CHEM 33500 - PHYSICAL BIOCHEMISTRY SPRING 2010

Instructor: Prof. S. De Carlo (212) 650-6070,
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Classes: Tuesday, Thursday 9:30 - 10:45 AM
Recitation: Tuesday 11:00-11:50 AM
Lab: Tuesday and/or Thursday 2:00 - 5:50 PM
Office Hours: Thursday 11:00 AM-12:00 PM

Please do not drop in outside designated office hours without an appointment. E-mail is the preferred mode of contact.

Textbooks:
Tinoco *et al.* Physical Chemistry for the Life Sciences – 4th edition.
van Holde *et. al.* Principles of Physical Biochemistry – 2nd edition.

The texts are not mandatory and all lecture notes will be posted on BlackBoard.

Grading :
Grades will be based on exams (best 2 of 3 - 15%), lab (15%), mid-term (35%) and final (35%). The final will be cumulative, all exams are closed books and no notes. Alphanumeric calculators will not be allowed, only simple scientific ones.

The following topics will be covered:

Part 1
1 General Introduction – reminder: units, equations of state
2 Biological Macromolecules
3 Introduction to Statistical Thermodynamics
4 Chemical Interactions and Properties
5 Kinetics Principles
6 Enzyme Kinetics/Energetics
7 Methods for the Separation and Characterization of Macromolecules

In this first part, the student will be reminded of important concepts taught in chemistry, biochemistry and physical chemistry I. The student will learn how to apply these concepts to bigger systems such as biological macromolecules. Chemical interactions that are important in biochemical assemblies will be discussed in depth. The student will be familiarized with simple physical principles to characterize, separate, isolate, and purify biological macromolecules. Some of these simple principles will be put in practice in the lab.

Part 2

8 Absorption and Emission Spectroscopy
9 Linear and Circular Dichroism
10 Scattering from Solutions of Macromolecules
11 Fourier Transform and X-Ray diffraction
12 Nuclear Magnetic Resonance Spectroscopy
13 Mass spectrometry and Cryo-Electron Microscopy

In the second part, the student will learn the basic principles of spectroscopy and will be introduced to the historic experiments that led to the development of useful concepts in quantum mechanics, the physics of the interaction between waves and matter. Molecular interactions will be revisited and the student will be guided through the basics of modern structural biochemistry techniques used to investigate the structure of biological complexes. The relationship between the physics behind the investigation technique and its outcome will be emphasized. A few practical examples will be used to further illustrate this relationship. The student will learn to distinguish between the modern techniques and their expected outcome, and learn when it is appropriate to use certain techniques and not others. Whenever possible, applications of such techniques to the medical field will also be presented (e.g. application of NMR for MRI).