[C3.3]	Advanced methods in biochemistry and biophysics	Compulsory elective module in the core area C3	3-9 CP (total) = 90-270 h		1,5 - 5,5 SWS
			Contact hours 1,5-5,5 SWS / 22,5-82,5 h	Independent study 67,5h - 187,5 h	

Content

The practical course consists of 5 different experimental parts, which are carried out all day in groups of usually two students.

1. **Determining the structure of a protein using solution NMR**: The students receive an introduction to multidimensional spectroscopy on an NMR device. They then evaluate the 3D and 2D spectra on the computer and calculate the structure of the protein.
2. **Mass spectrometry**: Under supervision, the students record MALDI and ESI mass spectra of peptides and proteins. Using the spectra, the students learn how to interpret the data obtained, including determining the sequence of peptides from MS/MS data. With prepared PMF spectra of enzymatic protein restrictions (PMF = Peptide Mass Fingerprint), the identification of proteins using databases is learned.
3. **Solid-state NMR:** The basics of MAS-NMR are taught (experimental setup; sample preparation; spectra recording). The basics of lineshape analysis and the influence of molecular motions will be introduced for the example of lipid bilayer samples. In addition, precise spin-spin distances are determined using dipolar recouplig techniques. The experimental data are evaluated by the students using computer simulations with the SIMPSON software.
4. Structure determination using **X-ray structure analysis**: The students set up crystallization experiments and then mount the resulting crystals on an X-ray system. The scattered radiation of the crystals after X-ray bombardment is quantitatively recorded. The structure of the protein is determined from diffraction data by means of "molecular replacement".
5. In the block course "**Introduction to biological electron microscopy with image processing**", after a 2-hour introductory lecture, practical aspects of biological electron microscopy and image processing are worked on directly on the research equipment in small groups (3-4 students). Students will use negative staining and cryo-fixation methods, and gain hands-on experience with TEMs.

At least 2 of the experimental parts must be taken.

Learning outcomes and skills

After completing the module, students can:

- apply these modern biophysical methods in the laboratory
- select the right techniques for specific biophysical questions
- accurately record and evaluate relevant data
- can link hypotheses about computer simulations with experimental data
- correctly present and interpret the results obtained

Admissions requirements/Conditions for participation in the module/courses

Methods for structural biology and biophysics module C3.1.

Recommended prior knowledge

Organizational details

Module allocation (degree programme/faculty)	Master Biochemistry / FB14
Module transferrable to other degree programmes	
Module offered	- Practical course 1: summer semester - Practical course 2: summer semester - Practical course 3: summer semester - Practical course 4: summer semester - Practical course 5: winter semester
Duration	2 semesters
Module coordinator	Prof. Glaubitz
Course requirements for credits	
Participation record	regular attendance
Coursework	Fulfillment and protocols of the practical course experiments
Forms of teaching / learning	
Language teaching and instruction	English
Module assessment	**Form / duration / content, if applicable**
Final module assessment	Protocols (ungraded, see §35)
Cumulative module assessment consisting of	
Composition of the module grade for cumulative module assessment	

	Mode of teaching / study	Semester hours per week	Semester CP			
			1	2	3	4

Advanced methods in biochemistry and biophysics *(At least 2 of the experimental parts must be taken.)*	P					
1. solution NMR		1	2			
2. Mass spectrometry		0,5		1		
3. Solid-state NMR		1		2		
4. X-ray structure		1		2		
5. Introduction to biological electron microscopy with image processing		2	2			
TOTAL		1,5-5,5	3-9			