

BIOCHEMICAL AND BIOPHYSICAL METHODS I

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Fall Semester 2019

Tuesdays and Thursdays, 3-5 PM, Carson Auditorium*

*November 7, 2019: RRB 110

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 recommend to enroll in both consecutive semesters, it is not required.

Format: The course will feature 1-2 lectures per session. The first half of the semester will focus on in-depth introductions to contemporary methodologies for the isolation and structural characterization of macromolecules and their assemblies. The second half of the semester focuses on case studies where these techniques are used to address ongoing research challenges in molecular biophysics.

Method of evaluation: Students will develop and defend a topical, concise research proposal on a subject distinct from their thesis research. This will take the form of a Specifics Aims page in NIH format (1 page, Arial 11 pt. font, 0.5" margins), followed by an oral presentation (5 minutes presentation + 5 minutes of questions). A maximum of 5 slides is permitted for the oral presentation.

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

Date	Topic	Lecturer(s)
Sep. 10	Intro to macromolecules: nucleic acids and proteins	Greg Alushin & Shixin Liu
Sep. 12	Methods: Isolating and tagging proteins	Mike Rout
Sep. 17	Methods: X-ray crystallography	Seth Darst
Sep. 19	Methods: Single-particle cryo-electron microscopy	Gabriel Lander (Scripps)
Sep. 24	Methods: Nuclear magnetic resonance spectroscopy	Art Palmer (Columbia)
Sep. 26	Methods: PyMOL tutorial	Darst lab
Oct. 1	Methods: Cryo-electron tomography	Elizabeth Villa (UCSD)
Oct. 3	Methods: Biological Mass spectrometry	Brian Chait
Oct. 8	Methods: Multi-scale structural modeling	Andrej Sali (UCSF)
Oct. 10	Case studies: Membrane proteins	Jue Chen & Rod MacKinnon
Oct. 15	Case studies: DNA replication Specific Aims Page Due	Mike O'Donnell
Oct. 17	Case studies: Transcription	Seth Darst & Elizabeth Campbell

Oct. 22	Case studies: Nucleic acid structure	Scott Strobel
Oct. 24	Case studies: Ribosome biogenesis	Sebastian Klinge
Oct. 29	Case studies: Cryo-EM of difficult specimens	Bridget Carragher (NYSBC) & Richard Hite (MSKCC)
Oct. 31	No lecture: Office hours to practice / discuss proposals	
Nov. 5	Proposal presentations	
Nov. 7	Proposal presentations	
Nov. 12	Proposal presentations	