BC512: Principles of Macromolecular Structure **Fall, 2018**

Instructor: Professor Robert Cohen
Office hours and location: Friday, 2:00 – 2:50 PM (or by appointment); MRB 273
E-mail: bob.cohen@colostate.edu

Class hours: Tuesdays 9:00 – 9:50 in Walnut 111

Course description: The objective of this course is to introduce modern methods for studying the structure, function, and solution behavior of macromolecules. The course is taught in a one-hour sessions per week and will be a combination of lectures to introduce concepts and reading of scientific literature to provide case studies using related methods.

The course is being taught in parallel with Physical Biochemistry (BC411), which is a prerequisite/co-requisite for the course.

The course will require knowledge of fundamental concepts in physical chemistry and their application to understanding the behavior of biological systems, including basic principles of protein structure, thermodynamics, structure determination by NMR and crystallography, biochemical equilibria, reaction rates and kinetics, and spectroscopy.

Outcomes: Students in BC512 are expected to develop an appreciation for macromolecular structure-function relationships and an understanding of many of the biophysical techniques commonly used to study macromolecular structure and function.

Assessment: Students will read primary scientific research papers and explain the experimental methods and results in a group setting, as well as answer questions raised during class.

Schedule

Date	Topic	Discussion papers
8/21	*Lecture:* Course introduction / Protein structure basics	— — —
8/28	*Protein Love-In #1:* Quantitative assays for protein	— — —
9/4	*Protein Love-In #2:* Protein purification	Chu-Ping *et al.* 1994, *J Biol Chem*
9/11	*Lecture:* ATPases and molecular machines	— — —
9/18	*Discussion 1:* ATPase-driven protein unfolding	Sen *et al.* 2013, *Cell*
9/25	*Lecture:* Diffusion and correlation spectroscopy	— — —
10/2	*Discussion 2:* FCS and FRAP analyses of Myo2	Friend *et al.* 2017, *Cytoskeleton*
10/9	*Lecture:* H/D-exchange (“HX”) in proteins	— — —
10/16	*Discussion 3:* HX probe of chaperone-assisted folding	Ye *et al.* 2018, *PNAS*
10/23	**Guest Lecture:* Molecular Dynamics	— — —
10/30	**Discussion 4:* Molecular Dynamics	TBA
11/6	*Discussion 5:* Defined protein-folding pathways	Englander & Mayne 2017, PNAS
11/13	*Discussion 6:* Machinery for plasmid segregation	Hu *et al.* 2017, *Biophys J*
11/20	No class (Fall break)	— — —
11/27	*Lecture:* Binding and multivalent interactions	— — —
12/4	*Discussion 7:* Avidity and avidity artifacts	Sims *et al.* 2009, *Mol Cell*; *NSMB*

**** Dr. Marcello Pignataro, guest lecturer and discussion moderator***

Grading: Students will be graded on how well discussions of assigned papers are led (50%), participation in discussions during the entire semester (during both lectures and discussions, 25%), and homework problems (25%).

Discussion Leaders (2 – 3 students per paper) are responsible for:

1. Developing a list of discussion topics and questions
2. Leading discussion and answering questions during class (including important principles not covered in class)

Discussion topics and questions need to be sent to Dr. Cohen to post on CANVAS by 5:00 PM on the Friday PRIOR to the discussion on Tuesday of the following week (*e.g.*, Discussion 1 topics and questions will be posted on 9/14 for in-class discussion on 9/18). Homework problem must be sent to Dr. Cohen to post on CANVAS by 5:00 PM Thursday after the discussion.

All students are responsible for reading the assigned papers, discussing the discussion topics, and answering questions posted by the Discussion Leaders. Students who are NOT the Discussion Leaders will hand-in written answers to the homework problems (due 5:00 PM to Dr. Cohen on the Tuesday class period).

Text: There is no required text for this course. Some material will be provided via class handouts or posting on the Canvas system, and students are expected independently to seek out other sources as necessary. A suggested text:

Discussion Assignments

Discussion Paper	Discussion Leaders (to be determined)

1. Chu-Ping *et al.* 1994, *J Biol Chem*
2. Sen *et al.* 2013, *Cell*
3. Friend *et al.* 2017, *Cytoskeleton*
4. Ye *et al.* 2018, *PNAS*
5. *To be announced*
6. Englander & Mayne 2017, PNAS
7. Hu *et al.* 2017, *Biophys J*
8. Sims & Cohen 2009, *Mol Cell*;
   Sims *et al.* 2009 *NSMB*