Introduction to Biophysical Chemistry
CHEM 4150/6150 (3.0 credits)
Department of Chemistry, Georgia State University
2020 Spring semester

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PSC 522
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Time and location: Tuesdays and Thursdays, 9:30 to 10:45 pm, LANGDL 615

Office Hours: Wednesdays 12 to 2 pm in PSC 522 or by appointment

Prerequisites: Math 2212 or equivalent with grade of C or higher

Course Objective:
Chemical control of biological systems requires a quantitative understanding of the physicochemical properties that define their structure and function. This course introduces students to the principles of physical chemistry with a focus on their application to biochemical processes and biophysical interactions.

Expected Learning Outcomes:
1. Understand the principles of physical chemistry that govern the interactions of biological macromolecules with small molecules (including drugs) and other macromolecules;
2. Become familiar with major biophysical techniques used to study biochemical systems;
3. Develop skills needed to critically analyze experimental data;
4. Develop a physically intuitive view of biological systems at the molecular level.

Textbook:
Physical Chemistry: Principles and Applications in Biological Sciences by Tinoco, Sauer, Wang, Puglisi, Harbison, and Rovnyak, 5th edition (2014), Pearson, Upper Saddle River, NJ.

Course materials:
Course content consists primarily of lecture slides, which will be supplied on iCollege, class discussions (i.e. notes that you take in class), and problem sets (more below). They are supplemented by textbook reading as indicated in the course schedule on p.3.

Problem sets:
A problem set will be assigned approximately every two weeks. They are aimed at reinforcing the concepts presented in class and **preparing you for many of the questions on the tests.** They will be marked for completeness only. Solutions for selected problems will be provided after the due dates.

Policy regarding calculators:
For problem solving, you will need a scientific calculator and learn how to use it. Any standalone scientific calculator will suffice; programming or graphing capabilities are not required. If you want suggestions, units such as the Casio *ƒ*x-260 or *ƒ*x-300 are reasonably equipped, widely available, easy to use, and inexpensive (<$10). **N.B. Sharing or substitution of standalone calculators with phones, tablets, or laptop computers during tests is not allowed.**

Assessments:
Assessment is based on the assigned problem sets (20%) and in-class tests (**4** x 20%), the last of which will be held during Finals week. Tests are composed of a mixture of multiple choices and short written questions. Graduate students enrolled in CHEM 6150 will answer extra questions, which are optional (bonus) for undergraduate students, aimed at probing a more advanced level of understanding. **Every test question will be mappable to learning objectives that precede each course section, so use them help direct your review.**

Grading Scale:
Students can be assured of the following grades by attaining the indicated scores:

90%	**A+**	77%	**B+**	67%	**C+**	50%	**D**
85%	**A**	74%	**B**	64%	**C**	Below 50%	**F**
80%	**A-**	70%	**B-**	60%	**C-**		

Academic integrity:
Students are reminded of the University's academic honesty policy, which can be found here: http://deanofstudents.gsu.edu/student-conduct/academic-honesty-policy. Specifically, all tests taken must represent individual, unaided efforts. Receiving or offering information on a test is cheating, as is the use of unauthorized supplementary materials or devices. Accessing and copying from the textbook's solution manual in your problem sets is also cheating. The consequences of cheating are potentially severe and permanent: don't do it!

Course Schedule

Week	Lecture	Topic		Chapter
1	**1**	Course overview and introduction		12
	2	Thermodynamics	Energy and enthalpy	2
2	**3**		Entropy and free energy	3
	4		Chemical potential and equilibrium constants	4
3	**5**		Calorimetry and non-calorimetric methods	
	6	Physicochemical bases of biomolecular interactions Physicochemical properties of biological macromolecules		3, 12
4	**7**			
	8			
5		**Test 1 (Lectures 1 to 5)**		
	9	Quantitative formulation of biomolecular interactions at equilibrium	Introduction, independent site binding	5, 6
6	**10**		Heterogeneity in site binding	
	11		Statistical features of multi-site binding	
7	**12**		Cooperativity, one-dimensional lattices	
	13	Kinetics	Chemical kinetics	9
8	**14**		Enzyme kinetics	10
	15			
9		**Test 2 (Lectures 6 to 12)**		
	16	Hydrodynamics	Theory: sedimentation, diffusion and viscosity	8
10		**Spring break — no class**		
11	**17**	Hydrodynamics (continued)	Techniques: gel, Electrophoresis, gel filtration, AUC	8
	18			
12	**19**		Quantum mechanical basis of spectroscopy	11

	20	Spectroscopy	Absorption spectroscopy: Beer's law, UV/vis, CD	13
13		**Test 3 (Lectures 13 to 18)**		
	21	Spectroscopy (continued)	Emission spectroscopy: fluorescence, luminescence	13
14	**22**		Scattering in solution: SLS, DLS, Raman	
	23		Nuclear magnetic resonance	14
15	**24**	Imaging and x-ray crystallography		15
	25			
Finals week		**Test 4 (Lectures 19 to 25)**		