

# Chemistry 256 - Biochemistry

Hofferberth, Spring 2019

## Course Description:

During the past century scientists have developed the technology to study biology with increasingly fine resolution. Biochemistry is the study of biology at molecular resolution. We will draw on your background in both biology and chemistry to understand the structure, function and interplay of the organic molecules responsible for life. Biochemistry is a burgeoning field that evolves rapidly in response to technological advances and we will discuss tools used by contemporary biochemists to unravel the molecular details of life.

## Instructor and Resources:

Instructor: Dr. John Hofferberth  
Email: hofferberthj@kenyon.edu  
Office: 312 Tomsich Hall  
Office Hours: Individual and Small Group Office Hours: MW 2:00-4:00 PM, 312 Tomsich (reserve office hour appointments at: <https://tinyurl.com/y8ahxy9k>)  
Weekly Review Session: F 2:00-3:00 PM, 103 Tomisch  
Open Inclusion Hours: F 3:10-4:00, In quad, Tomsich stairwell, or 3rd floor lounge  
Lecture Hall: 101 Tomsich  
Class Time: 10:10-11:00 AM, MWF  
Text: Lehninger Principles of Biochemistry 6<sup>th</sup> Edition (study guide recommended)  
Materials: HGS Molecular Structure Model (Kit C) (recommended)  
Website: moodle.kenyon.edu (search for Chemistry 256)

## Course Policies and Expectations:

Course Grade:

Quizzes (12 × 10 pts)	120 pts
Seminar Synopses (2 × 25 pts)	50 pts
Special Topic Poster	50 pts
Midterm Exams (3 × 100 pts)	300 pts
Final Exam	200 pts
Course Preparation Assignments (37 × 10 pts)	370 pts
Challenges (30 × 5 pts)	150 pts
<hr/> Total Points	<hr/> 1240 pts

The instructor will assign fair grades at the conclusion of the term. To estimate your grade during the semester use the following grade scheme.

Grade	Percent of Total Points Earned
A (+/-)	100% - 90%
B (+/-)	89% - 80%
C (+/-)	79% - 70%
D (+/-)	69% - 60%
F	< 60%

## Attendance:

Your attendance at every class session and the class poster session (see below) is expected. There will be no grade penalty for excused absences. However, students are responsible for learning material missed as a result of an excused absence.

## Office Hours:

Office hours are a valuable resource for you to interact directly with the instructor. You may reserve office hours in 15-minute blocks using this [link](#). To make the most of office hours, come prepared and be organized. For questions about course material, it is good practice to write a list of your questions in your notebook and include the pages in the notebook/textbook where you can find the source of the question. *Always bring your course notebook to office hours.* Arriving at your office hour with a small group of students (2-5) is **preferred** if your questions relate to course material. If a small group of students have several questions, they may reserve as many as 2 consecutive 15-minute office hour appointments. For personal questions (those not related to course material), please reserve no more than one 15-minute appointment. If you have a personal question that you think needs more than 15 minutes to discuss, email the instructor to set up a time to meet. If you need help but your schedule does not allow you to come to an office hour when you need it, email the instructor to make an appointment.

## Preparation:

*The material in this course builds on itself.* For that reason it is imperative that you keep up with the course material. Biochemistry is a subject that requires the memorization of facts, the understanding and application of concepts, and the integration and synthesis of knowledge from all parts of the course and prerequisite courses. To be successful, students will need to employ a variety of study tactics and learning strategies. The instructor will highlight good strategies for the different kinds of materials we study. An understanding of how we best learn is a valuable asset in this course (and others). An excellent guide to understanding how best to learn is the following text and is highly recommended reading prior to and throughout the course: "Make it

stick: the science of successful learning”, Brown, Roediger, and McDaniel, ©2014 Harvard University Press. In brief, **ACTIVE** learning strategies are far more valuable than passive ones. The course is structured to encourage the use of effective learning strategies that can be transferred to other courses as you learn how to use them.

## Learning Outcomes and Study Guide:

A study guide with learning outcomes has been linked to the Moodle page to help you understand the structure, goals, and expectations of different parts of the course. Consult this document regularly.

## Class Structure and Rationale:

Active preparation is essential for your success in Biochemistry. Prior to each class session (except the first day and prior to exam days), your job will be to **expose yourself to the material and concepts** that will be the focus of the next session, **consolidate and organize that information** into your course notebook, and **complete the Course Preparation Assignment (CPA)** in your notebook. Each class session will commence with a discussion of the CPA to allow you to get **feedback and calibrate your understanding**. After the CPA discussion, using only your notebook as a resource, you will participate in a small group that will apply and extend your knowledge of the topic on a team challenge. The team will submit their collective work on the challenge at the end of the class session. After class, you will complete the challenge in your course notebook, complete practice problems as you see fit and begin preparing for the next session. Each day when you arrive at class, you will find a pre-class assignment (Meta Monday, Wildcard Wednesday, Formative Friday (low-stakes quiz)), after the pre-class assignment the session will begin: CPA discussion and the team challenge.

The structure used in this course was designed based on the science of how humans learn best: (1) exposure to new information or concepts (establish short-term memory traces while reading or watching videos), (2) consolidation and organization (place new information in your existing scaffold of knowledge while writing the key information into your notebook and completing the CAP), (3) recall and application on CPAs, challenges, pre-class assignments, spaced/interleaved practice (shift knowledge into long-term memory and practice cueing it when needed to solve a problem - challenges, suggested HW problems, spiral review assignments), and (4) timely feedback, calibration and refinement through class discussion, formative assessments, and spiral reviews (establish knowledge in long-term memory and solidify it in the scaffold of knowledge available for complex cognitive processes). For more information read “Make it Stick” (referenced above).

Aspects of learning that are less cognitively demanding such as exposure to new terms and concepts, memorization, initial comprehension, and basic applications are focused outside of class sessions. Of primary importance during class sessions, when support and immediate

feedback is available, are activities that require higher cognitive functions such as applications to more complex problems, analysis of data, and synthesis of concepts to create new models or ways of understanding. Like most things in life, you will get out of the class what you put in. Doing your part prior to class will allow you to benefit more from what we do in class.

The structured nature of the course is known to improve learning outcomes for **all students** and is especially valuable in maximizing the benefits of having a diversity of backgrounds and life-experiences in our class community. (An excellent literature article with leading references on this topic: CBE—Life Sciences Education Vol. 13, 453–468, Fall 2014)

## Course Preparation Assignments:

The CPA template for each class will include suggested practice problems for the material in the *previous* class session, a reading and/or video assignment for the next class session, and the CPA questions to be completed and submitted before midnight the day before the *next* class session. To submit your CPA, you will scan your responses to the CPA questions in your notebook (a phone camera scanning app like “camscanner” works well but you can often do well with the native camera app on your phone, let me know if you don’t have a phone with a working camera and we will find an alternative for you), the scan will be pasted into a text document with at least 20 words typed on the page, and the CPA will be submitted via Moodle.

Your work preparing for class is essential and genuine engagement on each CPA will be rewarded with 10 points (~370 points total for the semester). In sum, your CPA grade makes the largest single contribution to your final grade. CPA grades are *all or nothing* (0 or 10 points). Each student will be permitted one missed CPA for the semester without a grade penalty. CPAs that are submitted on time, are complete, and show genuine engagement with every question/prompt will receive credit. It is your job to correct your CPAs (in your notebook) during the CPA discussion at the beginning of each class. If you have questions about one of your CPA responses it is your responsibility to ask about it during the CPA discussion - if you have the question, it is very likely that others do as well.

## Course Notebook:

You will be provided with a course notebook (a bound composition notebook) on the first day of class. You may use the provided notebook or any bound notebook you prefer. Your notebook will be the record of your work for the class and will include your notes on readings and videos, your personal work on challenges and practice problems, your pre-class assignments, and your CPA responses. *Bring your notebook to every class session (including exams) and any office hours you attend.*

Your notebook will be a temporal record of your activities for the class. Many students find it helpful to number the pages and make an index on the first few pages. After the index, **there**

**will be no blank pages between your work.** Each day upon entering class, students will date stamp where they completed their out-of-class work. Course notebooks will be checked during the midterm exams and final exam and returned the same day.

## Challenges and Teams:

Following the CPA discussion each class session, small teams of students (typically 3 students) will work on a challenge activity. Challenge activities are designed to build from the CPA and concepts learned earlier in the course or in pre-requisite courses. Typically challenges will focus on developing higher level cognitive abilities. In order to get the most out of challenge activities, teams must work efficiently and make sure that they have the opportunity to work on the difficult parts of the material as a collaborative team. During challenges the instructor will be available as a resource and groups that get stuck should get help quickly. Following class, students are responsible for completing the challenge in their notebook and then should do suggested problems, as they see fit, to gain confidence and experience with other problem types.

Active engagement with the challenges will be evidenced by what is written during the class session. At the end of the class session, each team will submit their collective work on the challenge to be graded. Teams that substantiate their engagement with a rich written record (text, calculations, drawings, structures, mechanisms etc) of their work will receive full credit (5 points) for the challenge. To be clear, challenge grades will be determined by the level of engagement evidenced by the written work submitted and not the correctness or amount of the challenge that was completed.

Teams will be randomly selected at the beginning of each class session by drawing a popsicle stick. The number and letter on the stick will assign each student a partner (1A with 1A, 1B with 1B, etc) and group of four students (all students with 1, two pairs of partners). Partners will sit next to one another and groups will sit in the same area of the room so they can work together when needed. To be maximally effective, these collaborations must be inclusive endeavors. Group members who quickly understand a particular question or part of a challenge should transition to the role of mentor/teacher for other group members. Two individuals who both think they understand but have different answers should carefully listen to each other and try to discover the correct interpretation. Working in teams is an essential skill in the workforce today and people with ability to function well in a team, make the most of all the human resources in a team, and team leadership skills are tremendously valuable.

## Quizzes:

Quizzes are an important learning tool that will enable you to calibrate your own understanding of course material. Quizzes have also been shown to help students consolidate their memory of a topic and allow them to build durable knowledge (read "Make it Stick" for details). Quizzes will be given at the beginning of class on Fridays (Formative Friday) and will be 5-10 minutes in

length depending on the topic. Students will write their responses to the quiz on the next available blank page of their course notebook.

## Midterm Exams:

Three cumulative 50-minute midterm examinations will be given during the semester on the dates indicated on the syllabus. If you have a conflict with any of the exam times you must notify the instructor by email at least one week prior to the exam to schedule an alternate exam time.

## Final Exam:

The final exam will be held on May 7th, 1:30 - 4:30 PM. The exam will be cumulative for the semester.

## Seminar Synopses:

You will attend two seminars during the semester that relate to the course material and prepare a one-page synopsis of each seminar that clearly describes the motivation for the work and the significance of the results presented in the seminar. It should be clear from your synopsis how the topic relates to this class. You should indicate your name, the title and date of the seminar clearly at the top of the page. Synopses will be typed and submitted electronically on the course Moodle page. An example synopsis is linked to the Moodle page. If you don't know if a particular seminar relates to the class, just ask during class (so all might benefit). **You must submit your synopsis within 24 hours of each seminar you attend.**

## Special Topic Posters:

Small teams of students (2-3 members) will prepare and present a poster on a special topic related to the course material. The posters will be presented during a poster session on the date indicated on the syllabus (April 30th, 11:10 AM-1:00 PM). Each team will prepare a 5-minute presentation pitched such that a classmate could understand the special topic. Posters will be prepared using a template file (on the Moodle page) and printed in the Chemistry Department. One member of your team will submit the topic of your poster and the names of all individual team members using the Google Form linked to the Moodle page by 4/15 by 11 PM. The final draft of the poster must be saved as a .pdf file and submitted one week before (on 4/23 by 11 PM) the presentation date to allow time for printing. Criteria for evaluation of the poster and presentation will be: topic selection (is it related/relevant to the class), presentation quality (professional, in the time limit, ability to respond to questions, level of pitch), poster quality (free from errors, accurate, original voice, quality/utility of graphics, style, organization).

## Academic Accommodations:

In accord with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990: If you anticipate that you may need accommodation in order to fully participate in this class, please identify yourself to Erin Salva, Director of Student Accessibility and Support Services. The instructor must receive information regarding the nature of the accommodation directly from Erin Salva and you must speak to the instructor about the accommodation at least one week in advance of using the accommodation for the class.

## Title IX and Privacy:

Kenyon College and the instructor of this course seek to provide an environment that is free of bias, discrimination, and harassment. If you have been the victim of sexual harassment/misconduct/assault we encourage you to report this. If you report this to the instructor, he must notify our college's Title IX coordinator. For more information about your options at Kenyon, please go to:

<http://www.kenyon.edu/directories/offices-services/office-of-equal-opportunity/sexual-assault-and-harassment/>

The instructor of this course will respect the privacy of all personal conversations with his students. In the case that he learns of activities or incidents that violate Title IX (sexual discrimination and/or harassment) or otherwise violate the law he is required to report such information to the Title IX coordinator or campus law enforcement, respectively.

## Integrity and Collaboration Expectations:

Academic integrity is expected in all aspects of this course. A detailed description of academic integrity and the College policy regarding academic dishonesty can be found at the following link:

[www.kenyon.edu/directories/offices-services/registrar/course-catalog-2/administrative-matters/academic-integrity-and-questions-of-plagiarism/](http://www.kenyon.edu/directories/offices-services/registrar/course-catalog-2/administrative-matters/academic-integrity-and-questions-of-plagiarism/)

Many aspects of this class encourage or require collaboration. Daily team challenges and the poster project will give you the opportunity to develop your ability to collaborate with your peers and the instructor. Learning material at lower cognitive levels (exposure, memorization, basic applications) is a solitary activity and is best done independently. However, work at higher cognitive levels often benefits from a collaborative approach as long as each member of the collaboration develops their own understanding as a result. The cognitive demand of the CPA

assignments will vary and collaboration is encouraged when it is helpful for every individual involved. If you collaborate on a CPA assignment, clearly indicate who worked with you at the top of the page. Work submitted for seminar synopses, midterm exams, and the final exam is to be completed independently.

## Devices:

Full engagement with the in-class portion of this course will be a key component of success. All electronic devices should be turned off before the beginning of every class session unless otherwise directed by the instructor. On occasion, wireless devices (computers or phones) will be used in class and are encouraged to bring such devices to class but keep them put away unless they are needed for a particular activity.

## Tentative Schedule:

Given below is the tentative schedule for the class. Readings in parentheses are suggested but will only receive superficial coverage. For more detailed expectations see the Learning Outcomes and Study Guide (linked to the Moodle page).

Date	Topic	Reading Sections
1/14	Introduction	(1.1 – 1.5)
1/16	C2 – Water, IM Forces, Acid-Base Chemistry	2.1 – 2.3 (2.4, 2.5)
1/18	C3 – AA's, Peptides, Proteins	3.1 – 3.4
1/21		
1/23		
1/25	C4 – 3D Structure of Proteins	4.1 – 4.4
1/28	C5 – Protein Function	5.1 – 5.3
1/30		
2/1		
2/4		
2/6	C6 – Enzymes	6.1 – 6.5
2/8	Exam 1	
2/11	C6 – Enzymes Continued	
2/13		
2/15		
2/18		
2/20	C7 – Carbohydrates	7.1, 7.2, (7.3 – 7.5)
2/22	C13 – Bioenergetics	pp 501-504, 13.1 – 13.3
2/25		
2/27		
3/1	Exam 2	



3/18	C14 – Glycolysis, Pyruvate, Feeder, Gluconeogenesis and the PPP  Poster Topic Submitted by 4/15, 11 PM	14.1 – 14.5
3/20		
3/22		
3/25		
3/27		
3/29		
4/1		
4/3		
4/5		
4/8		
4/10		
4/12		
4/15	C15 – Regulation	15.2, 15.3
4/17		
4/19	Review Day	
4/22	Exam III - 4/22	16.1 – 16.3
4/24	C16 – The Citric Acid Cycle	
4/26	Poster File Submitted by 4/23 11 PM	
4/29		
4/30	Class Poster Session 11:10 AM-1:00 PM	
5/1	C19 – Oxidative Phosphorylation	19.1 – 19.3
5/3		
5/7	Final Exam, 1:30-4:30 PM, Tom 101	