Biophysical Chemistry
Master Chemie, Master Life Science, Master Nanoscience
Winter Semester 2021/2022

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 (https://ilias.uni-konstanz.de/goto.php?target=crs_1286950).

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 (M. Drescher) will cover spectroscopic techniques that can provide information on structure and dynamics of biological systems. The second part of the course (K. Hauser) 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, evaluate, and apply the concepts and techniques covered. The student can 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.

Lectures
Lectures will take place on Thursdays (L602, 13:30-15:00, starting Oct. 28, 2021).

Tutorials
Tutorials will take place on Mondays (L602, 13:30-15:00). Due to the holiday on Mon. Nov. 1, the first Tutorial will be exceptionally on Thu. Nov. 4. Exception: on Nov. 08, 2021 the course will be held in R512.

The first problem set will be released via Ilias on Thu. Oct. 28. All students prepare their own solution set and hand it in before Thu. Nov. 4, 1pm via Ilias. Its solutions will be discussed in the tutorial on Thu. Nov. 4. (L602, 13:30-15:00).

All following problem sets will be released on Mondays, beginning on Nov. 1, 2021. All students prepare their own solution set and hand it in on the following Monday before 1pm via Ilias.

The solutions will be evaluated by the teaching assistants with either a pass or a fail. In order to participate in the oral exam, a student must have passed 9 out of the 12 problem sets. The solutions
to the problem sets will be discussed in tutorials which take place on Mondays (L602, 13:30-15:00, starting Nov. 4, 2021). Exception: on Nov. 08, 2021 the course will be held in R512.

Exam
The grade will be based on a 30-min oral exam (individual appointments).

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 2021-2022

Part 1: Malte Drescher / Jessica Dröden / Andreas Scherer

Lecture Practicalities, Intro Structural Biology, Fourier Transformations, Spin
Thu. Oct 28
Tutorial Thu. Nov 4

Lecture Magnetic Resonance Spectroscopy, Solution NMR, Magic-angle spinning NMR
Mon. Nov. 8

Lecture X-ray Diffraction, Cryo–Electron Microscopy
Thu. Nov. 11
Tutorial Mon. Nov. 15

Lecture Lecture Computer Chemistry
Thu. Nov 18
Tutorial Mon. Nov. 22

Lecture Eigenvalues and Eigenvectors, Structure of Atoms and Molecules, Interaction with Light
Thu. Nov. 25
Tutorial Mon. Nov. 29

Lecture Fluorescence and Phosphorescence, Fluorescence Microscopy, Superresolution
Thu. Dec. 2
Tutorial Mon. Dec. 6

Lecture Diffusion, Fluorescence Correlation Spectroscopy
Thu. Dec. 9
Tutorial Mon. Dec. 13
Part 2: Karin Hauser / Shane Maguire

Lecture Molecular Interactions
Thu. Dec. 16
Tutorial Mon. Jan. 10

Lecture Energy and Entropy
Mon. Dec. 20
Tutorial Mon. Jan. 10

Lecture Bioenergetics and Driving Forces
Thu. Jan. 13
Tutorial Mon. Jan. 17

Lecture Membrane Transport
Thu. Jan. 20
Tutorial Mon. Jan. 24

Lecture Kinetics and Rates of Molecular Processes
Thu. Jan. 27
Tutorial Mon. Jan. 31

Lecture Pathways and Transition States in Protein Folding
Thu. Feb. 3
Tutorial Mon. Feb. 7