

# MCB C100A / CHEM C130

## Biophysical Chemistry

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

**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	Reading Chapter	PS Due
1	1/22 W	JC	Introduction to biophysical chemistry, protein and DNA structure, and intermolecular forces.	1	
2	1/24 F	JC	Intermolecular forces. Protein primary and secondary structure.	1, 4	
3	1/27 M	JC	Protein primary and secondary structure.	4	
4	1/29 W	JC	Protein tertiary structure.	4	
5	1/31 F	JC	Membrane proteins, evolutionary variation.	4, 5	PS 1
6	2/3 M	JC	Protein structure/function relationships.	5	
7	2/5 W	JC	Protein structure/function relationships.	5	
8	2/7 F	JC	Protein structure/function relationships. Nucleic acids.	5, 2	PS 2
9	2/10 M	JC	Nucleic acids.	2	
10	2/12 W	JC	Nucleic acids.	2	
11	2/14 F	JC	Carbohydrates	3	PS 3
	2/17 M		<i>Academic Holiday (No Lecture)</i>		
12	2/19 W	JC	Exam review; MCB course evaluation		
	<b>2/20 Th</b>		<b>Midterm 1: 2050 VLSB 7-9 PM</b>		
13	2/21 F	THG	Thermodynamics of heat transfer	6.1-6.6	
14	2/24 M	THG	Heat Capacity and Boltzmann distribution	6.7-6.11	
15	2/26 W	THG	Intermolecular energy and forces, I	6.12-6.18	
16	2/28 F	THG	Intermolecular energy and forces, II	6.19-6.24	PS 4
17	3/3 M	THG	Statistical view of entropy, I	7.1-7.8	
18	3/5 W	THG	Probabilistic view of entropy, II	7.9-7.17	
19	3/7 F	THG	Thermodynamics and entropy, III	7.18-7.25	PS 5
20	3/10 M	THG	Energy multiplicity and Boltzmann distribution, I	8.1-8.7	
21	3/12 W	THG	Energy multiplicity and Boltzmann distribution, II	8.8-8.14	
22	3/14 F	THG	Helmholtz and Gibbs Free Energy, I	9.1-9.4	PS 6
23	3/17 M	THG	Standard Free Energy Changes, II	9.5-9.11	
24	3/19 W	THG	Free Energy and Work, III	9.12-9.16	
25	3/21 F	THG	Chemical Potential, IV	10.1-10.5	PS 7
	3/24-28		<i>Spring Recess (No Lectures)</i>		

26	3/31 M	THG	Exam 2 review		
	<b>4/1 T</b>		<b>Midterm 2: 2040 + 2060 VLSB, 8-10 PM</b>		
27	4/2 W	THG	Equilibrium Constants	10.6-10.11	
28	4/4 F	THG	Acid-Base Equilibria	10.12-10.18	
29	4/7 M	THG	Binding Equilibrium, I	12.1-12.11	PS 8
30	4/9 W	THG	Binding Equilibrium, II	12.12-12.23	
31	4/11 F	THG	Chemical Kinetics, I	15.1-15.10	
32	4/14 M	THG	Chemical Kinetics, II	15.11-15.21	PS 9
33	4/16 W	THG	Chemical Kinetics, III	15.22-15.30	
34	4/18 F		Enzyme Kinetics, I	16.1-16.8	
35	4/21 M	THG	Enzyme Kinetics, II	16.9-16.17	PS 10
36	4/23 W	THG	Enzyme Kinetics, III	16.18-16.29	
37	4/25 F	THG	Diffusion and Transport, I	17.1-17.10	
38	4/28 M	THG	Diffusion and Transport, II	17.11-17.23	PS 11
39	4/30 W	THG	Exam 3 review		
40	5/2 F	JC/THG	Course Review / Course Evaluations		
	<b>5/2 F</b>		<b>Midterm 3: 2050 VLSB, 7-9 PM</b>		
	5/5 M		Reading Week GSI Review Sessions		
	5/7 W		Reading Week GSI Review Sessions		
	5/9 F		Reading Week GSI Review Sessions		