

Course syllabus and information

Course information

Biochemistry and Molecular Biology 462 (BMB462) - Advanced Biochemistry II

9:10 am – 10:00 am; MWF

S107 S. Kedzie Hall

Spring semester 2020

Contact Information

| Instructor Information | Lectures | Office and Office Hours |
|--|-------------------------|--|
| Dr. Kevin Haudek Course coordinator Phone: 353-4377 haudekke@msu.edu (must include BMB462 in subject line) | 10-17 | 219 Biochemistry Office hours: Mondays 1-2 p.m. Wednesdays 10-11 a.m. or by email appointment |
| Dr. Lee Kroos kroos@msu.edu (must include BMB462 in subject line) | 28-41 | 422A Biochemistry Office hours by email appointment |
| Dr. Robert Quinn quinnrob@msu.edu (must include BMB462 in subject line) | 18-27 | 116B Biochemistry Office hours by email appointment |
| Dr. Carol Wilkins mindockc@msu.edu (must include "BMB462" in subject line) | 1-9 | 502B Biochemistry Office hours: Mondays, Wednesday and Fridays 10 -11:30 a.m. or by email appt. |
| Dr. Nan Jiang jiangn11@msu.edu (must include BMB462 in subject line) | Postdoctoral instructor | Review Sessions: Tues & Thurs 5-6 p.m. Location: 111 Biochemistry |

Course Materials

Required

- Nelson, D.L. and Cox, M.M. Lehninger Principles of Biochemistry, 7th ed. (2017). W.H. Freeman, New York. 1172 pages. *Paper or electronic versions are acceptable.*
- 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.

- i>clicker remote

The following book is required for the course, ***but free access to the e-book will be provided for the duration of the course.*** Information for accessing the e-text will be provided at the appropriate time.

- Wilkins, Carol A. Understanding Biochemical Pathways: A Pattern-Recognition Approach., 1st ed (2018) Cognella, Inc. 167 pages.

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 462 is the second 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 462 is a three credit course that continues the study of metabolism begun in BMB 461 and then examines the transmission and expression of the genetic material in bacterial and eukaryotic cells. At the conclusion of this course, successful students will be able to:

- Explain the roles of common membrane components and predict how the membrane will change based on changes in these components.
- Explain how signals are transduced in cells, categorize specific parts of signal transduction cascades based on general signal transduction principles, and predict how changes in a signaling system will alter the signaling process.
- Discuss the processes used to metabolize lipids, amino acids, and nucleotides, explain the function of individual reactions in these processes, and connect these processes with central metabolic pathways.
- Explain the mechanisms used to regulate cellular metabolism and predict how changes in these regulatory mechanisms will impact cellular metabolism.
- Explain the roles of nucleotides and nucleic acids in cells based on the structures of these molecules and predict how changes in these structure alter their functions.
- Explain how biomolecules store and transfer information and how this information is recognized and used by cells.
- Diagram the processes used to synthesize, repair, and recombine DNA and compare the structure and function of key proteins involved in these processes.
- Diagram the processes used to create various cellular RNAs and compare the structure and function of key proteins involved in these processes with proteins used to synthesize, repair, and recombine DNA.
- Diagram the processes needed to synthesize and target proteins and discuss the structure and function of key molecular machines involved in these processes.
- Explain how gene expression is regulated using classic examples of gene regulation as models, categorize specific examples of regulation by general regulatory mechanism, and predict how changes in a regulatory system will alter gene expression.
- Design a basic DNA cloning experiment incorporating the general processes used in cloning DNA.

Assessments

Your grade in BMB 462 will be determined by your performance on the following assessments and weighted by the percentage indicated:

| Assessment | Weight | Date or information |
|----------------------------|--------|---|
| Exam I | 18% | January 31 |
| Exam II | 16% | February 21 |
| Exam III | 21% | March 25 |
| Exam IV (Final exam) | 29% | April 28 per University Final Exam schedule. You will have 75 minutes to complete the exam. |
| In class clickers | 4% | Used during every lecture; each day weighted equally. Drop lowest 5 scores at end of semester |
| Clicker check-up exercises | 4% | Eight total over semester as scheduled; drop two lowest scores at end of semester |
| Online homework | 8% | Weekly assignments; 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 and/or course 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 any optional opportunities. 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 *may be allowed* on exams. Policies for each exam will be clarified by the instructor in the lecture(s) immediately before the exam and/or via email. Calculators with Wi-Fi capabilities, cellphones, and other Wi-Fi devices *will not be allowed* during any exam. 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. 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 9/10th of a point for sending in any answer and an additional 1/10th 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 4% 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, as announced in class. 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 molecular structures and abbreviations, and/or on material you are expected to read and learn prior to lecture. The material in each Check-up exercise will be explicitly identified in class or in D2L prior to the exercise. Correct responses 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 questions 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 4% of your final grade.

Online homework

Homework for BMB 462 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 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 8% of your final grade. There will be a homework assignment due each week. Most of the time, the due date will be on Sunday 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 these 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 academically 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 makeup 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). 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 in some circumstances.

Grading Criteria

This grading scale shows the percentage you must earn at the end of BMB462 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 BMB462 with an H-option provided they obtain a grade of 3.0 or higher in the course. The honors option consists of finding research articles and writing a term paper that address an unsolved biochemical question related to a topic covered in the course. 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. 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.

| Grade | Percentage |
|-------|------------|
| 4.0 | ≥ 87.0 |
| 3.5 | ≥ 78.0 |
| 3.0 | ≥ 69.0 |
| 2.5 | ≥ 60.0 |
| 2.0 | ≥ 52.0 |
| 1.5 | ≥ 45.0 |
| 1.0 | ≥ 40.0 |
| 0.0 | < 39.9 |

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.

Sapling Learning 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 Notes

Lecture notes will be posted on D2L in advance of the lectures. These notes contain most figures discussed during lecture and are designed to aid your note taking during lecture and while reading the text. They are not a substitute for reading the textbook. It is highly recommended that you print these lecture notes and read the assigned reading in the text prior to lecture, taking notes while you read. Then bring your notes to lectures to help fill in areas that were confusing to you when you first read them in the text.

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 462 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.)

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 in Nelson & Cox | Instructor |
|---------|---|---|-------------------------------|------------|
| 6-Jan | 1 | Course Introduction and Fatty Acids | 361-374 | Wilkins |
| 8-Jan | 2 | Lipid Structures and Properties | 374-376; 381-384 | Wilkins |
| 10-Jan | 3 | Membrane Structure and Properties | 387-405 | Wilkins |
| 13-Jan | 4 | Membrane Structure and Properties | 387-405 | Wilkins |
| 15-Jan | 5 | Membrane Transport | 405-431 | Wilkins |
| 17-Jan | 6 | Lipid Catabolism | 649-670 | Wilkins |
| 20-Jan | | MLK Jr Day - No Classes | | |
| 22-Jan | 7 | Lipid Catabolism | 649-670 | Wilkins |
| 24-Jan | 8 | Fatty Acid Anabolism | 811-826 | Wilkins |
| 27-Jan | 9 | Fatty Acid Anabolism | 811-826 | Wilkins |
| 29-Jan | 10 | Glycerolipid and Sphingolipid Anabolism | 826-836 | Haudek |
| 29-Jan | Optional Q and A by Instructor: 5 p.m. Location: TBA | | | |
| 31-Jan | Exam I: Lectures 1-9 | | | |
| 3-Feb | 11 | Cholesterol Metabolism | 837-854 | Haudek |
| 5-Feb | 12 | Amino Acid Metabolism | 675-705 | Haudek |
| 7-Feb | 13 | Amino Acid Metabolism | 859-872 ; 880-887 | Haudek |
| 10-Feb | 14 | Signaling | 437-466; 467-475 | Haudek |
| 12-Feb | 15 | Signaling | 437-466; 467-475 | Haudek |
| 14-Feb | 16 | Metabolic Integration | 907-939 | Haudek |
| 17-Feb | 17 | Metabolic Integration | 907-939 | Haudek |
| 19-Feb | 18 | Nucleotide Chemistry and Metabolism | 279-285; 310-313; 888-902 | Quinn |
| 19-Feb | Optional Q and A by Instructor: 5 p.m. Location: TBA | | | |
| 21-Feb | Exam II: Lectures 10-17 | | | |
| 24-Feb | 19 | Nucleotide Chemistry and Metabolism | 279-285; 310-313; 888-902 | Quinn |
| 26-Feb | 20 | DNA Structure | 29-39; 285-299; 955-956 | Quinn |
| 28-Feb | 21 | DNA and Chromosome Structure | 29-39; 285-299; 955-956 | Quinn |
| 3/2-3/6 | | Spring Break; No classes | | |
| 9-Mar | 22 | Chromosome Structure | 957-981 | Quinn |
| 11-Mar | 23 | DNA Replication | 987-1005 | Quinn |
| 13-Mar | 24 | DNA Replication | 987-1005 | Quinn |
| 16-Mar | 25 | DNA Replication | 987-1005; 1063-1074 | Quinn |
| 18-Mar | 26 | DNA Repair & Recombination | 1005-1016; 297-300 | Quinn |
| 20-Mar | 27 | DNA Repair & Recombination | 1016-1031 | Quinn |
| 23-Mar | 28 | RNA Structure & Function | 34-35; 290-295; 955-956 | Kroos |
| 23-Mar | Optional Q and A by Instructor: 4:30 p.m. Location: TBA | | | |
| 25-Mar | Exam III: Lectures 18-27 | | | |
| 27-Mar | 29 | Transcription | 1035-1039 | Kroos |
| 30-Mar | 30 | Transcription | 1039-1042; 1133-1134 | Kroos |
| 1-Apr | 31 | Transcription | 1042-1047 | Kroos |
| 3-Apr | 32 | RNA Processing | 1047-1063; 1070-1074 | Kroos |
| 6-Apr | 33 | RNA Processing | 1047-1063 | Kroos |
| 8-Apr | 34 | Translation | 1077-1085 | Kroos |
| 10-Apr | 35 | Translation | 1088-1101 | Kroos |
| 13-Apr | 36 | Translation | 1101-1113 | Kroos |
| 15-Apr | 37 | Protein Targeting and Degradation | 1114-1123 | Kroos |
| 17-Apr | 38 | Regulation of Gene Expression | 1127-1138 | Kroos |
| 20-Apr | 39 | Regulation of Gene Expression | 1138-1147 | Kroos |
| 22-Apr | 40 | Regulation of Gene Expression | 1147-1160 | Kroos |
| 24-Apr | 41 | DNA Cloning | 319-335 | Kroos |
| 27-Apr | Optional Q and A by Instructor: 5 p.m. Location: TBA | | | |
| 28-Apr | Exam IV: Lectures 28-41 12:45-2:00 p.m. | | | |