BIOCHEM 508 - 001 General Biochemistry II

Credits: 3
This class meets for three 50-minute class period each week over the ~15 week spring semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for about 2 hours out of the classroom for every class period. The syllabus includes additional information about meeting times and expectations for student work.

Canvas Course URL: https://canvas.wisc.edu/courses/75167

Course Designations and Attributes: Level – Advanced, **Breadth** - Physical Sciences, **L&S Credit Type** – C, Honors available

Meeting Time and Location
MWF 9:55-10:45 am Room 1125 DeLuca Biochemistry Building

Instructional Mode: Lecture

INSTRUCTORS AND TEACHING ASSISTANTS

Dr. Timothy Rhoads, trclass@biochem.wisc.edu
Office hours: Room 1104 DeLuca Biochemistry Building, Monday 11am-noon, Wednesday 11 am-noon or by appointment

Prof. Sebastian Bednarek, sybednar@wisc.edu
Office hours: Rm 215C HF DeLuca Laboratories, Tuesday, 11:30 am–12:30 pm, Wednesday, 11:00 am–12 noon or by appointment

Graduate Assistants:
Elizabeth Duchow, educhow@wisc.edu
Discussion Section: TBD
Office hours: TBD

Aayushi Jain, jain45@wisc.edu
Discussion Section: TBD
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Miguel Angel Osorio Garcia, osoriogarcia@wisc.edu
Discussion Section: TBD
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Course Description:
Biosynthesis of biological molecules, signal transduction mechanisms, chemistry and metabolism of nucleic acids, protein synthesis, and molecular and cellular biology. Honors credits available with consent of instructor.

Requisites: Biochem 507

LEARNING OUTCOMES

The main focus of the first half of Biochem 508 is on biochemical information pathways that transmit genetic information into functional proteins and the role of Molecular Machines in these processes. In lectures 1-10 we will discuss the molecular mechanisms that replicate genetic information from one generation to the next with high fidelity and how specific elements of DNA are transcribed into RNA. Lectures 11-20 will address the biochemical reactions involved in the translation of genetic information into the amino acid sequences of proteins, and the mechanisms required for the maturation of nascent polypeptides into fully functional proteins. Major themes that we will cover are the energy costs and role of molecular machines in the maintenance and regulation of the flow of genetic information into proteins and how defects in these processes manifest in disease.

The second half of the course will focus on biosynthesis of metabolic intermediates and the integration and coordination of metabolism at the tissue and organismal level. In lectures 21-29, we will cover several fundamental biosynthetic processes, including those for lipids, amino acids, and nucleotides, as well as some of the methods and techniques used to study metabolism. Lectures 30-37 will cover the signaling pathways and mechanisms that control metabolic integration throughout the body, including hormone signaling, the insulin receptor, and ion channels. Major themes that we will cover are how key biosynthetic processes are regulated and the consequences of this regulation at the individual reaction, cell, tissue, and whole body levels.

Office Hours and Discussion Sections

Your instructors will be available to help you during office hours and discussion sections, listed above and on the Canvas course Learn@UW homepage, or by appointment. During the Discussion sessions, the course graduate assistants will address questions related to material presented in class and go over any problems you have difficulty with. **Attendance** is not required but **is very strongly recommended**. You are free to attend any session.

EXAMS AND GRADING

Each of the three midterm exams will count 100 points and will be held during class time (see syllabus for schedule of exams). The final exam will be worth 150 points (~100 points from the last set of lectures and ~50 points of cumulative material). 30 additional points will be awarded based on the completion of 6 online survey/quizzes (survey 1.5 pts, quizzes 2.5 pts each), participation in 4 In Class Discussion/Exercises (2 pts each) and 4 Peerwise exercises (2 pts each). The online quizzes and Peerwise exercises must be completed by the listed deadlines in the course schedule to receive credit. Your best two out of the three hour exams, your quiz/In Class/Peerwise Exercise points, and your grade on the final will be used to determine your grade in the course. If you miss an hour exam, your final grade will be based on the other two; make-up hour exams will

not be given. An alternative time for the final will be arranged for those with three exams within 24 hours as per university policy.

We will do our best to grade the midterms fairly and accurately within a few days of the in class exam. If you believe an error was made in grading, you must submit your test for a regrade with a written explanation of the grading issue, within one week after the tests are returned in class. Please give your exam for regrading to either the instructors or to the graduate assistants. Final exams will not be subjected to regrading out of fairness to those students who have left town following the end of the semester.

Letter grades for the course will only be assigned after all possible total points for the course have been tabulated. We (the instructors and graduate assistants) will not discuss with you your expected letter grades during the semester. However, our policy is to guarantee for those scoring ≥90% of the total 380 points in the class, a letter grade of "A".

Some semesters, we end up with median scores on the three midterm exams that differ by ten points or more. If there is a wide variation in median scores this semester, we may decide to normalize your scores on all three exams to the same median, making each exam equally valuable in determining your final grade. Although we offer you the option of discarding your lowest score, we do not recommend skipping the third exam simply because you have two good scores already. Doing so can work against you when we normalize before deciding which exam to drop for each student.

In the Course Content of this website, each exam module has a submodule of Study Materials. Suggested supplementary reading will be posted here. To help focus your preparation for exams, we have provided study guides for each lecture which include a list of learning objectives and terms you should know with each lecture in that module. We have also provided last year's exams. We also encourage you to use the discussion board to ask and answer questions other students have asked. The graduate assistants and professors will monitor these discussions and answer questions. However, we often find that students in this class do a terrific job of answering each other's questions, too, and we encourage you to participate in these exchanges.

Survey/Quizzes and In Class Discussion/Exercises

There will be 1 survey (1.5pts) to determine discussion section times and 5 Quizzes (2.5 pts each) related to material covered in lecture and supplemental videos. The survey and quizzes will be online and need to be completed by the deadline indicated in the course schedule. In addition, there will be 4 in class discussion/exercises. The purpose of these class periods is to integrate concepts and to provide opportunities to work through and discuss problems related to material from the lectures and supplemental videos. To receive participation points (2 pts/class), students will work individually as well as in groups during the in class discussion/ exercises on problem sets and report their answers using TopHat (see below).

Peerwise Exercises

There will be a total of four Peerwise exercises, corresponding to the four parts of the course (lectures 1-10 and exam 1, lectures 11-20 and exam 2, lectures 21-29 and exam 3, lectures 30-37 and the final exam). Log into the Peerwise "Biochemistry 508_spring 2018" by clicking on the

link at the top of this page, or use the following URL: https://peerwise.cs.auckland.ac.nz/course/main.php. You will need the Peerwise course ID# 16486 and your student ID number to get onto the site and set up your *UW student username* and password.

Each exercise will be worth 2 participation points. For each Peerwise exercise, you will compose a multiple choice question with at least 4 answers; only one answer should be correct. You must write an explanation for why the particular answer actually is correct. Once you have posted your question, you may answer or critique the questions of others, and may respond to critiques of your own question (improving it). You will earn one of the 2 points available when you post your question with the appropriate tag shown below. You will earn the second point when you reach an answer score of 200, achieved by answering the questions of others. The question you write should be on a topic from the assigned lectures from the table below. You may write and post more than one question if you choose for each exercise, but only one will earn points and that will be the one you add the tag to (it should be your favorite). For each module, a group of students will need to read and prepare questions from assigned lectures that are given after the due dates. This will require reading ahead and using the posted online lectures. To make it fair, the assignments for the last lectures in each module are juggled so that each group of students is disadvantaged by this equally over the course of the semester. To receive the first point the question must be posted on the due date (before class; 9:50am). You may answer and critique the questions of others anytime up to the date of the relevant exam, and the cutoff to add to your answer score for that second point will be before 9:50am on the date of each exam. Each exam will feature one of the questions posted by the class.

Assignment Schedule for Peerwise Exercises				
Due dates	**Module1 Feb 9**	**Module2 Mar7**	**Module3 Apr9**	**Module4 Apr30**
Last name beginning with letter	**Choose Quest #1 Topic from:**	**Choose Quest #2 Topic from:**	**Choose Quest #3 Topic from:**	**Choose Quest #4 Topic from:**
A-C	**Lectures 1, 2**	**Lectures 11, 12**	**Lectures 21, 22**	**Lectures 30, 31**
D-J	**Lectures 3, 4**	**Lectures 13, 14**	**Lectures 23, 24**	**Lectures 32, 33**
K-M	**Lectures 6, 7**	**Lectures 16,17**	**Lectures 25-27**	**Lectures 34, 35**
N-Z	**Lectures 8, 9**	**Lectures 18, 19**	**Lectures 28, 29**	**Lectures 36, 37**

TEXTBOOK, SOFTWARE & OTHER COURSE MATERIALS:

Textbook

In this course, examination questions are derived primarily from the lecture material. We will assign readings and problem sets from *Lehninger Principles of Biochemistry* by Nelson and Cox (W.H. Freeman, 5th-7th editions). We will also point you to relevant practice problems from The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry by Osgood and Ocorr (if you purchase one, be sure you get the one that goes with the 5th - 7th editions). If you have access to another recent textbook of biochemistry and want to use it instead, we will be happy to help you locate the sections that correspond to each of the lectures shown on the syllabus. A few copies of Lehninger and several other textbooks are on reserve at the Steenbock Library, as well as a few copies of the study guide.

Study Materials

For each exam, we will provide a list of suggested readings for the lectures and goals to know. In addition, we will suggest problems, mostly taken from the end-of-chapter problems in the textbook and from the "Absolute, Ultimate Study Guide" to help you prepare for the exam. You will find the reading assignments and suggested problem assignments in the *Study Materials* area under each exam module in the Course Content. Note that the problems in the text have brief answers in an appendix; expanded solutions are in the last half of the "Absolute Ultimate Study Guide." If you still have trouble understanding the solution to a problem, please contact a graduate assistant, who will go over the problem in an office hour or discussion section. Although the problems will not be collected or graded, it will be to your great advantage to work them as soon as possible after the relevant lecture. In addition to working the assigned problems, you may find it helpful to complete some of the other exercises in the Study Guide. For more tips on how to succeed in 508, please see "How to Do Well". In addition, supplementary reading material for the course will be posted in the course content *Study Materials* area.

Top Hat

We will be using the Top Hat (www.tophat.com) classroom response system in class discussion/exercises. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. You can visit the Top Hat Overview (https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system. For additional information see "Using Top Hat" for additional information on getting started and using Top Hat. You should have received an email invitation to register for Top Hat. However, if didn't receive an invite email, you can register by simply visiting our TopHat course website: https://app.tophat.com/e/357544. The TopHat Biochemistry 508_spring 2018 **course join code is 357544**.

Top Hat will require a paid subscription. UW-Madison students receive reduced subscription prices for Top Hat (https://learnuw.wisc.edu/toolbox/tophat.html): One semester (4 months) - $16 (This option cannot be upgraded to a year.); One year (12 months) - $20; Lifetime (5 years) - $54.

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their Support Team directly by way of email (support@tophat.com), the in app support button, or by calling 1-888-663-5491.

Lecture Videos

We will be recording all of our lectures and making them available to you via Learn@UW. Please note that we do not consider the lecture videos a substitute for attending lectures. The lecture recordings are meant as a study aid. Please be aware of the possibility that - due to technical or human error - a lecture may not get recorded. It is also possible that material may be presented or discussed during a lecture that is not adequately recorded, so we strongly encourage you to attend all lectures.

OTHER COURSE INFORMATION

Honors credit

Biochemistry 508 can be taken for honors credit. To receive honors credit for Biochem 508, you must have chosen the honors option when you registered for 508, complete the Honors-specific extra assignments (for details see the Biochemistry 508 Honors document on the course website) and receive a grade of "B" of better in the course.

RULES, RIGHTS & RESPONSIBILITIES

- See the Guide's to Rules, Rights and Responsibilities

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA." http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." https://diversity.wisc.edu/

Course schedule for Biochem 508: Spring 2018

Part I: Information Pathways

Wed	Jan 24	Instructional overview	Bednarek
Fri	Jan 26	1. Nucleic acids; topology and packaging	Bednarek
		Discussion section time survey due (9:50am deadline)	
Mon	Jan 29	2. DNA metabolism I	Bednarek
Wed	Jan 31	3. DNA metabolism II	Bednarek
Fri	Feb 2	4. DNA metabolism III	Bednarek
Mon	Feb 5	5. In Class Discussion/Exercise: Nucleic Acid Technology I	Bednarek
		Online Quiz 1 due before class period (9:50am deadline)	
Wed	Feb 7	6. Regulation of gene expression I	Bednarek
Fri	Feb 9	7. Regulation of gene expression II	Bednarek
		Peerwise Quest. #1 due before class period (9:50am deadline)	
Mon	Feb 12	8. Regulation of gene expression III	Bednarek
Wed	Feb 14	9. RNA Processing	Bednarek
Fri	Feb 16	10. In Class Discussion/Exercise: Nucleic Acid Technology II	Bednarek
		Online Quiz 2 due before class period (9:50am deadline)	
Mon	**Feb 19**	**Exam 1 covers lectures 1-10 (worth 100 points)**	

Part II: Protein Synthesis and Targeting

Wed	Feb 21	11. Protein synthesis I: Ribosomes/tRNA	Bednarek
Fri	Feb 23	12. Protein synthesis II: Translation Initiation/Regulation	Bednarek
Mon	Feb 26	13. Protein synthesis III: energetics and special aspects	Bednarek
Wed	Feb 28	14. Molecular chaperones	Bednarek
Fri	Mar 2	15. In Class Discussion: Protein Synthesis	Bednarek
		Online Quiz 3 due before class period (9:50am deadline)	
Mon	Mar 5	16. Secretory Protein Synthesis	Bednarek
Wed	Mar 7	17. Vesicular transport	Bednarek
		Peerwise Quest. #2 due before class period (9:50am deadline)	
Fri	Mar 9	18. Nuclear and Mitochondria protein import	Bednarek
Mon	Mar 12	19. Protein degradation	Bednarek
Wed	Mar 14	20. In Class Discussion: Collagen synthesis and trafficking	Bednarek
		Online Quiz 4 due before class period (9:50am deadline)	

Part III: Biosynthesis

Fri	Mar 16	21. Review of metabolism & the pentose phosphate shunt pathway	Rhoads
Mon	**Mar 19**	**Exam 2 covers lectures 11-20 (worth 100 points)**	
Wed	Mar 21	22. Photosynthetic carbon fixation	Rhoads
Fri	Mar 23	23. Biosynthesis of fatty acids and eicosanoids	Rhoads

Mon	***Mar 26***	***Spring Break***
Wed	***Mar 28***	***Spring Break***
Fri	***Mar 30***	***Spring Break***

Mon	Apr 2	24. Biosynthesis of triacylglycerol and phospholipids	Rhoads
Wed	Apr 4	25. Elucidating lipid metabolism: classic and modern techniques	Rhoads
Fri	Apr 6	26. Biosynthesis of sterols and isoprenoids	Rhoads
Mon	Apr 9	27. Cytochrome P-450 and biosynthesis	Rhoads
		Peerwise Quest. #3 due before class period (9:50am deadline)	
Wed	Apr 11	28. Nitrogen fixation and amino acid biosynthesis	Rhoads
Fri	Apr 13	29. Compounds formed from AAs/ Nucleotide biosynthesis	Rhoads

Mon Apr 16 Exam 3 covers lectures 21-29 (worth 100 points)

Part IV: Biosignaling and the Integration of Metabolism

Wed	Apr 18	30. Tissue specialization in metabolism	Rhoads
Fri	Apr 20	31. Hormones in the integration of metabolism	Rhoads
Mon	Apr 23	32. Insulin receptor: A receptor tyrosine kinase	Rhoads
Wed	Arp 25	33. β-Adrenergic receptor, cAMP, and protein kinase A	Rhoads
Fri	Arp 27	34. Ion channels and signaling through calcium	Rhoads
Mon	Apr 30	35. Integration of metabolism: Regulation of body weight	Rhoads
		Peerwise Quest. #3 due before class period (9:50am deadline)	
Wed	May 2	36. Applied biosignaling: Vision and olfaction	Rhoads
Fri	May 4	37. Applied biosignaling: Regulation of cell division	Rhoads
		Online Assignment/Quiz for Cancer Metabolism video lecture due by 5pm	

Fri May 11 Final (worth 150 points; cannot be dropped)
~50 points Cumulative from Lectures 1-29
~100 points from lectures 30-37
10:05 am–12:05 pm; Room TBA