CHEM C130 / MCB C100A
Biophysical Chemistry

Thermodynamic and kinetic concepts applied to understanding the chemistry and structure of biomolecules (proteins, membranes, DNA, and RNA). Topics include entropy, bioenergetics, free energy, chemical potential, reaction kinetics, enzyme kinetics, diffusion and transport.

Instructors: Jamie Cate, Department of Chemistry and Molecular & Cell Biology
708B Stanley Hall, jcate@lbl.gov
Office Hours (**482 Stanley Hall**): F, 3:00-4:30pm (or by appointment)

Jay Groves, Department of Chemistry
408A Stanley Hall, jtgroves@lbl.gov
Office Hours (**TBD**): _, _-_ (or by appointment)

Graduate Student Instructors:
Jenny Lin: jyl02007@berkeley.edu
William Huang: williamhuang@berkeley.edu
Alex Padron: apadr007@berkeley.edu
Lindsey Young: lindsey.young@berkeley.edu

Location and Time: Lecture: 390 Hearst Mining, MWF 9:00-10:00am

Discussion 103:   179 Stanley, Fri 10:00-11:00am; Jenny
Discussion 102:   101 Wurster, Fri 10:00-11:00am; Alex
Discussion 104/106: 179 Stanley, Fri 11:00-12:00pm; Lindsey
Discussion 101:   179 Stanley, Fri 1:00-2:00pm; William

Offered: Spring semester

Units: 4

Workload: 3 hours of lecture per week plus one hour of TA-led discussion. There will be three mid-terms, weekly problem sets, and mandatory final exam. See course policies.

Text: *The Molecules of Life: Physical Principles and Cellular Functions*, J. Kuriyan, B. Konforti, and D. Wemmer (Garland Science, 2013). Note that there are small differences between the Kindle version and the printed text.

Syllabus

Lecture	Date	Lecturer	Topic	Text/Reading
1	1/20 W	JC	Introduction to biophysical chemistry, protein and DNA structure, and intermolecular forces.	Ch. 1
2	1/22 F	JC	Intermolecular forces. Protein primary and secondary structure.	Ch. 1, 4
3	1/25 M	JC	Protein primary and secondary structure.	Ch. 4
4	1/27 W	JC	Protein tertiary structure.	Ch. 4
5	1/29 F	JC	Membrane proteins, evolutionary variation.	Ch. 4, 5 PS 1 DUE
6	2/1 M	JC	Protein structure/function relationships.	Ch. 5
7	2/3 W	JC	Protein structure/function relationships.	Ch. 5
8	2/5 F	JC	Protein structure/function relationships. Nucleic acids.	Ch. 5, 2 PS 2 DUE
9	2/8 M	JC	Nucleic acids.	Ch. 2
10	2/10 W	JC	Nucleic acids.	Ch. 2
11	2/12 F		(No class today)	PS 3 DUE in discussion sections.
	2/15 M		*Academic Holiday (No Lecture)*	
12	2/17 W		GSI-led review	
	2/18 Th		**Midterm 1: 10 Evans 7-9 PM**	
13	2/19 F	JG	Heat capacity and Boltzmann distribution	Ch. 6
14	2/22 M	JG	Intermolecular energy and forces	Ch. 6
15	2/24 W	JG	Thermodynamics and entropy, I	Ch. 7 PS 4 DUE
16	2/26 F	JG	Thermodynamics and entropy, II	Ch. 7
17	2/29 M	JG	Thermodynamics and entropy, III	Ch. 7
18	3/2 W	JG	Energy multiplicity; Boltzmann distribution, I	Ch. 8 PS 5 DUE
19	3/4 F	JG	Boltzmann distribution, The Boltzmann Game I	Ch. 8
20	3/7 M	JG	The Boltzmann Game, II	Ch. 8
21	3/9 W	JG	Helmholtz Free Energy	Ch. 9 PS 6 DUE
22	3/11 F	JG	Gibbs Free Energy	Ch. 9
23	3/14 M	JG	Standard Free Energy Changes	Ch. 9
24	3/16 W	JG	Free Energy and Work	Ch. 9
25	3/18 F	JG	Exam 2 Review	PS 7 Due
	3/18 F	JG	**Midterm 2: 10 Evans, 7-9 PM**	
	3/21-25		*Spring Recess (No Lectures)*	
26	3/28 M	JG	Chemical Potential	Ch. 10
27	3/30 W	JG	Equilibrium constants	Ch. 10
28	4/1 F	JG	Acid-Base Equilibrium	Ch. 10

29	4/4 M	JG	Binding equilibrium, I	Ch. 12 PS 8 DUE
30	4/6 W	JG	Binding equilibrium, II	Ch. 12
31	4/8 F	JG	Molecular recognition; Free energy of binding	Ch. 12
32	4/11 M	JG	Chemical Kinetics, I	Ch. 15 PS 9 DUE
33	4/13 W	JG	Chemical Kinetics, II	Ch. 15
34	4/15 F	JG	Chemical Kinetics, III	Ch. 15
35	4/18 M	JG	Arrhenius and Transition State Theory	Ch. 15
36	4/20 W	JG	Catalysis, Enzymes, Michaelis-Menton Kinetics	Ch. 16 PS 10 DUE
37	4/22 F	JG	M-M Kinetics	Ch. 16
38	4/25 M	JG	Competitive Inhibitors	Ch. 16
39	4/27 W	JG	Non-competitive inhibitors	Ch. 16
40	4/29 F	JG	Exam 3 review / Course Evaluations	PS 11 Due
	4/29 F		**Midterm 3: 10 Evans, 7-9 PM**	
	5/2 M		Reading Week GSI Review Sessions	
	5/4W		Reading Week GSI Review Sessions	
	5/6 F		Reading Week GSI Review Sessions	
	5/9 M		**FINAL: 7-10 PM**	