

## Course syllabus and information

### Course information

Biochemistry and Molecular Biology 461 (BMB461) - Advanced Biochemistry I

11:30 a.m. -12:20 p.m.; MWF

101 Biochemistry

Spring semester 2020

### Contact Information

Instructor Information	Lectures	Office and Office Hours
<b>Dr. Kevin Haudek</b> Course coordinator Phone: 353-4377 <a href="mailto:haudekke@msu.edu">haudekke@msu.edu</a> (must include "BMB461" in subject line)	30-41	219 Biochemistry Mondays 1-2 p.m. Wednesdays 10-11 a.m. or by email appointment
Dr. Xiangshu Jin <a href="mailto:jinxiang@msu.edu">jinxiang@msu.edu</a> (must include "BMB461" in subject line)	1-18	107A Biochemistry Wednesdays 1-2:30 p.m. or by email appt.
Dr. Sophia Lunt <a href="mailto:sophia@msu.edu">sophia@msu.edu</a> (must include "BMB461" in subject line)	19-29	522A Biochemistry Mondays 3:30-4:30 p.m. Or by email appt.
Shaylynn Miller <a href="mailto:mill3075@msu.edu">mill3075@msu.edu</a> (must include "BMB461" in subject line)	Teaching Assistant	Reviews: Wednesdays and Thursdays At 5-6 p.m. Location: A148 Plant & Soil Sciences

### Course Materials

All course materials are used in BMB462 as well.

#### Required

- Nelson, D.L. and Cox, M.M. Lehninger's Principles of Biochemistry, 7<sup>th</sup> ed. (2017). W.H. Freeman, New York. 1172 pages.
- Access to Sapling Learning ([www.saplinglearning.com](http://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 remote

### *Optional*

The study guide associated with this 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.

## **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. 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	19%	January 31
Exam II	19%	February 21
Exam III	19%	March 27
Final exam (Exam IV + cumulative portion)	27%	April 30 – University Final Exam Schedule
In class clickers	4%	Used during every lecture with each day weighted equally; drop lowest 5 scores at end of semester
Online homework	8%	Weekly assignments; drop lowest 2 scores at end of semester
Clicker exercises	4%	Eight total 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 quiz and course survey at the beginning and 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 second and last week of class for these optional assessments. No other bonus opportunity or extra credit is offered in this course.

### *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 4 in. x 6 in. notecard to the exams with notes or

equations you deem important. 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. 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. Material expected to be memorized will be covered on the Clicker Check-up Exercises. 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 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 9/10<sup>th</sup> of a point for sending in any answer and an additional 1/10<sup>th</sup> 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. At the end of the semester your lowest five 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.

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. It is also your responsibility to check your clicker grade in D2L on a regular basis to verify that your points are being recorded correctly. It is your responsibility to bring your clicker to class each day and if you forget to bring your clicker or miss class for any reason, you will receive no points for that day. You must attend class and use your clicker to receive points: having a friend bring 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.

### *Clicker "Check-up" Exercises*

There will be eight clicker Check-up exercises during the semester, scheduled as indicated on the course schedule. These Check-up Exercises consists of several clicker questions give in succession at the beginning of a class period. In general, these assignments will be based on material you are expected to memorize, such as amino acid structures and abbreviations. The material in each Check-up exercise will be explicitly identified in class or in D2L prior to the exercise. Correct response given during Check-up exercises are awarded a point; incorrect answers are awarded zero points. Your score for each exercise is the total number of question you answered correctly. During the Check-up exercises you will not be allowed to use notes, books, calculators or talk with classmates or instructors. Check-up questions do not represent the types of questions you can expect on exams. Your two lowest scores for Check-up exercises will be dropped at the end of the semester. The remaining Check-up exercises will be worth 5% of your final grade.

### *Online homework*

Homework for BMB 461 is delivered through SaplingLearning ([www.saplinglearning.com](http://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 5% 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. 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). Students do not need to provide documentation in order to receive these dropped scores. In the case of an extended (>7 day) illness, 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 SaplingLearning system, there are no extensions on homework deadlines.

### *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 as soon as possible but no later than 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 (i.e. death of a loved one) 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.

### *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 address 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.

Grade	Percentage
4.0	≥ 82.0
3.5	≥ 76.0
3.0	≥ 69.0
2.5	≥ 62.0
2.0	≥ 54.0
1.5	≥ 45.0
1.0	≥ 38.0
0.0	< 38.0

## 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 not an online course**, and these recordings are not a substitute for attending lectures and taking notes. **You should not depend on these recordings**: some lectures may not be available or may be of poor quality due to technical difficulties. In such cases, there will be no recording posted. In addition, it is at the instructor's discretion to turn on the recording only after announcements regarding exams, etc. 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/> .

## 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 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. (See [Spartan Life: Student Handbook and Resource Guide](#) and/or the MSU Web site: [www.msu.edu](http://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
6-Jan	1	Aqueous solutions and pH	45-70	Jin
8-Jan	2	Buffers; Solving acid/base problems	45-70	Jin
10-Jan	3	Amino acids and peptides; <b>Clicker exercise #1</b>	75-89	Jin
13-Jan	4	Proteins: Primary structure & evolution	96-97; 104-109	Jin
15-Jan	5	Proteins: Secondary structure	115-125	Jin
17-Jan	6	Proteins: Three-dimensional structure; <b>Clicker exercise #2</b>	125-142	Jin
20-Jan		<b>MLK Jr Day - No classes</b>		
22-Jan	7	Proteins: Structure and Folding	142-151	Jin
24-Jan	8	Protein purification	89-96	Jin
27-Jan	9	Protein-ligand binding: Myoglobin and hemoglobin	157-174	Jin
29-Jan	10	Enzyme catalysis and mechanism	187-198	Jin
30-Jan	Optional Q and A by Instructor: 4-5 p.m. Location TBA			
31-Jan	<b>Exam I: Lectures 1-9</b>			
3-Feb	11	Enzyme catalysis and mechanism	213-225	Jin
5-Feb	12	Enzyme kinetics: Introduction	198-206	Jin
7-Feb	13	Enzyme kinetics: Inhibition	206-213	Jin
10-Feb	14	Enzyme kinetics: Regulation and allostery ; <b>Clicker exercise #3</b>	225-236	Jin
12-Feb	15	Enzymology and medicine	822-823	Jin
14-Feb	16	Bioenergetics: Principles	491-507	Jin
17-Feb	17	Bioenergetics: High-energy compounds and phosphoryl transfer; <b>CI Exer #4</b>	507-517	Jin
19-Feb	18	Bioenergetics: Redox reactions and energy balance	517-526	Jin
20-Feb	Optional Q and A by Instructor: 4-5 p.m. Location TBA			
21-Feb	<b>Exam II: Lectures 10-18</b>			
24-Feb	19	Carbohydrates: I	241-252	Lunt
26-Feb	20	Carbohydrates: II	252-267	Lunt
28-Feb	21	Introduction to metabolism	491-494	Lunt
3/2-3/6		<b>Spring Break; No classes</b>		
9-Mar	22	Glucose metabolism: Glycolysis	533-548	Lunt
11-Mar	23	Glucose metabolism: Glycolysis	548-553	Lunt
13-Mar	24	Glucose metabolism: Glycolysis and Fermentation	553-558	Lunt
16-Mar	25	Glucose metabolism: Gluconeogenesis; <b>Clicker exercise #5</b>	558-565	Lunt
18-Mar	26	Regulation of Glycolysis and Gluconeogenesis	575-600	Lunt
20-Mar	27	Glucose metabolism: Pentose phosphate pathway	565-570	Lunt
23-Mar	28	Glucose metabolism: Pentose phosphate pathway; <b>Clicker exercise #6</b>	565-570	Lunt
25-Mar	29	Pyruvate dehydrogenase complex	619-624	Lunt
27-Mar	<b>Exam III: Lectures 19-29</b>			
30-Mar	30	Citric acid cycle	619-633	Haudek
1-Apr	31	Citric acid cycle and glyoxylate cycle	633-642;800-802	Haudek
3-Apr	32	Mitochondrial electron transport I	711-728	Haudek
6-Apr	33	Mitochondrial electron transport II	711-728	Haudek
8-Apr	34	Oxidative phosphorylation I; <b>Clicker exercise #7</b>	728-744	Haudek
10-Apr	35	Oxidative phosphorylation II	728-744	Haudek
13-Apr	36	Glycogen metabolism	601-607	Haudek
15-Apr	37	Regulation of glycogen metabolism	608-614	Haudek
17-Apr	38	Photosynthesis: Light-driven ATP synthesis I	755-776	Haudek
20-Apr	39	Photosynthesis: Light-driven ATP synthesis II	755-776	Haudek
22-Apr	40	Photosynthesis: Carbon fixation I; <b>Clicker exercise #8</b>	780-800	Haudek
24-Apr	41	Photosynthesis: Carbon fixation II	780-800	Haudek
	Optional Q and A by Instructor: TBA			
30-Apr	<b>Exam IV: Lectures 30-41 (100 pts) + Lectures 1-41 (50 pts); 12:45 p.m. -2:45 p.m. in 101 Biochemistry</b>			