BC512: Principles of Macromolecular Structure **Fall, 2019**

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.

BC512 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 discuss issues raised during the class.

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 (1 – 2 students per paper) are responsible for:

1. meeting with Dr. Cohen during the week prior to their assigned Discussion date to discuss their assigned paper(s)
2. developing a list of discussion topics and questions
3. leading discussion and answering questions during class (including important principles not covered in class)

Discussion topics and questions need to be sent by the Discussion Leaders 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 9/6 for in-class discussion on 9/10). ***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 submit written answers to the homework problems to Dr. Cohen at the beginning of 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.

Schedule

Date	Topic	Discussion papers
8/27	*Lecture:* Course introduction / Protein structure basics	— — —
9/3	*Protein Love-In:* Quantitative assays for protein	— — —
9/10	*Discussion #1:* Single-cell protein quantitation	Wu & Pollard 2005, *Science*
9/17	*Lecture:* Diffusion and correlation spectroscopy	— — —
9/24	*Discussion #2:*	TBA
10/1	*Lecture:* Liquid-liquid phase separation in cells	— — —
10/8	*Discussion #3:* Nucleolar domains and protein QC	Frottin *et al.* 2019, *Science*
10/22	*Lecture:* H/D-exchange ("HX") in proteins	— — —
10/29	*Discussion #4:* HX of chaperone-assisted folding	Ye *et al.* 2018, *PNAS*
11/5	*Lecture:* Proximity labeling	— — —
11/12	*Discussion #5:* BioID and APEX comparison	TBA
11/19	*Discussion #6:* Protein unfolding by the Cdc48 ATPase	Twomey *et al.* 2019, *Science*
11/26	No class (Fall break)	— — —
12/3	*Lecture:* Single-molecule force measurements	— — —
12/10	**Discussion #7:* Mechanical barriers in transcription	Chen *et al.* 2019, *Elife*
12/4	*Discussion #8:* Avidity and avidity artifacts	Sims *et al.* 2009, *NSMB*; Sims & Cohen 2009, *Mol Cell*

**** Dr. Tingting Yao, guest discussion moderator***

Discussion Assignments

Discussion Paper	Discussion Leaders (to be determined)
1. Wu & Pollard 2005, *Science*	*Bob Cohen*
2. TBA	
3. Frottin *et al.* 2019, *Science*	
4. Ye *et al.* 2018, *PNAS*	
5. TBA	
6. Twomey *et al.* 2019, *Science*	
7. Chen *et al.* 2019, *Elife*	
8. Sims & Cohen 2009, *Mol Cell*; Sims *et al.* 2009 *NSMB*	*Bob Cohen*