekend and will have a time limit. Quizzes are expected to be an individual effort; consulting with other students in any form is prohibited and a breach of academic honesty. Correct response given during quizzes are awarded a point; incorrect answers are awarded zero points. Your two lowest scores for quizzes will be dropped at the end of the semester. The remaining quizzes will be worth 17% of your final grade.

Quizzes are expected to be individual efforts. No sharing of answers or questions is allowed; nor is consulting with other students.

Online homework

Homework for BMB 461 is delivered through SaplingLearning (www.saplinglearning.com). 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 covers 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 10% of your final grade. There will be a homework assignment due each week. Most of the time, the due date will be on Monday night with the exception of exam weeks, when the due date will be adjusted. It is your responsibility to check SaplingLearning regularly to find when each assignment is due. At the end of the semester, your lowest two homework scores will be dropped. Your average percentage correct on each of the remaining assignments unit will be used to determine what percentage you earn for your overall homework grade. Because we are dropping some of your homework scores, there will be no deadline extensions or make-up points offered for any reason. This includes, but is not limited to, illness, technical/computer issues, vacations, etc.

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, severe, and extended illness (> 7 days). 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 a few low scores dropped at the end of the semester to address occasional student absences (for any reason, including 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, 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.

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 more than one week prior to the exam 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 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. 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. 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.

For grief absences students must notify the Associate Dean or designee of their college of the need for a grief absence and must provide appropriate verification. 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. The policy on grief absence is described here: https://reg.msu.edu/ROInfo/Notices/GriefAbsence.aspx.

Make-up exams are administered at the instructor's convenience, typically within 48 hours of the original exam and may be scheduled without consulting students. Make-up exams typically consist of essay and calculation questions but instructors retain the right to offer multiple choice makeup exams or exams of mixed formats.

Grading Criteria

This grading scale shows the percentage you must earn at the end of BMB461 to guarantee a particular grade. 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 (see https://ombud.msu.edu/classroom-policies/). 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. 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.

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.

SaplingLearning 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. As such you may not post the recordings or other course materials online 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

When possible, audio-video recordings of the lectures will be provided on D2L. The purpose of these recordings is to allow review of lectures as you study. **BMB 461 is a synchrononus online course,** which expects regular attendance. Any recording is not a substitute for attending lectures and taking notes. Some lectures may not be available or may be of poor quality due to technical difficulties. In such cases, there may be no recording or a truncated recording posted and students should refer to the assigned textbook pages.

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/ .

Accommodations

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at

rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. Please present this form to Prof. Haudek at the start of the term and/or two weeks prior to the accommodation date. Requests received after this date may not be honored.

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 Responsibilites (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. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Web site: www.msu.edu.)

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. *Using multiple clickers to send in answers for classmates who are not present is considered academic dishonesty.*

SIRS

Michigan State University takes seriously the opinion of students in the evaluation of the effectiveness of instruction, and has implemented the SIRS (Student Instructional Rating System) process to gather student feedback. This course utilizes the “online SIRS” system, and you will receive an e-mail sometime during the last two weeks of class asking you to fill out the SIRS at your convenience. As a reminder to be sure to fill out the SIRS evaluation form, the final grade for this course will not be accessible on STUINFO during the week following the submission of grades for this course unless the SIRS online form has been filled out. You have the option on the online SIRS form to decline to participate in the evaluation of the course.

Date	Lec. #	Topic	Reading Pages	Instructor
11-Jan		Reading, Reviewing, Reflection		
13-Jan		Reading, Reviewing, Reflection		
15-Jan		Reading, Reviewing, Reflection		
18-Jan		**MLK Jr Day - No classes**		
20-Jan	1	Biochemistry & Water	45-58	Haudek
22-Jan	2	Buffers; Solving acid/base problems	58-70	Haudek
25-Jan	3	Amino acids and peptides	75-89	Haudek
27-Jan	4	Proteins: Primary structure	96-97; 104-109	Haudek
29-Jan	5	Proteins: Secondary structure	115-125	Haudek
1-Feb	6	Proteins: Three-dimensional structure	125-142	Haudek
3-Feb	7	Proteins: Structure and Folding and Purification	142-151	Haudek
5-Feb	8	Protein-ligand binding: Myoglobin and hemoglobin	157-174	Haudek
6-Feb&7-Feb		**Take home Exam I**		
8-Feb		**Online Exam I: Lectures 1-7**		
10-Feb	9	Enzyme catalysis and mechanism	187-198	Haudek
12-Feb	10	Enzyme catalysis and mechanism	213-225	Haudek
15-Feb	11	Enzyme kinetics: Introduction	198-206	Haudek
17-Feb	12	Enzyme kinetics: Inhibition & Regulation	206-213; 225-236	Haudek
19-Feb	13	Bioenergetics: Gibbs Free Energy	491-507	Haudek
22-Feb	14	Bioenergetics: High-energy compounds and phosphoryl transfer	507-517	Haudek
24-Feb	15	Bioenergetics: Redox reactions and energy balance	517-526	Haudek
26-Feb		**Online Exam II: Lectures 8-15**		
27-Feb&28-Feb		**Take home Exam II**		
1-Mar	16	Carbohydrates: I	241-252	Lunt
3-Mar		**Break day; No Wed classes**		
5-Mar	17	Carbohydrates: II	252-267	Lunt
8-Mar	18	Introduction to metabolism	491-494	Lunt
10-Mar	19	Glucose metabolism: Glycolysis	533-548	Lunt
12-Mar	20	Glucose metabolism: Glycolysis	548-553	Lunt
15-Mar	21	Glucose metabolism: Glycolysis and Fermentation	553-558	Lunt
17-Mar	22	Glucose metabolism: Gluconeogenesis	558-565	Lunt
19-Mar	23	Regulation of Glycolysis and Gluconeogenesis	575-600	Lunt
22-Mar	24	Glucose metabolism: Pentose phosphate pathway	565-570	Lunt
24-Mar	25	Pyruvate dehydrogenase complex	619-624	Lunt
26-Mar		**Online Exam III: Lectures 16-25**		
27-Mar&28-Mar		**Take home Exam III**		
29-Mar	26	Citric acid cycle	619-633	Hamberger
31-Mar	27	Citric acid cycle and glyoxylate cycle	633-642;800-802	Hamberger
2-Apr	28	Mitochondrial electron transport	711-728	Hamberger
5-Apr	29	Electron transport & oxidative phosphorylation	711-744	Hamberger
7-Apr	30	Oxidative phosphorylation	728-744	Hamberger
9-Apr	31	Glycogen metabolism	601-607	Hamberger
12-Apr	32	Regulation of glycogen metabolism	608-614	Hamberger
14-Apr	33	Photosynthesis: Light-driven ATP synthesis I	755-776	Hamberger
16-Apr	34	Photosynthesis: Light-driven ATP synthesis II	755-776	Hamberger
19-Apr	35	Photosynthesis: Carbon fixation I	780-800	Hamberger
21-Apr	36	Photosynthesis: Carbon fixation II	780-800	Hamberger
23-Apr		**Break day; No Fri classes**		
25-Apr - 27-Apr		**Take home Exam IV**		
29-Apr		**Online Exam IV: Lectures 26-36 (12:45- 2:45 p.m.)**		