Fall 2011 - CHEMISTRY 675
Physical Chemistry of Macromolecules

Lectures: Mon & Wed
6:00 PM-7:15PM FW 201→FW300

Instructor – James R. Horn, FW 432, 753-8654, jrhorn@niu.edu (note: j r horn)
Office Hours – By appointment

On-Line Blackboard Course Information: https://webcourses.niu.edu

Materials: Suggested text: *"Proteins, Structure and Molecular Properties,"* 2nd edition, by Thomas E. Creighton (W.H. Freeman and Company;1992, **ISBN-10:** 071677030X); Microsoft Excel or OpenOffice Calc (http://www.openoffice.org/ which is part of a free office suite) for problem sets.

Exams and Assignments

Exams – There will be three exams covering topics discussed in the course. Each exam will count as one-third of the exam grade. These examinations may take the form of a written exam or a take-home open-book exam. The Exact dates and times will be arranged prior to each examination.

Weekly Assignments- Assignments will generally be given to students during class on Friday and will be due by 4:00 p.m. on the following Friday. Assignments should be submitted to the instructor or Blackboard (when electronic). In order for the assignments to graded and returned in a timely fashion, it is necessary that the documents be submitted on time. Late assignments will be accepted up to 5 days late at 4:00 p.m., but 10% of the total points will be deducted for each day the assignment is late.

Problem sets/presentation/quiz- One of the best ways to increase your understanding of the principles and concepts in biophysical chemistry comes from working exercises and reading relevant literature. Therefore, graded problem sets provide the most effective feedback and incentive for staying current with the material. Students are welcome and encouraged to study with other students and to discuss problem sets; however, **submitted documents should represent your individual effort.**

Literature Critiques- These critiques will be used to help you learn to think and write critically about published work. Literature articles to be used must be approved by the instructor. The format to be used for the literature critiques is given at the end of this packet.

Scheduled Final Exam Day- Monday December 5, 6-7:50PM

Grading

Final grades will be based upon performance on assignments (problem sets, literature critiques, presentations, quizzes) and exams. Three exams will count for 40% (i.e., 3 each at 13.3%) of the final grade. Assignments will count for 60% of the final grade. There is not a defined scale for grading cut-offs. Final grade assignments will be made on a curve.

Hand-outs, Class Slides

If not handed out in class useful material may be found on the course Blackboard site.

Any student who may need an accommodation due to a disability, please make an appointment to see me during my office hours, or when convenient. A letter from Disability Support Services authorizing your accommodations is usually needed before accommodations can be granted.

LECTURE SCHEDULE

The topics listed below are a guide of the anticipated order and content of the presentations. Please note that the schedule of topics here may be adjusted during the semester

Class Week		**TOPIC**
8/22	M	Introduction
	W	Structure and Properties of Amino Acids and Polypeptides
		-Protein Tertiary Structure: Sequence and Structural Homology
		-Predicting Protein Structure from Sequence
8/29	M	Molecular Structure from X-Ray Diffraction (Electronic Class)
	W	From Diffraction Data to Molecular Models
		What do Models say (and not say) about function?
9/5	M (NC)	Principles of NMR Spectroscopy
	W	Deriving Structural Information from NMR Spectroscopy
9/12	M	Spectroscopy
	W	-Absorbance
		-Circular Dichroism
		-Fluorescence
9/19	M(NC)	Monday: No class Gibbs
	W	Overview of Intermolecular Interactions in Biological Pathways
9/26	M	Use of Spreadsheets and Simulations
	W	Principles of Equilibrium Studies of Ligand binding
10/3	M	Stoichiometry of Ligand Binding & Stoichiometric Titrations
	W	Basic Principles of Parameter Estimation, Model fitting, & Data Analysis
		Parameter Estimation with Nonlinerar Least Squares Analysis
10/10	M	Chemical thermodynamics
	W	Allosteric Systems & Anti-cooperativity
		Using of statistical mechanics in modeling binding (MWC and KNF)
		Kinetics of binding
		-Surface Plasmon Resonance
10/17	M	Titration Calorimetry- Theory and Application
	W	Titration Calorimetry
		Properties of binding curves
10/24	M	Linkage in binding
	W	Measuring linked proton Binding using ITC
10/31	M	Protein Stability-
	W	-Two-state theory
		-Ensemble Properties of Proteins
		-Multi-State transitions and coopertivity
11/7	M	Chemical Denaturation of Proteins
	W	Thermal Denaturation of Proteins
		Differential Scanning Calorimetry

11/14	M W	"Buffer"/Presentations
11/21	M W (NC)	No Class Wed
11/28	M W	Intro to Computational Methods Molecular Modeling- Molecular Dynamics Molecular Docking
12/5		**FINALS WEEK**

*No Class (NC) on Monday, September 5th (Labor Day), Sept 19th, and November 23rd (Thanksgiving Break).

CHEMISTRY 675 - COURSE OBJECTIVES

Principles and techniques will be covered for investigating fundamental properties governing the function of key biological molecules. This will include examining aspects of protein and DNA structure, thermodynamics, kinetics and their interactions. Principles and techniques will be illustrated with examples from the scientific literature. Critical thinking skills will be developed through evaluation of the literature and design of experiments.

Other Useful Textbooks (not required)

Introduction to Protein Structure, by C. Branden & J. Tooze, Garland Publishing, New York.

Biophysical Chemistry by Cantor & Schimmel (3 volume set), W.H. Freeman, Co., 1980

Binding and Linkage by Wyman and Gill, University Science Books, 1990