

Biochemistry I

BCM 475 (Fall 2017) – 3 credits

Instructors

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Teaching Assistants

Matthew Allen / Email: mfallen@syr.edu / initial contact regarding clickers, homework, and exam grading

Tongyin Zheng / Email tzheng100@syr.edu / initial contact regarding Monday recitation and office hours

Lecture: 9:30 – 10:25 am on Mondays, Wednesdays, and Fridays in LSC Room 001

Recitation: 7:00 – 8:00 pm on Mondays in Physics Stolkin Auditorium

Office Hours: 8:00 – 9:00 pm Mondays in Physics Stolkin Auditorium (Tongyin Zheng),

8:15 – 9:15 am Fridays in LSC 214 (Prof. Welch or Castañeda)

Course Description

This course covers several important biological and biomedical topics. It has been designed to prepare you for careers in fields that require a fundamental understanding of biochemistry, such as medicine, life sciences research, or bioengineering. For those of you preparing for the MCAT, all the topics in this course are important. For those of you that are biochemistry majors, this course is the first part of a two-part sequence in biochemistry that is required for your major.

You will learn about the structure and function of four different types of molecules: proteins, nucleic acids, lipids, and carbohydrates. You will use equations to describe thermodynamic and kinetic principles for biochemical reactions. You will dissect and compare complicated biochemical structures and systems with respect to their formation, function, and regulation.

You will then apply this information to a study of core metabolic pathways, including glycolysis, the citric acid cycle, and oxidative phosphorylation. You will also cover additional important catabolic and anabolic cellular processes, such as glycogen and fatty acid metabolism. These essential biochemical concepts build upon information you have studied in the prerequisite courses: General Biology, General Chemistry, and Organic Chemistry.

Prerequisite

CHE 325 (Organic II) is a prerequisite for this course.

Learning Objectives

- 1) You will be able to identify, draw, and know properties of at least four different biomacromolecules, specifically proteins, nucleic acids, lipids, and carbohydrates.
- 2) You will be able to assess how enzymes facilitate biochemical reactions.
- 3) You will be able to formulate experiments and assess quality of experiments addressing molecular structure, and isolation/separation of biomacromolecules.
- 4) You will be able to understand and predict models for information transfer cascades, as used in metabolic regulation.
- 5) You will be able to predict sites and nature of regulation in metabolic pathways that transform energy, given knowledge of common mechanisms of regulation for biomacromolecules.
- 6) You will be able to compare and contrast the synthesis, storage, and transformation of carbohydrates, fatty acids, and triglycerides, from which living organisms harvest energy.

Required Materials

- 1) **Textbook:** Biochemistry (8th edition) by Berg JM, Tymoczko JL, and Stryer L (2015). The bookstore stocks the unbound version of the text, bundled together with online access to the Sapling Learning Environment.
- 2) **Sapling Online Homework:** This is bundled together with the textbook at the bookstore. However, if you purchase the textbook separately, you will have to purchase access to Sapling Homework separately. To enroll in the online homework program, go to the BCM 475 Blackboard website and click 'Online Homework'.
- 3) **Clickers:** To participate in polling sessions and receive credit you must purchase and correctly register both a subscription and a clicker.
 - a. **Create a Student Turning Account and Link the Account to Blackboard.** Go to the course Blackboard site and click **Tools** and follow the link for **Turning Account Registration**. Login and follow the instructions to create an account, if you have not done so before.
 - b. **Purchase a Subscription and associate it with your Turning Account**
Subscriptions cost approximately \$25 for one year or \$50 for five years. You may purchase a subscription at the SU Bookstore or through the Turning Technologies website.
 - c. **Purchase a Clicker and associate it with your Turning Account**
Clickers cost \$20 for the RF LCD or \$30 for the QT2. You may purchase a clicker as part of bundle with a subscription at the SU Bookstore or through the Turning Technologies website.

RESOURCES

All lectures will be in LSC 001. The textbook will be used extensively. Email announcements will be sent to your @syr.edu accounts. Friday office hours will be 8:15 – 9:15 am (Prof. Roy Welch, ending 10/20; Prof. Carlos Castañeda, starting 10/27). The location of Friday office hours will be LSC 214. Tongyin Zheng's recitation will be Mondays 7:00 – 8:00 pm, immediately followed by office hours 8:00 – 9:00pm. Monday recitation and office hours will be in Stolkin Auditorium in the Physics building. Please note that there will be no recitation on 09/04. There will also be no recitations on scheduled exam days.

GRADES

BCM 475 will have the following grading scheme:

Exams 1-3: Each is worth 20%

Final Exam: 20%

Sapling Online Homework: 15%

Clickers: 5 %

The grading scale will be such that the average score will represent a B- or C+, to be determined. All letter-grade numerical boundaries will be chosen to minimize assignments of different letter grades to two students whose performance is essentially identical. Completion of any incomplete will require taking the missed exam(s) in Fall 2018, which is the next time this course will be offered.

a) Examination Policies: The dates and times (M 7:00 PM – 9:00 PM) for the three exams are as indicated in the syllabus. The final exam will be on Friday, December 15 between 3:00 PM and 5:00 PM in LSC 001. **There is no possibility to make up an exam in BCM 475.** A student presenting a *valid excuse* (defined below) who has missed one exam, can have the averages of the remaining two exams used as the score for the missed exam. A student with a second or third "miss" will receive a grade of zero for the additional missed exam(s). **In order to receive a passing grade in BCM 475, a student must take the comprehensive final exam.** A student who fails to take the comprehensive final exam at the scheduled date and time, may gain the right to take a make-up final exam (2 hours in length) provided that a valid excuse is presented.

A valid excuse: A valid excuse is a written and dated document that is presented to the instructor *within three days of the missed exam*. A valid medical excuse must *be signed by a physician* and it must be evident from the excuse that the student was unable to write the exam at the specified date/time. A valid student-athlete excuse is an official document provided to the instructor by the Athletic Office stating the reason for the absence. The student-athlete excuse must be provided within the first two weeks of class in order for it to be valid.

b) Exam regrade requests: You have the opportunity to request an exam regrade if you feel there is a mistake in the grading of your exam. All exams will be scanned electronically prior to being returned, and exam regrade requests will be evaluated using the electronic copy of the exam. Exam regrades will be performed using the following guidelines:

- 1) Exam regrade requests must be submitted by email to Professor Welch, Professor Castañeda, **and** Matthew Allen.
- 2) Please email a note clearly indicating the question for regrading and explaining the issue in question (2-3 sentences max). Note: Exams submitted for regrade will be considered in their entirety; it is possible to lose points during a regrade to yield a lower overall exam score.
- 3) Do not alter your paper exam IN ANY WAY in the event it is needed for reference.
- 4) Turning in exams with altered, corrected, or additional answers for a regrade is a clear violation of the academic honesty policy, and will be penalized accordingly (grade of "F" for the class and referral to the academic integrity office).
- 5) Regrade requests must be submitted by email by 5 PM on the regrade request deadline announced during lecture (**generally one week following the return of the exams**). No regrade requests will be considered if submitted after the announced deadline.

c) Sapling Online homework: Weekly assignments will be given on Monday mornings at 11:00 am, and will consist of approximately 20 questions. Assignments will be due on Sunday mornings at 8:00 am, and should be completed entirely online using Sapling Learning. The purpose of the assignments is to test your understanding of the material covered in class, and a few questions on each of the exams will be derived from the Sapling online homework. For this reason, we strongly suggest that you complete all of the assignments on your own. Difficult problems from assignments will be reviewed during recitation sessions on the following Mondays at 7 pm. Students should identify problems as difficult by emailing them to **Tongyin Zheng**, along with any specific questions about the problem or the topic, before the assignment is due. Note that if you experience any technical difficulties, please follow the instructions provided here: <https://community.macmillan.com/docs/DOC-6915-students-still-need-help>

d) Clickers: Clicker questions represent a small but significant part of your grade. You are responsible for 1) bringing your clicker to class, 2) making sure it has sufficient battery power, 3) having your Turning Technology account activated and in good standing, and 4) tracking that your clicker answers are recorded in Blackboard.

There will be a total of 30 points worth of clicker questions per week. There will be two types of questions, which we will call recognition and synthesis questions. Recognition questions will appear between one and three times per lecture, and will not count more than three points each. Recognition questions will be relatively straightforward and short; their purpose will be to gauge how well you are keeping up with the course material and retaining current information. Synthesis questions will appear once per week, and will count for between three and 22 points. Synthesis questions will be more in-depth and longer; their purpose will be to gauge how well you can apply current information to solve problems.

Your final clicker grade will be calculated from the sum of all your clicker points for the semester, and will represent 5% of your total grade for the course. Points missed due to excused absences will not be counted in your final clicker grade, but proof of the excused absence must be submitted and approved. **Matthew Allen** will be the point of first contact regarding clicker issues.

Lecture and Recitation Attendance

Attendance in all classes is expected at Syracuse University. Students must attend lectures to receive

credit for the clicker questions that form part of the lecture. No credit will be awarded if clicker questions are not answered during class and recorded by Turning Technologies. It is the student's responsibility to ensure that they attend class, that they bring their clicker, and that their clicker is operating correctly. **Matthew Allen** will be the point of first contact regarding clicker issues.

ACADEMIC INTEGRITY:

Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice. For more information and the complete policy, see <http://academicintegrity.syr.edu>.

Complete academic honesty is expected of all students. Any incidence of academic dishonesty, as defined by the SU Academic Integrity Policy (see <http://academicintegrity.syr.edu>), will result in both course sanctions and formal notification of the College of Arts & Sciences. In this course, all submitted writings, calculations, and/or graphical work that counts towards the grade must be the creation of individual students, and not the result of a partnership or group effort; no student may receive help from any other student during in-class written examinations.

DISABILITIES:

If you believe that you need accommodations for a disability, please contact the Office of Disability Services (ODS), located at 804 University Avenue, third floor, or go to the ODS website at <http://disabilityservices.syr.edu>, and click current students tab to register on-line. You may also call (315) 443-4498 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue "Accommodation Authorization Letters" to students as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible. Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create learning environments that are useable, equitable, inclusive and welcoming. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, we invite any student to meet with us to discuss additional strategies beyond accommodations that may be helpful to your success.

FAITH-BASED OBSERVANCES:

SU's religious observances policy, found at http://supolicies.syr.edu/emp_ben/religious_observance.htm, recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, BCM475 students will be provided an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify the instructor by email before the end of the second week of classes (i.e. by Sept. 8th). An online notification process is available through MySlice/Student Services/Enrollment/My Religious Observances from the first day of class until the end of the second week of class.

BCM 475 Course Schedule for Fall 2017 (tentative)

L	Day	M	D	Chapter	Topic	Notes
1	Monday	8	28	1	Biochemistry: an evolving science	Pgs. 1-22
2	Wednesday	8	30	2	Protein Composition and Structure	Pgs. 27-40
3	Friday	9	1	2	Protein Composition and Structure	Pgs. 41-61
4	Wednesday	9	6	3	Exploring Proteins and Proteomes	Pgs. 65-85
5	Friday	9	8	4	DNA, RNA, and the Flow of Genetic Information	Pgs. 86-114
6	Monday	9	11	4	DNA, RNA, and the Flow of Genetic Information	Pgs. 115-129
7	Wednesday	9	13	5	Exploring Genes and Genomes	Pgs. 135-164
8	Friday	9	15	6	Exploring Evolution and Bioinformatics	Pgs. 169-187
9	Monday	9	18	7	Hemoglobin: Portrait of a Protein in Action	Pgs. 191-210
10	Wednesday	9	20	8	Enzymes: Basic Concepts and Kinetics	Pgs. 215-229
11	Friday	9	22	8	Enzymes: Basic Concepts and Kinetics	Pgs. 230-243
12	Monday	9	25	---	Review Session	CH 1-7
X	Monday	9	25	7pm	EXAM 1: A-K: HEROY GEOLOGY AUDITORIUM L-Z: PHYSICS STOLKIN AUDITORIUM	EXAM 1 covering CH 1-7
13	Wednesday	9	27	9	Catalytic Strategies	Pgs. 251-264
14	Friday	9	29	9	Catalytic Strategies	Pgs. 265-281
15	Monday	10	2	10	Regulatory Strategies	Pgs. 285-295
16	Wednesday	10	4	10	Regulatory Strategies	Pgs. 296-308
17	Friday	10	6	11	Carbohydrates	Pgs. 315-336
18	Monday	10	9	12	Lipids and Cell Membranes	Pgs. 341-362
19	Wednesday	10	11	13	Membrane Channels and Pumps	Pgs. 367-378
20	Friday	10	13	13	Membrane Channels and Pumps	Pgs. 379-391
21	Monday	10	16	14	Signal Transduction Pathways	Pgs. 397-418
22	Wednesday	10	18	15	Metabolism: Basic Concepts and Design	Pgs. 423-431
23	Friday	10	20	15	Metabolism: Basic Concepts and Design	Pgs. 432-445
24	Monday	10	23	---	Review Session	CH 8-14
X	Monday	10	23	7pm	EXAM 2: A-K: HEROY GEOLOGY AUDITORIUM L-Z: PHYSICS STOLKIN AUDITORIUM	EXAM 2 covering CH 8-14

25	Wednesday	10	25	16	Glycolysis	pgs. 449-469
26	Friday	10	27	16	Regulation of Glycolysis	pgs. 469-487
27	Monday	10	30	16	Regulation of Glycolysis & Gluconeogenesis	pgs. 469-487
28	Wednesday	11	1	17	PDH complex and Intro to Citric Acid Cycle	Pgs. 495-506
29	Friday	11	3	17	The Citric Acid Cycle	Pgs. 506-517
30	Monday	11	6	18	Reduction Potentials	Pgs. 523-529
31	Wednesday	11	8	18	Respiratory Chain and Proton Gradient	Pgs. 529-544
32	Friday	11	10	18	ATP Synthase	Pgs. 544-558
33	Monday	11	13	20	Pentose Phosphate Pathway	Pgs. 601-612
34	Wednesday	11	15	21	Glycogen Metabolism	Pgs. 617-627
35	Friday	11	17	21	Glycogen Metabolism	Pgs. 627-638
36	Monday	11	27	---	Review Session	CH 15-18, 20-21
X	Monday	11	27	7pm	EXAM 3: A-K: HEROY GEOLOGY AUDITORIUM L-Z: PHYSICS STOLKIN AUDITORIUM	EXAM 3 covering CH 15-18, 20-21
37	Wednesday	11	29	22	Fatty Acid Metabolism	Pgs. 643-652
38	Friday	12	1	22	Fatty Acid Metabolism Part 2	Pgs. 653-672
39	Monday	12	4	27	The Integration of Metabolism	Pgs. 801-811
40	Wednesday	12	6	27	The Integration of Metabolism	Pgs. 812-822
41	Friday	12	8	---	Review Session	Chapters 1-18, 20-22, 27
X	Friday	12	15	ALL	CUMULATIVE FINAL LOCATIONS TBA	3:00 – 5:00 pm

On exam days (exams 1,2,3),

Those students whose last names begin with A-K will go to Heroy Geology Auditorium.

Those students whose last names begin with L-Z will go to Physics Stolkin Auditorium.