Chem-Che 752: Biophysical Chemistry

Total Credit: Three

Schedule: Monday 6.00 – 7.20 p.m.; Wednesday 7.30 – 9.50 p.m.

Room: not yet assigned

Lecturer: Reinhard Schweitzer-Stenner; RSchweitzer-Stenner@drexel.edu, Disque Hall 218, phone: 215-895-2268

Textbook: van Holde, Johnson, Ho: Principles of Physical Biochemistry, Prentice Hall. **Chang:** Physical Chemistry for the Chemical and Biological Science, University Science Books. **K.A. Dill and S. Bromberg** Molecular Driving Force, Garland Science. **J.N. Omuchic, Z. Luthey-Schulten and P.G. Wolynes:** Theory of Protein Folding: The Energy Landscape Perspective. *Annu. Rev. Phys. Chem.* 48, 545-600, 1997. **N. Sutin** Theory of Electron Transfer Reactions: Insights and Hindsights. *Inorg. Chem.* 30, 441-497, 1983. Research paper literature will be cited during the lecture/

Assignments: Two or three set of home assignments will be provided. The assignments will be graded and count 25%.

Exams and Homework: Besides the final there will be a written midterm, open book exams. It will count for 25% of the grade. Students are allowed to bring along with themselves all types of textbooks and class notes. The final exam counts 50%. It encompasses the writing of a review article about the designated area related to class material. Writing the article will involve some type of research activities. Literature for this review will not be provided by the instructor, it will be the sole responsibility of the student to perform an appropriate literature search. The respective assignments will be given at the end of April. The final grade will be obtained on the basis of the total score, i.e. 0.25*assignment points + 0.25*mid-term-exam points+0.5*final exam points. The grading scheme is A: 100-85 P, B: 84.99-70 P, C: 69.99 P-55 P, D: 54.99-40 P, F; less than 40 P. All students, who are not part-time are expected the Chemistry Seminar of **Dr. Harold Scheraga on April 18.**

Complaints: Complaints about the grading of assignments and exams have to be brought to the attention of the lecturer within 48 hours after their return. All grades are considered final afterwards.

Drop out: According to Drexel University policy, students are allowed to drop courses until the last day of the sixth week.

Office hour: To comply with Drexel policy I officially offer office hours on Monday from 4.30 through 6.00 p.m. **However, students are urged to see me in my office in the case of any problems and questions**.

Principal philosophy: The course will emphasize conceptual thinking instead of memorizing. Students shall be prepared to employ concepts introduced in class to a variety of problems. Exams will frequently contain question, which check the understanding of the subject. It is assumed that the participating students have a solid working knowledge of pre-calculus and calculus. I will sometimes employ concepts from Statistical Mechanics. Help will be given to students who do not have a background on this. Basic knowledge of quantum mechanics is assumed. This class will be quite different from that taught two years before. It is the first attempt of the instructor to create a course, which is dedicated to introduce basic research concepts rather than textbook teaching. Therefore textbooks, review articles and research papers will be used. Students may buy the van Holde textbook, but it is not really necessary. It is expected instead that the participating students do their own literature searches

Behavior in class: Students are asked to appear on time for the class and to switch off their cellular phones. Cheating will lead to an F for the entire course. I am encouraging discussions, but not chattering while I am lecturing. For the final exam, texts from other sources have to be explicitly quoted. It is expected that students use their own words for writing the final paper.

Syllabus

1. Protein structure

    - amino acids
    - forces and stability
    - secondary structure
    - X-ray crysallography
    - structural propensities
    - tertiary and secondary structures

2. Cooperativity and allosteric effects

    - Landau theory
    - Helix-coil transition
    - Ising model
    - Two site mode of cooperativity
    - The hemoglobin case

3. Conformation substates

    - substates and kinetics
    - protein and glasses

4. Enzyme kinetics

    - Catalysis
    - Kinetics
    - Chymotrypsin
    - Multisubstrate systems
    - Inhibition
    - Allosteric Interactions

5. Electron transfer processes

    - The respiratory chain
    - Photoreaction center
    - Potential energy and surfaces
    - Ultrafast spectroscopy

6. Protein folding and unfolding

    - The Anfinsen experiment
    - The hydrophobic effect
    - The landscape mode
    - The unfolded state