

Biophysical Chemistry

Master Chemie, Master Life Science, Master Nanoscience
Winter Semester 2019/2020

Instructors:

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Course info in ILIAS

Information about the course, including course materials, problem sets, and announcements can be found in ILIAS.

Course overview

The course will focus on the application of concepts and techniques from Physical Chemistry to practical problems in Life Science. The first part of the course will cover spectroscopic techniques that can provide information on structure and dynamics of biological systems. The second part of the course will focus on thermodynamic concepts and kinetics to describe biological macromolecules. Applications in current research fields will be presented.

Learning Objectives

The aim of the course is to provide the student with a toolbox of Physical Chemistry to address problems in Life Science. After completion of the course the student will be familiar with principles and is able to discuss and evaluate the concepts and techniques covered. The student will be able to select the appropriate tool for a problem at hand. Optional extension of the course with a research internship (see below) gives the student the opportunity to apply and extend course topics in the scientific practice.

Assignments

Problem sets are released one week before each tutorial session. Solutions will be discussed in these tutorial sessions. Make sure to have your own set of solutions prepared beforehand! During the course, the students will be asked to read a number of recent research papers, which will also be discussed in the tutorial sessions.

Final grade

The final grade for the course will be based on a 30-min oral exam.

Study Material

The biophysical part of the course is largely covered in the text book "Molecules of Life" by Kuriyan, Konforti, and Wemmer. Miscellaneous study material will be posted in ILIAS.

Credits

The credit for the course is 6 ECTS. The course can be extended with an additional 6 ECTS by doing a research internship (4-5 weeks full-time) in one of the biophysical chemistry groups: Drescher, Hauser, Kovermann, Mathies, Peter, Zumbusch.

Course Schedule – Winter Semester 2019-2020

Part 1: Guinevere Mathies / Xiaoxun Chen

	Topic	Date, Time	Room
Lecture 1	Practicalities, Intro Structural Biology, Fourier Transformations, Spin	Wed. Oct. 23, 10:00-11:30	M631
Tutorial 1		Mon. Oct. 28, 13:30-15:00	L829
Lecture 2	Magnetic Resonance Spectroscopy, Solution NMR, Magic-angle spinning NMR	Wed. Oct. 30, 10:00-11:30	M631
Tutorial 2		Mon. Nov. 4, 13:30-15:00	L829
Lecture 3	X-ray Diffraction part I	Wed. Nov. 6, 10:00-11:30	M631
Tutorial 3		Mon. Nov. 11, 13:30-15:00	L829
Lecture 4	X-ray Diffraction part II, Cryo-Electron Microscopy	Wed. Nov. 13, 10:00-11:30	M631
Tutorial 4		Mon. Nov. 18, 8:15-9:45	M631
Lecture 5	Eigenvalues and Eigenvectors, Structure of Atoms and Molecules, Interaction with Light	Wed. Nov. 20, 10:00-11:30	M631
Lecture 6	Fluorescence and Phosphorescence, Fluorescence Microscopy, Super-resolution	Mon. Nov. 25, 13:30-15:00	L829
Tutorial 5		Wed. Nov. 27, 10:00-11:30	M631
Tutorial 6		Mon. Dec. 2 13:30-15:00	L829
Lecture 7	Diffusion, Fluorescence Correlation Spectroscopy	Wed. Dec. 4, 10:00-11:30	M631
Tutorial 7		Mon. Dec. 9, 13:30-15:00	L829

Part 2: Karin Hauser / Ho-Wah Siu

Lecture 8	Molecular Interactions	Wed. Dec. 11, 10:00-11:30	M631
Tutorial 8		Mon. Dec. 16, 13:30-15:00	L829
Lecture 9	Energy and Entropy	Wed. Dec. 18, 10:00-11:30	M631
Tutorial 9		Mon. Jan. 6, 13:30-15:00	L829
Lecture 10	Bioenergetics and Driving Forces	Wed. Jan. 8, 10:00-11:30	M631
Tutorial 10		Mon. Jan. 13, 13:30-15:00	L829
Lecture 11	Membrane Transport	Wed. Jan. 15, 10:00-11:30	M631

Tutorial 11		Mon. Jan. 20, 13:30-15:00	L829
Lecture 12	Molecular Recognition	Wed. Jan. 22, 10:00-11:30	M631
Tutorial 12		Mon. Jan. 27, 13:30-15:00	L829
Lecture 13	Kinetics and Rates of Molecular Processes	Wed. Jan. 29, 10:00-11:30	M631
Tutorial 13		Mon. Feb. 3 13:30-15:00	L829
Lecture 14	Pathways and Transition States in Protein Folding	Wed. Feb. 5, 10:00-11:30	M631
Tutorial 14		Mon. Feb. 10, 13:30-15:00	L829