CHEM 135: Chemical Biology

Fall 2015 | Mon • Wed • Fri • 9:10 am to 10 am | 120 Latimer Hall

Course objectives: How do inanimate molecules of carbon, hydrogen, oxygen and nitrogen (plus a few others) give rise to the living, breathing life we see around us? How do our cells harness the chemical energy of molecules to carry out the metabolic reactions that keep us moving, growing, and thinking? What is the underlying logic to the cellular pathways that initiate, sustain, and pass on our genetic material? The study of biochemistry and chemical biology seeks to answer these and many more questions.

Chem 135 is an introduction to the principles of chemical biology and biochemistry—the organizing chemical concepts of life itself. At the end of the semester, students should be familiar with definitions of chemical biology and biochemistry; the structure, function, and reactivity of the major classes of biomolecules; mechanisms and features of enzyme catalysis; principles of cellular metabolism; and the primary pathways of the central dogma.

Instructor: Evan W. Miller
227 Hildebrand Hall
evanwmiller@berkeley.edu (NOT evanmiller@berkeley.edu)
Office hours: Fridays 3-5 pm in 227 Hildebrand Hall

Graduate Student Instructors (GSIs):

	Vincent Grenier	*Rishi Kulkarni*	*Julia Lazzari-Dean*
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Office Hours	Wednesday, 3-5pm	Tues/Thurs, 9-10 am	Monday, 11am to 1 pm
Location	Bixby Commons	Bixby Commons	Bixby Commons

Textbook/Software:

"Lehninger Principles of Biochemistry," by Nelson and Cox. (6th ed. preferred, 4th and 5th ed. are okay)

Tophat Subscription: www.tophat.com Tophat is an interactive software platform that allows students to use their own devices (smartphones, tablets, laptops) to interact with the lecture. A subscription is required and is $24 / semester ($0.65/class).

Course website: The course website is maintained through the UC Berkeley bCourses site. Please visit bcourses.berkeley.edu to find our course website (Chem 135, FA 2015). All course information will be distributed through the bCourse site. This includes syllabus, problem sets and solutions, announcements, handouts, grades, etc. You are responsible for announcements made through the bCourse Website.

We will use "Piazza" to facilitate group discussion. This is an application that runs through our bCourses site. Group discussion threads are moderated by the instructor and GSIs. *Please use Piazza instead of email to ask questions if you're struggling with concepts or problem sets.* Posts can be completely anonymous and can be answered by fellow classmates as well as GSIs or instructors. Part of your participation grade will include your contributions to the Piazza discussion.

Problem Sets: Approximately 8 problem sets will be available throughout the duration of the course. These are due at the beginning of the class period listed on the syllabus. Answer keys are posted immediately following the class in which the problem sets are due, so we will not accept late problem sets. Group work is encouraged, but the answers to the questions must come from your own understanding (as opposed to simply copying down what the group decided was the best answer).

Participation: Active participation in Chem 135 is the best way to learn the material and succeed! As an extra motivator, participation will account for 5% of your grade. There will be ample opportunity to participate in class – through answering questions, working problems on the board, acting as a representative for your problem-solving group, etc. You must make at least one substantive contribution per week. At the end of class every Friday, you will be able to submit your contribution via TopHat. We will also digitally take attendance via TopHat, so be sure to sign up! You can miss 3 courses without losing any attendance credit.

Grading: Grades will be based on problem sets (20%), class participation (5%), three in-class exams (15%) and a final exam (30%). For each student, we will also calculate grades by taking the worst mid-term exam as 5% and the final as 40%. The best overall score will be used.

Final Exam: A comprehensive final exam will be held **Thursday, December 17, 2015**, from **7 pm to 10 pm** in **Latimer 120**.

Prerequisites: Chem 3B or 112B; Bio 1A. This class will assume basic understanding of the principles of general and organic chemistry and cell biology. Concepts from these courses will not be extensively reviewed in class. Come see us during office hours if you need extra help or guidance!

Ethics/Honor Code: "As a member of the UC Berkeley community, I act with honesty, integrity and respect for others."

Chem 135 Fall 2015: Lecture and Exam Schedule
(all dates are approximate -- see bCourse site for up-to-date schedule)

Day	Date	Lecture	Topic	Notes	Chapter
Wed	Aug 26	1	Course Introduction / Chemical Biology / Water		1
Fri	Aug 28	2	Amino Acids		1,2
Mon	Aug 31	3	Protein Structure I		3
Wed	Sep 2	4	Protein Structure I		4
Fri	Sep 4	5	Protein Function	PS 1 due	5
Mon	Sep 7	---	Labor Day		
Wed	Sep 9	6	Enzyme Catalysis: RNAse		6
Fri	Sep 11	7	Enzyme Catalysis: Proteasess		6
Mon	Sep 14	8	Enzyme Catalysis II -- RNAse and Proteases	PS 2 due	6
Wed	Sep 16	9	Enzyme Kinetics I		6
Fri	Sep 18	10	Enzyme Kinetics II		6
Mon	Sep 21	11	Enzyme Kinetics III	PS 3 due	6
Mon	*Sep 21*	*Review 1*	*Optional Review Session. 7- 8:30 pm. Location TBD.**		
Wed	**Sep 23**	**Exam 1**	**Exam 1 – in class**		
Fri	Sep 25	12	Central Dogma		
Mon	Sep 28	13	Nucleic Acids I		8, 25
Wed	Sep 30	14	Nucleic Acids II		8, 26
Fri	Oct 2	15	DNA replication and PCR		25
Mon	Oct 5	16	DNA Sequencing and Processing	PS 4 due	9
Wed	Oct 7	17	CRISPR/Cas9		9
Fri	Oct 9	18	Next-Generation Sequencing		26
Mon	Oct 12		---		
Wed	Oct 14	19	The Genetic Code and Translation		27
Fri	Oct 16	20	The Genetic Code and Translation II		27
Mon	Oct 19	21	Chemical Biology Highlight – Unnatural Amino Acids	PS 5 due	---
Mon	*Oct 19*	*Review 2*	*Optional Review Session. 7- 8:30 pm. Location TBD.**		
Wed	**Oct 21**	**Exam 2**	**Exam 2 – in class**		
Fri	Oct 23	22	Carbohydrate structure II		7
Mon	Oct 26	23	Bioenergetics and Metabolism I		13
Wed	Oct 28	24	Glucose Metabolism I		14
Fri	Oct 30	25	Glucose Metabolism II		14
Mon	Nov 2	26	Gluconeogenesis and Fermentation	PS 6 due	14
Wed	Nov 4	27	Citric Acid Cycle I		16
Fri	Nov 6	28	Citric Acid Cycle II		16
Fri	*Nov 6*	*Review 3*	*Optional Review Session. 7- 8:30 pm. Location TBD.**		
Mon	**Nov 9**	**Exam 3**	**Exam 3**		
Wed	**Nov 11**	**---**	**Veterans' Day**		
Fri	Nov 13	29	Membranes and Ion Channels		11,12
Mon	Nov 16	30	Oxidative phosphorylation I		19

Wed	Nov 18	31	Oxidative phosphorylation II		19
Fri	Nov 20	32	Photosynthesis		20
Mon	Nov 23	33	Fatty Acid Metabolism I	PS 7 due	17
Wed	**Nov 25**	**---**	**Thanksgiving**		
Fri	**Nov 27**	**---**	**Thanksgiving**		
Mon	Nov 30	34	Fatty Acid Metabolism II		21
Wed	Dec 2	35	Nucleic Acid Metabolism		22
Fri	Dec 4	36	Amino Acid Metabolism	PS 8 due	18
Mon	Dec 7	RRR	Review Session 1**		
Wed	Dec 9	RRR	Review Session 2**		
Fri	Dec 11	RRR	Review Session 3**		
Thurs	**Dec 17**	FINAL	**FINAL EXAM. 7 pm to 10 pm.**		

* Review sessions before exams are optional, will be led by Prof. Miller, and will be at a location TBD.

** No new material will be covered during RRR review sessions. The review sessions will be led by Prof. Miller and will meet at the same time and place as our regularly scheduled class.