

BIOCHEMISTRY 6765: ADVANCED PHYSICAL BIOCHEMISTRY

BIOCHEM 6765.01 - AdvBiochm-Physical

MoWeFr 9:10AM – 10:05AM (7 weeks)

Instructor: Mark P. Foster, foster.281@osu.edu, 734 Riffe Bldg

Office hours: Mondays, 11:30 – 12:30 am, or by appointment

GTA: Cameron Jamshidi, jamshidi.6@osu.edu

FOCUS

Survey of Molecular Biophysical Methods

GOAL

Equip students with sufficient background to be able to read and understand research papers utilizing biophysical methods to understand macromolecular structure, function and interactions.

CLASS MATERIALS

Materials for the course will include assigned text readings, handouts provided in class, and materials available on-line via Carmen (<http://carmen.osu.edu>). Other sources of information will include the current research literature as well as structural databases.

PRIMARY TEXT

Methods in Molecular Biophysics. Zaccai, Serdyuk & Zaccai. 2nd Ed. 2017. ISBN 978-1107056374.

<https://www.amazon.com/Methods-Molecular-Biophysics-Structure-Dynamics/dp/1107056373>

SUPPLEMENTARY TEXTS:

The Molecules of Life. Physical and Chemical Principles. Kuryan, Konforti, Wemmer. 2013. ISBN 9780815341888

Biophysical Chemistry: Part II: Techniques for the Study of Biological Structure and Function. Cantor and Schimmel, 1980, ISBN 9780716711902

Biophysical Techniques, Iain Campbell, Oxford University Press, 2012. ISBN 9780199642144.

<http://global.oup.com/uk/orc/biosciences/biochem/campbell/>

TOPICS

- Thermodynamics (Equilibria, Calorimetry)
- Hydrodynamics (Diffusion, Sedimentation, Light Scattering)
- Mass Spectrometry
- Computational tools: Data fitting (GNU PLOT), molecular visualization (PyMOL)
- X-ray Diffraction (Crystallography, Solution Scattering)
- Electronic Spectroscopy (UV-Vis, CD, Fluorescence)
- NMR Spectroscopy (Basics, Structure Determination, Dynamics)
- Molecular Modeling (Dynamics Simulations, Docking)
- Single Molecule Methods (SM-FRET, AFM, Tweezers)
- Microscopy (Cryo-EM)

GRADING

Homework Assignments (6): 1/3, Midterm exam: 1/3, Final exam: 1/3.

Letter grades will be assigned on a curve, on a scale appropriate for an advanced graduate course.

EXAMS

Midterm: Wednesday, 1/30/2019, 7-9 pm

Final: Monday, 2/25/2019, 7-9 pm

COMPUTER-AIDED STRUCTURE ANALYSIS

We will use of molecular visualization software to learn about macromolecular structure and interactions using the software PyMOL (<http://www.pymol.org/>). The university has a site license that will allow installation on your own (or laboratory) computer; details will be posted on Carmen. A tutorial on the use of the software will be provided in one class session.

DATA FITTING

We will use computer software (e.g., Gnuplot) to fit data to models using non-linear regression, and discuss how to assess the resulting fit and parameters.

ASSIGNMENTS

Problem sets (6) including research paper analysis will be assigned throughout the course; students are allowed to work in groups to solve the homework assignments. Some of the homework problems will be new this year, and some will be the same as ones assigned previously. *It is academic misconduct to copy old answer keys and hand them in as your own work.*

TOP HAT

TopHat.com will be used for polling and informal assessments. The join code for the course is 970810. You may wish to install an app on your mobile device to facilitate interaction.

MISCONDUCT

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

ACCESSIBILITY

Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614- 292-3307, slds@osu.edu; <http://slds.osu.edu>.

BIOCHEM 6765 LECTURE PLAN

Date	Day	Topic	Reading	Assignment
2019-01-07	Mon	Intro	ZSZ Introduction, Ward 2013	
2019-01-09	Wed	Mass Spectrometry	ZSZ B, Konermann 2014	
2019-01-11	Fri	Thermodynamics	ZSZ C, TMOL 10.25-29	
2019-01-14	Mon	<i>(MLK Holiday)</i>		
2019-01-16	Wed	Non-linear Data Fitting	<i>Mutolsky & Christopolous, 2003</i>	Asg. 1 due
2019-01-18	Fri	Hydrodynamics	ZSZ D, TMOL 17	
2019-01-21	Mon	(cont.)		
2019-01-23	Wed	X-ray Crystallography	ZSZ G3, Wlodawer 2013	Asg. 2 due
2019-01-23	Wed	<i>Molecular Visualization (7-9 pm in BPL)</i>	PyMOL tutorials	
2019-01-25	Fri	X-ray Crystallography		
2019-01-28	Mon	Solution Scattering (SAXS)	ZSZ G1-2, Putnam 2007	
2019-01-30	Wed	Review		Asg. 3 due
2019-01-30	Wed	<i>Midterm exam (7-9 pm)</i>		
2019-02-01	Fri	Electron Microscopy (Cryo-EM)	ZSZ H	
2019-02-04	Mon	Molecular Modeling (Dynamics Simulations, Docking)	ZSZ I, Adcock+McCammon_CR2016	
2019-02-06	Wed	(cont.)		
2019-02-08	Fri	NMR – Intro	ZSZ J, Marion 2013	Asg. 4 due
2019-02-11	Mon	NMR – Dynamics	<i>Mittermeier+Kay 2009, Kleckner 2010</i>	
2019-02-13	Wed	NMR -- Structure Determination		
2019-02-15	Fri	Electronic Spectroscopy	ZSZ E, Klostermeier & Millar 2002	Asg. 5 due
2019-02-18	Mon	(cont.)		
2019-02-20	Wed	Single Molecule Methods	ZSZ F, Walter 2008	
2019-02-22	Fri	(Review)		Asg. 6 due
2019-02-25	Mon	<i>Final Exam (7-9 pm)</i>		