CH-311

Macromolecular structure and interactions

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Cursus	Sem.	Type
Chemistry	BA5	Obl.
HES - CGC	H	Obl.

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

Summary

This course covers the basic biophysical principles governing the thermodynamic and kinetic properties of biomacromolecules involved in chemical processes of life. The course is held in English.

Content

- **The conformation of biological macromolecules and membranes**
  - Forces in biomolecules
  - Protein primary and secondary structure
  - Tertiary structure of proteins
  - DNA structure
  - Conformations of unstructured polymers in solution (Gaussian chain models, freely-jointed chain, wormlike chain)

- **Conformational equilibria and dynamics of polypeptides and proteins**
  - Thermodynamics of protein folding (folding equilibria, calorimetry of protein folding transitions)
  - Kinetics of protein folding (folding pathways, intermediates)
  - Conformational transitions in proteins (native state fluctuations, allostery, structural rearrangements in enzyme catalysis)
  - Thermodynamics and kinetics of alpha-helix - coil transition

- **Spectroscopy of Biomolecules**
  - Biomolecular absorption spectroscopy (UV absorption, circular dichroism)
  - Biomolecular fluorescence
  - Structural biology: X-ray crystallography, electron microscopy and NMR spectroscopy of proteins

- **Ligand-receptor interactions**
  - Equilibrium binding reactions
  - Binding inhibition

- **Transport phenomena and stochastic processes in biology**
  - Fluctuations in biology
  - Macromolecular diffusion

Keywords

biophysics, biophysical chemistry, protein, nucleic acid, structure, thermodynamics, kinetics, protein folding, spectroscopy, fluorescence, absorption, helix-coil, fluctuations, receptor, ligand

Learning Prerequisites

Required courses

Biochemistry I
Chemical thermodynamics

Important concepts to start the course

General chemical and biochemical concepts

Learning Outcomes

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

- Describe physical chemistry methods in biology
- Integrate chemical and physical concepts in biology
- Reason which methods are appropriate for a biological problem

Teaching methods

ex cathedra

Expected student activities

Attendance of the lectures
Study of indicated materials

Assessment methods

Written exam

Resources

Bibliography

"Principles of Physical Biochemistry", Van Holde, Prentice Hall
"Physical Biology of the Cell", Phillips, Kondev, Theriot, Garcia, Garland Science

Ressources en bibliothèque

- Physical biology of the cell / Phillips
- Principles of physical biochemistry/ Van Holde

Prerequisite for

Dynamics of biomolecular processes
Chemical biology
Experimental biological & biophysical chemistry
Nanobiotechnology and Biophysics
Cellular Signaling