Chemistry 01:160:437, Chemistry 16:160:537
Biophysical Chemistry I

Instructor

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Location and Time

first class session:	CCB, Tuesday September 4, 3:20-4:40 PM
all subsequent class sessions:	Waksman Institute 1001, Tuesdays, 3:20-4:40 PM and Waksman Institute 311, Thursdays, 3:20-4:40 PM

Course Description

Three-dimensional structures and interactions of proteins, nucleic acids, and their macromolecular assemblies, emphasizing principles of structural assembly and connections between structure and function, and introducing students to methods used to visualize structures.

Course Pre-Requisites/Co-Requisites

Required: 01:160:324, 328, or 342 or equivalent coursework in physical chemistry or physical biochemistry, or permission of the instructor.

Recommended: 11:115:403-404, 01:694:407-408, or equivalent coursework in biochemistry and molecular biology (may be taken concurrently), or permission of the instructor.

Course Texts

Required: *Textbook of Structural Biology,* Anders Liljas et al., 2nd Edition, 2017.

Recommended: *Principles of Protein Structure*, G. Schultz and R. Schirmer, 1979.

Recommended: *The Double Helix: A Personal Account of the Discovery of the Structure of DNA*, J. Watson, 1968 (any edition).

Course Structure

Students are expected (i) to read and understand course literature, (ii) to complete homework assignments, (iii) to deliver oral presentation on biomolecular system/structure, and (iv) to prepare final written report on biomolecular system/structure, and (v) to participate in class discussions. Students will build molecular models and use databases and software tools for understanding and manipulating structures of biological macromolecules.

Course Requirements

Homework (30%)

Oral presentation (30%).

Written report (30%)

Participation (10%).

Students enrolled in the course will be subject to the Rutgers University Academic Integrity Policy (http://academicintegrity.rutgers.edu/files/documents/AI_Policy_2013.pdf).

Course Schedule

session 1, 9/4: overview: space, time, and energy

session 2, 9/6: bonded interactions: bonds, bond lengths, bond angles, torsion angles, chemical energy

session 3, 9/11: non-bonded interactions, 1: van der Waals interactions, electrostatic interactions, H-bonds

session 4, 9/13: non-bonded interactions, 2: hydrophobic effect, polyelectrolyte effect, binding energy

session 5, 9/18: structure determination; structure analysis; structure visualization

session 6. 9/20 (guest instructor Stefjord Tojolli): structure visualization with PyMOL, 1

session 7. 9/25 (instructor away: guest instructor Stefjord Tojolli): structure visualization with PyMOL, 2

session 8, 9/27: protein structure, 1: amino acids; levels of protein structure; primary structure; ϕ/φ space

session 9, 10/2: protein structure, 2: secondary structure, information presentation

session 10, 10/4: protein structure, 3: tertiary structure, quaternary structure, folding

session 11, 10/9: DNA structure, 1: nucleotides; primary structure; α/β/γ/δ/ε/ξ space

session 12, 10/11: DNA structure, 2: DNA secondary structure, information preservation

session 13, 10/16: DNA structure, 3: DNA topology, topoisomers, topoisomerases

session 13, 10/18: protein-DNA interaction, 1

session 13, 10/23: protein-DNA interaction, 2

session 14, 10/25 (instructor away): RNA structure

session 15, 10/30: enzymes, substrates, templates, cofactors, inhibitors

session 16, 11/01: central dogma; nucleic acid synthesis/engineering; protein synthesis/engineering, 1

session 17, 11/06: central dogma; nucleic acid synthesis/engineering; protein synthesis/engineering, 2

session 18, 11/08: central dogma; nucleic acid synthesis/engineering; protein synthesis/engineering, 3

session 18, 11/13: molecular machines: RNA polymerase, 1, transcription machinery

session 19, 11/15: molecular machines: RNA polymerase, 2; transcription initiation

session 20, 11/20: molecular machines: RNA polymerase, 3; transcription initiation-elongation

session 21, 11/27: molecular machines: RNA polymerase, 4; transcription elongation-termination

session 23, 11/29: student presentations, 1

session 24, 12/04: student presentations, 2

session 25, 12/06: student presentations, 3

session 25, 12/11: student presentations, 4

Course Readings *(Textbook of Structural Biology)*

session 3, 9/11: chapters 1-2.1

session 5, 9/18: chapter 19.1

session 8, 9/27: chapter 2.2

session 9, 10/2: chapters 2.3-2.4, 19.2

session 10, 10/4: chapters 3-4, 19.3

session 11, 10/9: chapters 5.0-5.1

session 12, 10/11: chapter 5.2

session 14, 10/25: chapter 5.3

session 15, 10/30: chapter 10.2

session 17, 11/06: chapters 8-9

session 18, 11/08: chapters 10.3-11

session 21, 11/27: chapter 10.3-10.6

Course Recommended Reading (*Principles of Protein Structure*)

session 3, 9/11: chapters 3.1-3.4

session 4, 9/13: chapters 3.5-3.6

session 5, 9/18: chapter 7

session 8, 9/27: chapters 1, 4

session 9, 10/2: chapter 5.1

session 10, 10/4: chapters 5.2-6

Course Recommended Reading (*The Double Helix*)

session 12, 10/11: all chapters

Homework Assignments

session 10, 10/9: homework assignment 1

session 11, 10/11: homework assignment 2

session 13, 10/16: homework assignment 3

session 15, 10/30: homework assignment 4

session 17, 11/06: homework assignment 5