CH-312

Molecular and cellular biophysics II

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Cursus	Sem.	Type
Chemistry	BA6	Opt.
HES - CGC	E	Obl.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Written
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Summary

In this course we will discuss advanced biophysical topics using classical and current literature, building on the framework established in the course Molecular and Cellular Biophysics I. The course is held in English.

Content

1 Protein folding / substates / dynamics
• molecular chaperones and protein folding in the cell
• conformational fluctuations in protein function and regulation
• natively disordered proteins
2 Protein machines
• motor proteins in trafficking
• motor proteins in DNA and chromatin transactions
3 DNA binding proteins / transcription
• protein DNA interactions
• search processes in the nucleus
• dynamics and function of the transcription machinery
4 Channels and receptors
• ion channels, receptors
• detection of physical and chemical stimuli
5 Membranes
• fusion, fission, membrane deformation
• diffusion

Keywords

protein folding, dynamics, molecular machines, DNA, transcription, receptors, membrane, diffusion, trafficking

Learning Prerequisites

Required courses

Molecular and Cellular Biophysics I
Biochemistry I
Chemical thermodynamics

Recommended courses

Biochemistry II

Important concepts to start the course

Protein structure, folding, function and dynamics
Theoretical biophysics, thermodynamics, chemical kinetics
Membranes and lipids

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze the contribution of protein conformational fluctuations on their stability and function
- Implement theoretical thermodynamic concepts to describe the relation between protein folding and molecular recognition
- Work out / Determine the relation between chemical and mechanical energy as applied in protein machines
- Infer transport processes in the nucleus based on models of molecular diffusion
- Contrast different types of membrane protein receptors and their mode of function
- Demonstrate how chemical energy is employed to enable vesicle trafficking and membrane fusion
- Critique literature articles on biophysical topics
- Synthesize general biophysical concepts from current research articles

Transversal skills

- Continue to work through difficulties or initial failure to find optimal solutions.
- Take feedback (critique) and respond in an appropriate manner.
- Make an oral presentation.
- Summarize an article or a technical report.

Teaching methods

Ex cathedra and student presentations / discussions.

Expected student activities

Preparation of articles
Presentations of articles from the classical and current literature
Active participation to discussions

Assessment methods

Written exam

Supervision

Office hours	No
Assistants	No
Forum	No

Others	Moodle

Resources

Bibliography

Literature articles / reviews
"Biophysical Chemistry", Cantor and Schimmel, Vols 1-3 (Freeman, New York 1980)
"Molecular and Cellular Biophysics", Meyer B. Jackson (Cambridge University Press, 2006)

Ressources en bibliothèque

- Molecular and cellular biophysics / Jackson
- Biophysical chemistry / Cantor

Prerequisite for

CH-413 Nanobiotechnology and Biophysics
CH-419 Cellular Signalling