

Chemistry 63800

Biophysical Chemistry

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Office Hours: by appointment

Course Information

Spring

T Th 10:30-11:20

Course description

This course aims to develop basic understanding on the subject of structure and folding of biological macromolecules (**proteins** and nucleic acids) and the energetics of biomolecular interactions.

Prerequisites

none

Course requirements

Homework	30 pts each (150 total)
Midterm exams:	100 pts each (200 Total)
Final Exam	200 pts
In-class oral presentation	100 pts
Total	650 pts

Grading policies

These cutoffs serve as a guide and may be adjusted

90 +	A
80 – 89	B
70 – 79	C
55 – 69	D
< 55	F

Texts (optional)

Physical Chemistry: Principles and Applications in Biological Sciences, 4th Edition
Ignacio Tinoco, Kenneth Sauer, James Wang, Joseph Puglisi

Course materials available on Brightspace (homework, etc.)

Course content

1. **Thermodynamics** (Tinoco, Chapters 2-5, ~3-4 lectures)

Free energy and physical equilibria, Free energy and chemical equilibria, Biochemical application of thermodynamics, Thermodynamics of metabolism, Biological redox reactions, biological membranes, active and passive transport.

2. **Ligand Binding and Cooperativity:** (Cantor and Schimmel, Chapters 15, 17.)

Emphasis on Scatchard plots, MWC model (~2-3 Lectures)

3. **Non-Covalent Interactions in biomolecules:**

Van der Waals, electrostatics, hydrogen bonding, hydrophobic effect in protein folding. Tinoco, Chapter 9 (~2 lectures)

Introduce concepts of dihedral angles, ASA, and Volume in description of macromolecular systems. Material from Cantor & Schimmel, Chapter 5 and literature reviews (~ 2 lectures)

4. **Diffusion and Sedimentation** (Tinoco, Chapter 6)

Focus on obtaining molecular size, shape and aggregation state information. (~2-3 lectures).

5. **Kinetics:** (Tinoco, Chapter 7, and 10 (Fluorescence only) + Reviews from literature on SPR, ITC, FA)

Enzyme kinetics, Use of kinetics to obtain binding constants and a few experimental methods for kinetic and equilibrium measurements of K_d , eg. Surface Plasmon Resonance (SPR), Isothermal Titration Calorimetry (ITC), Fluorescence titration, fluorescence anisotropy. (~ 5 lectures).

Missed or Late Work

Late homework will be accepted with 1-day extension, subject to a 4 pt deduction. Special arrangements will be made in the case of an illness or unavoidable conflict with the scheduled exams.

Ethical standards

Usual standards of academic behavior apply. When working on your report, the text should represent your original thought process. If you quote the literature source verbatim (even half-sentence) use quotation marks and provide the reference.