Fall 2016 - CHEMISTRY 675
Physical Chemistry of Macromolecules

Lectures: Mon, Wed, and Fri
10-10:50AM FW 201→FW300

Instructor – James R. Horn, FW 432, 753-8654, jrhorn@niu.edu (note: j r horn)
Office Hours- W:11AM-noon or by appointment, although I am often able to accommodate if you stop by my office during the week

On-Line Blackboard Course Information: https://webcourses.niu.edu. Class slides, reading material, and other useful material may be found on Blackboard.

Materials: Suggested text: *"Proteins, Structure and Molecular Properties,"* 2nd edition, by Thomas E. Creighton (W.H. Freeman and Company; 1992, **ISBN-10:** 071677030X); Software: Microsoft Excel (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- There will be a variety of assignments (HW, small quizzes, presentations, reading, literature critiques, etc.) throughout the semester. HW 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 3 days late at 4:00 p.m., but 10% of the total points will be deducted for each day the assignment is late.

- HW/Problem sets - 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. Graded problem sets and quizzes provide 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.
- Literature- There will be literature we will read and discuss in class, sometimes preceded with a quiz

Scheduled Final Exam Day- Monday December 5, 10-11:50 a.m.

Grading

Final grades will be based upon performance on assignments (problem sets, literature critiques, presentations, quizzes) and exams. The final grade will be weighted as follows: three **exams** (**45%), assignments/quizes** (**40%)**, end of the semester **undergraduate project** (**15%)**. The initial grading scale is: 93-100%: A, 90-92%: A-, 87-89%: B+, 83-86%: B, 80-82%: B-, 77-79%: C+, 73-76%: C, 70-72: C-, 60-69%: D, Below 60%: F; however, final grade cutoffs are often on a curve (i.e., scale will not be raised, but it may be lowered).

If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu.Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

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
	F	-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
	F	What do Models say (and not say) about function?
9/5	M (NC)	
	W	Principles of NMR Spectroscopy
	F	Deriving Structural Information from NMR Spectroscopy
9/12	M	Spectroscopy
	W	-Absorbance
	F	-Circular Dichroism
		-Fluorescence
9/19	M	Overview of Intermolecular Interactions in Biological Pathways Use of Spreadsheets and Simulations
	W	
	F	
9/26	M (NC)	No class Gibbs
	W	Principles of Equilibrium Studies of Ligand binding
	F	
10/3	M	Stoichiometry of Ligand Binding & Stoichiometric Titrations
	W	Basic Principles of Parameter Estimation, Model fitting, & Data Analysis
	F	Parameter Estimation with Nonlinerar Least Squares Analysis
10/10	M	Chemical thermodynamics
	W	Allosteric Systems & Anti-cooperativity
	F	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
	F	Properties of binding curves
10/24	M	Linkage in binding
	W	Measuring linked proton Binding using ITC
	F	
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	“Buffer”/Presentations

	W F	Buffer/Presentations
11/21	M W (NC) F (NC)	Buffer Thanksgiving Break
11/28	M W F	Intro to Computational Methods Molecular Modeling- Molecular Dynamics Molecular Docking
12/5	M	**FINALS WEEK (10AM Final Exam)**

*No Class (NC) on Monday, September 5th (Labor Day), Sept 26th, and Nov. 23/25 (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 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

Biophysical Techniques, Campbell, Oxford, 2012