

Biology 5357: Chemistry & Physics of Biological Molecules**Fall 2009**

Class Meetings: Tuesday and Thursday, Lecture, 8:30-10:00am, 521 Becker Library
Friday, Discussion Section, 2:30-3:30pm, 521 Becker Library

Coursemaster: Jay Ponder (CCB 208, 362-4195, ponder@dasher.wustl.edu)

Web Site: <http://dasher.wustl.edu/bio5357/>

Objectives: This course explores the physicochemical basis for the structural integrity, thermodynamic properties and biological functions of proteins, nucleic acids and lipid membranes

Textbooks: There are no required textbooks. The following books may be useful for parts of the course, and are available from WashU libraries and online booksellers:

Introduction to Protein Structure, 2nd Ed., Branden & Tooze, 1999

Protein Structure and Function, Petsko & Ringe, 2004

Principles of Physical Biochemistry, 2nd Ed., van Holde, Johnson & Ho, 2005

Thermal Biophysics of Membranes, Heimburg, 2007

Membrane Structural Biology, Luckey, 2008

Other Info: Bio 5357 is required by the DBBS Graduate Programs in Biochemistry and in Computational & Molecular Biophysics. Lectures coincide with the corresponding Medical School course, and 1st-year Medical and MSTP students may substitute Bio 5357 for credit. Undergraduate courses in Biochemistry and in Physical Chemistry are recommended prior to enrollment, but not required.

Module 1: Peptides and Proteins: Structure and Folding

Aug 27	Protein Taxonomy I: Primary & Secondary Structure	Ponder
Sep 1	Protein Taxonomy II: Motifs & Supersecondary Structure	Ponder
Sep 3	Protein Taxonomy III: Tertiary Structure & Fold Types	Ponder
Sep 8	Protein Folding I: Forces that Determine Structure	Ponder
Sep 10	Protein Folding II: Mechanisms of Protein Folding	Ponder
Sep 11	Special Topics: G-Protein Coupled Receptors	Marshall
Sep 15	Protein Folding III: Characterization of Folding Pathways	Ponder
Sep 17	Protein Folding IV: Mutagenesis Studies	Ponder
Sep 18	Discussion Section	Ponder
Sep 22	Protein Folding V: Structure Prediction & Design	Ponder

Module 2: Proteins in the Crystal and in Solution

Sep 24	X-Ray I: Crystals, Symmetry, Diffraction, Bragg's Law	Ponder
Sep 25	Discussion Section	Ponder
Sep 29	X-Ray II: Structure Factors, Density & Patterson Maps	Ponder
Oct 1	X-Ray III: Phase Determination Methods & Refinement	Ponder

Oct 2	Special Topics: Recent Applications of Crystallography	Ellenberger
Oct 6	NMR I: Intrinsically Disordered Proteins	Hall
Oct 8	NMR II: More on Intrinsically Disordered Proteins	Hall
Oct 9	Discussion Section	Hall
Oct 13	NMR III: Protein Dynamics	Hall
Oct 15	NMR IV: More on Protein Dynamics	Hall
Oct 16	No Class - Fall Break	

Oct 20 **Mid-Term Examination**

Module 3: Nucleic Acids: Structure and Interactions

Oct 22	DNA I: A-, B- and Z-Form Duplex Structures	Hall
Oct 23	Discussion Section	Hall
Oct 27	DNA II: DNA Chips, Non-Standard Structure, Bending	Hall
Oct 29	DNA III: Supercoiling, Persistence Length, Electrostatics	Hall
Oct 30	Discussion Section	Hall
Nov 3	RNA I: Ribozymes	Hall
Nov 5	RNA II: Aptamers and Riboswitches	Hall
Nov 6	No Class - Biochemistry & Molecular Biophysics Retreat	
Nov 10	RNA III: Structure and Stability	Hall
Nov 12	RNA IV: Type I Intron & RNA Folding	Hall
Nov 13	RNA V: RNA-Protein Interactions	Hall

Module 4: Membranes and Associated Molecules

Nov 17	Membranes I: Composition, Properties and Function	Schlesinger
Nov 19	Membranes II: Structural Overview by Physical Methods	Schlesinger
Nov 20	Special Topics: Proteins and Membranes	Henzler-Wildman
Nov 24	Stabilizing Forces: Hydrophobic & vdW, and Surface Tension	Schlesinger
Nov 26	No Class – Thanksgiving Break	
Nov 27	No Class – Thanksgiving Break	
Dec 1	Forces Affecting Function: Curvature and Fluctuation	Schlesinger
Dec 3	Modeling Membranes: Fluidity, Diffusion and Inhomogeneity	Schlesinger
Dec 4	Special Topics: Membrane Simulation	Baker
Dec 8	Membrane Fusion and Membrane Pores	Schlesinger
Dec 10	Membrane Perturbations: Peptides and Proteins	Schlesinger
Dec 11	Special Topics: Channels and Transport	Heuttner

Dec 15 **Final Examination**