

Biochemistry 384i – Foundations in Biochemistry

UA Online and iCourse – Winter 2018

Description of the Course

Fundamental concepts in physical biochemistry (energy conversion, water, and membranes), protein structure/function, methods in protein biochemistry, enzyme mechanisms, protein-mediated cell signaling, and fundamental energy conversion pathways. This course is designed for undergraduate students with majors in any of the Life Sciences and other pre-professional health science students, many of whom are working towards a Biochemistry minor. Bioc 384 is the companion course to Bioc 385 “Metabolic Biochemistry.” Note that since the same textbook is used for both courses, it is possible to take them out of sequence if necessary by referring to material in the book.

Bioc 384/385 Course Prerequisites: MCB 181R, CHEM 152, and CHEM 241A or equivalents.

Course Objectives:

Students will be able to:

1. Demonstrate proficiency with vocabulary used in biochemistry.
2. Describe energy conversion processes and the role of membranes in biochemistry.
3. Describe the structure of nucleic acids and core methods in nucleic acid and protein biochemistry.
4. Explain the principles of oxygen transport and protein transport across biological membranes.
5. Describe the catalytic properties, kinetics, and allosteric regulation of metabolic enzymes.
6. Understand the key differences between four major signal transduction pathways in eukaryotes.
7. Describe the enzymatic reactions and bioenergetics of glucose metabolism.

Course web site on D2L

Information about lectures, homework, exams, grades, supplemental reading and all other aspects of this course will be available on the D2L course web site. The information contained in this course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructors. Any changes will be announced on the course web site. It is the responsibility of each student to check the course web site at least weekly.

Instructor

Dr. Miesfeld: rlm@email.arizona.edu

Course Materials

Required Textbook: **Miesfeld & McEvoy *Biochemistry*** is made available as an E-book with all e-media ancillaries to all students at a discount (~\$95) after an “opt out” deadline has passed – *you must actively choose to opt out by logging onto UAAccess Student, select booklist, and follow prompts*. If you already have the 360 day E-book license you are good to go. If you have a print copy, you will still need the SmartWork online homework, which is accessed through the D2L website and is free for the 2018-19 academic year. Note that this textbook was chosen because it was specifically developed for non-biochemistry majors with an interest in the health professions or environmental studies in the life sciences. Any royalties in excess of \$500 that are received by RLM from textbook sales to UA students in this class will be donated to the College of Science Galileo Circle for the awarding of undergraduate student scholarships: <https://cos.arizona.edu/content/galileo-circle-scholars>

Accessibility and Accommodations

It is the University’s goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations. Contact DRC and instructions are given at the following website:

<http://drc.arizona.edu>

University Policy against Discrimination and Harassment

The University has policies against discrimination and harassment. The policies are outlined on the website. <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Student Assessment

The exams will be monitored by Examity <http://odltools.arizona.edu/examity-students> using Level 3, which is live proctoring with required pre-scheduled exam times. The special instructions are:

- 1) handheld or online **calculator is allowed**
- 2) **drink on desk is allowed**
- 3) student **may use a small whiteboard for scratch notes** and calculations, but it *must be erased* at the end of the exam
- 4) students **may have a copy of the first page of the exam** with formulas and diagrams but *must not have any writing on it in front or back, nor can anything be written on it during the exam*
- 5) the student **MUST have a handheld mirror with them at the beginning of the exam** and use it to reflect the laptop/computer screen and keyboard during authentication to ensure there are no notes attached to the computer.

Examity live proctoring for all exams is paid for by the required \$50 online fee. There will be **4 Midterm Exams** worth 150 points each and a **Cumulative Final Exam** worth 150 pts. The Final Exam is based on a large set of multiple choice review questions taken from the Norton Publishing Test Bank that will be posted on the D2L website in the Quiz menu with unlimited attempts and answers provided. These review questions will be available as a study guide *in advance* of the Final Exam. Only four exam scores will be used in the final grade, giving total exam points of 600 pts. There will be **12 Homework Assignments** (access through D2L Quizzes tab) worth 10 pts each to give a total of 120 pts. In addition, there will be **24 SmartWork (SW) Quizzes** (access through SW link on Content tab) each worth 5 points for a total of 120 pts. There are **12 Discussion Assignments** worth 10 pts each to give a total of 120 pts. The format for the Discussions consists of answering all of the instructor questions *in your own words* (**not copying answers** from another student or an internet resource), pose a follow-up question to one of the instructor questions, and then choose a peer's follow-up questions and describe why you think it is a good question. This is a **total of 960 pts** in the course. **Extra credit** of up to 35 pts. is available.

Guaranteed grade cutoffs for total points (some adjustment downward in the cutoffs may occur):

864 total pts. (90%) for an "A" grade

768 total pts. (80%) for a "B" grade

624 total pts. (65%) for a "C" grade

480 total pts. (50%) for a "D" grade

<480 total pts. (<50 %) for a "E" grade

A grade of Incomplete can only be obtained at the end of the semester, when all but a minor portion of the course work has been satisfactorily completed. Consult the UA General Catalog for information.

Make-Up Exam Policy

Students who know in advance that they will be unable to take an examination must contact the instructor to *request* an alternate time to take the exam. In the case of an emergency during the window time of the exam, the student must contact the instructor by email or phone *before* the exam begins. Proof of the problem, such as a note from a physician, is required in order to take a make-up exam.

University Code of Conduct and the Code of Academic Integrity

The Dean of Students' office provides you with a link to a comprehensive index of important University policies and procedures: <http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>

All students in this class have to follow the University Code of Conduct and the Code of Academic Integrity. Any violations will be reported to the Dean of Student's Office.

Readings in the Biochemical Sciences - Extra Credit (EC1 and EC2) Opportunity

Outside reading of two biochemistry papers found under the *Assignments tab in D2L* are worth *15 points each* in the form of bonus points for 30 pts. extra credit. Scoring is as follows: 15 pts. for a paper that is well-written and answers all questions fully, 12 pts. for basic answers but with some misconceptions, 8 pts for incomplete answers, 4 pts for minimal effort and/or failure to demonstrate understanding, and 0 pts. for exceeding threshold match using TurnItIn.com plagiarism software. These ~2 page EC papers are to be turned in **by 11:00pm on the day of the deadline**. *No assignments will be accepted by email to the instructor or TA before or after the deadline. All files uploaded to D2L Dropbox MUST be in MS Word format (.doc or .docx), if the uploaded file is not readable by TurnItIn.com, it will be scored as zero.* In addition, 5 points of extra credit will be given to everyone if 50% of the students complete the TCEs.

Confidentiality of Student Records

See the following website for details <http://www.registrar.arizona.edu/ferpa/default.htm>

The information contained in this course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by this instructor.

Module	Topic	Lecture Title	Textbook Readings	Smartwork Quizzes
1	1	<i>Introduction to Biochemical Principles</i>	<i>Chapter 1</i>	SW1
	2	<i>Energy Conversion Processes</i>	<i>Chapter 2; 2.1</i>	SW2
	3	<i>Structure and Function of Water</i>	<i>Chapter 2; 2.2</i>	SW3
	4	<i>Biological Membranes</i>	<i>Chapter 2; 2.3</i>	
2	5	<i>Structure of DNA and RNA</i>	<i>Chapter 3; 3.1</i>	SW4
	6	<i>Genomics and Nucleic Acid Methods</i>	<i>Chapter 3; 3.2, 3.3</i>	
	7	<i>Amino Acids and Peptides</i>	<i>Chapter 4; 4.1</i>	SW5
3	8	<i>Hierarchical Organization of Protein Structure</i>	<i>Chapter 4; 4.2</i>	SW6
	9	<i>Mechanisms of Protein Folding</i>	<i>Chapter 4; 4.3</i>	
		EXAM 1 Topics 1-9		
4	10	<i>Protein Purification Methods</i>	<i>Chapter 5; 5.1</i>	SW7
	11	<i>Peptide Sequencing & X-Ray Diffraction/NMR</i>	<i>Chapter 5; 5.2, 5.3</i>	SW8
	12	<i>Functional Classes of Proteins</i>	<i>Chapter 6; 6.1</i>	
	13	<i>Hemoglobin: Structure and Function</i>	<i>Chapter 6; 6.2a</i>	SW9
5	14	<i>Hemoglobin: Allostery and Evolution</i>	<i>Chapter 6; 6.2b</i>	
	15	<i>Membrane Transport Proteins</i>	<i>Chapter 6; 6.3</i>	SW10
	16	<i>Structural Proteins: The Actin-Myosin Motor</i>	<i>Chapter 6; 6.4</i>	
6	17	<i>Overview of Enzymes</i>	<i>Chapter 7; 7.1</i>	SW11
	18	<i>Enzyme Structure and Function</i>	<i>Chapter 7; 7.2</i>	
	19	<i>Enzyme Reaction Mechanisms and Kinetics</i>	<i>Chapter 7; 7.3, 7.4</i>	SW12
		EXAM 2 Topics 10-19		

Module	Topic	Lecture Title	Textbook Readings	Smartwork Quizzes
7	20	<i>Regulation of Enzyme Activity</i>	<i>Chapter 7; 7.5</i>	SW13
	21	<i>Overview of Cell Signaling Pathways</i>	<i>Chapter 8; 8.1</i>	SW14
	22	<i>G-protein Coupled Receptor Signaling</i>	<i>Chapter 8; 8.2</i>	
8	23	<i>Receptor Tyrosine Kinase Signaling</i>	<i>Chapter 8; 8.3</i>	SW15
	24	<i>Tumor Necrosis Factor Receptor Signaling</i>	<i>Chapter 8; 8.4</i>	
	25	<i>Nuclear Receptor Signaling</i>	<i>Chapter 8; 8.5</i>	SW16
	26	<i>Overview of Metabolism</i>	<i>Chapter 9; 9.1</i>	
9	27	<i>Structure and Function of Simple Sugars</i>	<i>Chapter 9; 9.2</i>	SW17
	28	<i>Glycolysis: Enzymatic Reactions</i>	<i>Chapter 9; 9.3</i>	
	29	<i>Glycolysis: Regulation of Metabolic Flux</i>	<i>Chapter 9; 9.4, 9.5</i>	SW18
		EXAM 3 Topics 20-29		
10	30	<i>Redox Reactions and Reduction Potentials</i>	<i>Chapter 10; 10.1</i>	SW19
	31	<i>Structure and Function of Pyruvate Dehydrogenase</i>	<i>Chapter 10; 10.2</i>	SW20
	32	<i>Redox Reactions of the Citrate Cycle</i>	<i>Chapter 10; 10.3</i>	SW21
11	33	<i>Citrate Cycle Regulation and Intermediates</i>	<i>Chapter 10; 10.4, 10.5</i>	
	34	<i>The Chemiosmotic Theory</i>	<i>Chapter 11; 11.1</i>	SW22
	35	<i>The Mitochondrial Electron Transport System</i>	<i>Chapter 11; 11.2</i>	
12	36	<i>The ATP Synthase Complex</i>	<i>Chapter 11; 11.3</i>	SW23
	37	<i>Mitochondrial Shuttle Systems</i>	<i>Chapter 11; 11.4</i>	SW24
	38	<i>Regulation of Oxidative Phosphorylation</i>	<i>Chapter 11; 11.5</i>	
		EXAM 4 Topics 30-38		
		FINAL EXAM: Based on a Set of Review Questions (questions are <u>not</u> taken directly from midterm exams)		