

BC512: Principles of Macromolecular Structure**Fall, 2107****Instructor:** Professor P. Shing Ho**Office Hours and Office:** Thursdays, 2:00 – 3:00 PM (or by appointment); MRB375**E-mail:** Shing.Ho@ColoState.EDU**Class hours:** Tuesdays 9:00 – 9:50 in Engineering E103

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 current 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, X-ray 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 a solid understanding of many of the biophysical techniques commonly used to study macromolecular structure and function.

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

Schedule

Date	Topic	Reading
8/22	<i>Lecture:</i> Introduction/Basics of Protein Structure	vH-J-H Chp 1
8/29	<i>Lecture:</i> Basics of Protein Structure	
9/5	<i>Discussion 0:</i> Threading & Tertiary Structure	Loret, 1991, <i>Biochemistry</i>
9/12	<i>Lecture:</i> Thermodynamics of Protein Folding	
9/19	<i>Discussion 1:</i> Proline cis-trans isomerization	Torbeev, 2013, <i>PNAS</i>
9/26	<i>Lecture:</i> Thermodynamics of Protein Folding	
10/3	<i>Discussion 2:</i> van't Hoff analysis tRNA synthetase	Sharma, 2008, <i>JBC</i>
10/10	<i>Lecture:</i> Heisenberg Uncertainty Principle & Light	
10/17	<i>Discussion 3:</i> Super-resolution microscopy	Galbraith, 2011, <i>J. Cell Sci</i>
10/24	No Class (Dr. Ho out of town)	
10/31	<i>Lecture:</i> X-Ray crystallography, structure quality	vH-J-H Chp 6
11/7	<i>Discussion 4:</i> Uniqueness of X-ray structures	
11/14	<i>Lecture:</i> MS H/D-exchange	Burra, 2009, <i>PNAS</i>
11/21	No Class (Fall Break)	
11/28	<i>Discussion 5:</i> MS H/D-X protein structure	Yan, 2004, <i>Mol Cell Proteom</i>
12/5	<i>Discussion 6:</i> Do folding funnels exist?	Englander, 2017, <i>PNAS</i>

Grading: Students will be graded on how well discussions of assigned papers are led (50%), participation in discussion 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 (10 pts)
2. Leading discussion during class (including any basic principles not covered in class, 20 pts)
3. Answering questions during class (10 pts)
4. Writing and grading ONE homework problem relevant to the discussion (10 pts).

Discussion topics and questions need to be sent to Dr. Ho 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 September 1 for discussion). Homework problem must be sent to Dr. Ho to post on CANVAS by 5:00 PM Thursday after the discussion.

All students are responsible for reading the assigned papers, and 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. Ho 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 to seek out other sources as necessary themselves. A suggested text:
Principles of Physical Biochemistry, 2nd Ed. by van Holde, Johnson & Ho

Discussion Assignments

Discussion Paper	Discussion Leaders (names, e-mails)		
1. Torbeev, 2013, <i>PNAS</i> Discussion: 9/19/2017	Matt O'Malley	Zachary Hazlett	Zhihao Zhao
2. Sharma, 2008, <i>JBC</i> Discussion: 10/3/2017	Gerald Liman	Vinay Kapoor	Amr Elhamamsy
3. Galbraith, 2011, <i>J. Cell Sci</i> Discussion: 10/17/2017	Ryan Czarny	Wyatt Beyers	Erin Boedicker
4. Burra, 2009, <i>PNAS</i> Discussion: 11/7/2017	Lindsay Winkenbach	Paul Otera	
5. Yan, 2004, <i>Mol Cell Proteom</i> Discussion: 11/28/2017	Craig Marshall	Jacob Cox	Abby Ward