

BCH507 – Protein Structure and Function

2 or 3 Credits (see below), Spring Semester, 2009

Farber 134B, Tuesdays, 10:30-12:30

Coordinator: Daniel Kosman (829-2842; camkos@buffalo.edu)

Jennifer Surtees, Mark Sutton, Ken Blumenthal

Course Objective: The primary objective of this course is for students to become familiar with the principal, broad questions in protein structural biology and the experimental strategies used to answer them. Specifically, protein function reflects changes in the non-covalent interactions – both intra- and intermolecular – that the protein makes with its environment. Changes in these contacts result in changes in the energy of the protein and of its environment. The objective is, therefore, for students to understand this linkage between conformation and energy change, and to become acquainted with the methodologies used to observe the change in interaction, and to quantitate the associated change in energy. These methods will include quantitative thermodynamic and kinetic analyses on molecular populations and single molecules using biophysical techniques including FRET, AFM, ESR, DSC, ITC and SPR. The primary teaching will be done from the experimental literature. Using research papers, students will learn about various methods to observe protein conformation change, and the methods used to systematically map these changes to specific elements in the protein's structure. A primary objective of the course will be to develop the concept of the "state" of a system, of how a state represents a collection of atoms, their bonding, and their location in space, and how changes in this collection of atoms and its conformation can be represented by a quantifiable change in energy.

Text – There is no text for this course. Useful reference material can be found in:

“Exploring the Energy Landscape of Protein Structure and Function”. This is the material I used in BMS503 in the Fall with an additional Chapter on Tools of the Trade. I'll be making this available after Jan. 1.

Numerous internet links will be given and you will be expected to make full use of them. The first thing you have to do is to use the internet to figure out what the acronyms on the next page mean. That will be the first question I ask you on January 13th !

Class Meetings: Class will meet once a week, Tuesday, 10:30 – 12:30 in Farber 134B.

Student Evaluation: Students will be asked to make brief oral presentations based on summaries they write about a research paper that makes use of a specific technique as described above. Overall grades will be assigned on the basis of class participation and these oral presentations and the grades on the written exercises.

Variable credit: 2 or 3 hours? You can register for 2 or 3 hours of credit. For the extra credit hour you will write an additional research “proposal” on one of three or four problems offered by the faculty. This paper will be due no later than 9 am, Monday May 4, 2009. This paper will be ~10 pages in length and will focus on the use of one or more of the techniques we've covered during the course as applied to answer a research question posed by one of the faculty. These problems will be given out as the course proceeds so that you could write your paper in March if you so chose, or, at least, have it ready to turn in before May 4. If you do register for 3 credit hours, your grade for the course will be based 2/3 on your “coursework” and 1/3 on your grade on this research proposal. Credit hour change deadline: Friday, Jan. 16, 2009 to avoid change fees.

Meeting Schedule

1. Jan. 13 – Quantification of protein folding thermodynamics – DSC (Kosman)
2. Jan. 20 - Techniques for following protein folding: fluorescence and AFM (Kosman)
3. Jan. 27 – Using FRET and AFM in a protein folding experiment (Kosman)
4. Feb. 3 – Proteins and nucleic acids visualized at the single molecule level (Surtees)
5. Feb. 10 - Proteins and nucleic acids visualized at the single molecule level (Surtees)
6. Feb. 17 – Protein-membrane dynamics – EPR (Kosman)
7. Feb. 24– ABC transporters: coupling ATP hydrolysis to membrane transport (Kosman)
8. March 3 - GTP hydrolysis: Smg Signaling followed by FTIR (Kosman)

No class on March 10: Spring Break

9. March 17 – Binding, binding, binding Part I – ITC (Kosman)
10. March 24 – Binding, binding, binding Part II – SPR (Sutton)
11. March 31 – Clamping and unwinding: protein-induced DNA conformation change (Sutton)
12. April 7 – Clamping and unwinding: protein-induced DNA conformation change (Sutton)
13. April 14 – Conformation and function in a membrane channel (Blumenthal)
14. April 21– Conformation and function in a membrane channel (Blumenthal)

NOTE: Reading materials for Dr. Kosman's meetings are available in electronic form at either the BCH website - http://www.smbs.buffalo.edu/bch/announcements/BCH507/BCH_507.html - or his lab web site. For the latter, go to <http://wings.buffalo.edu/smbs/bch/kosman/index.htm> to download material from the link, Dr. Kosman's Teaching Home Page.

Readings for other faculty will be posted on the BCH website or Blackboard.