BIOCHEMICAL AND BIOPHYSICAL METHODS II

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Winter Semester 2020
Tuesdays and Thursdays, 3-5 PM, Weiss 301

This course presents the fundamental principles of biochemistry and biophysics, with an emphasis on methodologies. In addition, case studies are discussed, examining how physical and chemical methods have been used to establish the molecular mechanisms of fundamental biological processes. The course is offered in two consecutive semesters. Part I (Fall semester) introduces biological macromolecules and experimental tools for dissecting their three-dimensional structures and assembly principles. Part II (Winter semester) covers methods aimed at delineating the conformational fluctuations, chemical turnovers, and kinetic trajectories of biological complexes at molecular, cellular, and evolutionary scales. While it is highly recommended to enroll in both consecutive semesters, it is not required.

Format: The course will feature one 2-hour lecture per session. The first half of the semester will focus on in-depth introductions to contemporary methodologies for visualizing and probing dynamic molecular and cellular processes. The second half of the semester focuses on case studies where these techniques are used to address ongoing research challenges in biology.

Method of evaluation: Students will choose from a list of topics assembled by the course organizers and write a News-and-Views style mini-review with one figure and 10-15 references (2-page limit, Arial 11 pt. font, 0.5" margins), covering both historical background and latest development on the subject.

Recommended reading:

- *The Molecules of Life: Physical and Chemical Principles* by John Kuriyan, Boyana Konforti, and David Wemmer
- *Molecular Biology of the Cell* by Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter
- *Physical Biology of the Cell* by Rob Phillips, Jane Kondev, Julie Theriot, and Hernan Garcia

Schedule:

Date	Topic	Lecturer
Jan. 14	Methods: Atomic force microscopy	Simon Scheuring (WCM)
Jan. 16	Methods: Super-resolution microscopy	Melike Lakadamyali (U Penn)
Jan. 21	Methods: Single-molecule fluorescence and force spectroscopy	Shixin Liu
Jan. 23	Methods: Molecular dynamics simulation and computational chemistry	John Chodera (MSKCC)
Jan. 28	Methods: Protein chemistry	Tom Muir (Princeton)
Jan. 30	Methods: Enzymology	Philip Cole (HMS)
Feb. 4	Methods: Spectroscopy	Tom Sakmar
Feb. 6	Methods: Chromatin dynamics at the genomic scale	Viviana Risca
Feb. 11	Case studies: Evolution of protein folding and function	Rama Ranganathan (U Chicago)
Feb. 13	Case studies: Macromolecular phase separation	Eli Rothenberg (NYU)
Feb. 18	Case studies: Cytoskeletal filaments and cell mechanics	Greg Alushin
Feb. 20	Case studies: Reading and writing the histone code	David Allis
Feb. 25	Case studies: Evolutionary dynamics of the nuclear pore complex	Mike Rout
Feb. 27	Case studies: Dynamic cellular processes	Tarun Kapoor

	Review draft due	
Mar. 3	Case studies: Gene evolution	Li Zhao
Mar. 5	Office hours	
Mar. 10	**Review due**	