MBIOS 466/566

Fall, 2008

Instructors: Michael Smerdon, Jim Brozik, Dan Mitchell, ChulHee Kang

Texts :

Tinoco Jr., I., Sauer, K., Wang, J. C., and Puglisi, J. D. (2002) *PHYSICAL CHEMISTRY: Principles and Applications in Biological Sciences*, Prentice Hall, Upper Saddle River, NJ

Barrante, James R. (1998) *Applied Mathematics for Physical Chemistry*, Prentice Hall, Upper Saddle River, NJ

Supplemental material and problems will be assigned for specific topics.

Instructor	Topics
44 lectures	
	I. Absorption and Emission Spectroscopy of Biopolymers
Smerdon (10 lectures) 8/25 – 9/17	A. Basic principles of absorption and emission of light 1. Predictions of quantum theory 2. Absorption-emission balance and rules for emission B. Absorption and emission of biopolymers 1. UV-VIS and CD absorption (protein and DNA 2º structure determination) 2. Fluorescence (quenching; energy transfer & FRET; polarization)
	---------- EXAM I* (9-19-08) ----------
Smerdon (4 lectures) 9/22 – 9/29	**II. Size and Shape of Biopolymers in Solution** A. Sedimentation velocity (sedimentation coefficient) B. Sedimentation equilibrium (M_w of monomers and complexes) C. Light scattering (molar mass and rms radius)
Brozik (6 lectures) 10/1 – 10/13	**III. Single Molecule Imaging of Biopolymers** A. Fluorescence Microscopy: Geometric Optics, Microscope Objectives, Optical Filters, Wide Field Imaging, Scanning Confocal Imaging, Detectors, Optical Aberrations. B. Single Molecule Imaging / Spectroscopy: Single Photon Statistics, Single Photon Detectors (ICCD, EMCCD, PMTs, APDs) and Detection Limits (quantum efficiencies and noise), Collection Efficiency, FCS, TCSPC. C. Stochastic Nature of Biological System: Potential Energy Surfaces, Rectified Stochastic Motion, Probability Distributions, Discrete State Models, Real Single Molecule Data.
	---------- EXAM II* (10-15-08) ----------
Mitchell (10 lectures) 10/17 – 11/7	**IV. Magnetic Resonance Spectroscopy of Biopolymers** A. Basic principles of NMR B. Solid-state NMR C. Protein & nucleic acid structure determination
	---------- EXAM III* (11-10-08) ----------
Kang (10 lectures) 11/12 – 12/10	**V. Scattering and Diffraction of Biopolymers** A. X-ray diffraction and crystallography of DNA, RNA and proteins B. Electron diffraction and microscopy (2D crystal and membrane proteins) C. Synchrotron and MAD, Laue method D. Modern applications in biotechnology (protein engineering and drug design)
	---------- EXAM IV* (12-12-08) ----------

*Each exam will cover only material covered since the last exam.