Course syllabus

Biophysical Chemistry
Biofysikalisk kemi

KFKN10, 7.5 credits, A (Second Cycle)

Valid for: 2025/26
Faculty: Faculty of Engineering LTH
Decided by: PLED B/K
Date of Decision: 2025-04-07
Effective: 2025-05-05

General Information

Main field: Biotechnology **Depth of study relative to the degree requirements:** Second cycle, in-depth level of the course cannot be classified
Main field: Pharmaceutical Technology **Depth of study relative to the degree requirements:** Second cycle, in-depth level of the course cannot be classified
Main field: Technology **Depth of study relative to the degree requirements:** Second cycle, in-depth level of the course cannot be classified
Elective mandatory for: MLAK1
Elective for: B4-l, B4-mb, K4-l, MBIO1, N4, N4-nbm
Language of instruction: The course will be given in English on demand

Aim

The course aims at giving the student:

- molecular-level understanding of the structure, stability, interactions and dynamics of proteins.
- knowledge about the principal physical methods used in modern protein science.
- practical experience in using some of these methods.
- the knowledge base needed to use and critically assess the protein research literature.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- describe the principal physico-chemical properties of proteins, such as structure, stability, interactions and dynamics.
- account for these properties in terms of molecular-level theroetical models.
- interpret experimental results from physico-chemical studies of proteins.

Competences and skills
For a passing grade the student must

- use physico-chemical concepts and models to solve problems involving proteins.
- apply his/her theoretical knowledge to biotechnological and biomedical problems.
- use electronic protein databases.
- carry out spectroscopic measurements on proteins.

Judgement and approach
For a passing grade the student must

- read and critically assess research literature in protein science.
- communicate effectively with researchers in protein science.

Contents

The course addresses the following main topics:

- The chemical building-blocks and three-dimensional structures of proteins: Structure analysis by X-ray crystallography; Structure and sequence databases; Bioinformatics.
- Protein characterization by optical spectroscopy: Physical principles and applications of fluorescence and circular dichroism spectroscopy.
- Polypeptide conformation: Models of polymer conformation and conformational transitions; Conformational entropy; Folding cooperativity.
- Protein energetics and stability: Packing; Hydration; Electrostatics; Thermal and solvent-induced denaturation; Differential scanning calorimetry.
- Protein dynamics: Kinetic models; Proton exchange; Diffusion control; Protein folding; Computer simulation of proteins.
- Nuclear magnetic resonance: Principles of NMR spectroscopy and relaxation; Analysis of structure, interactions and dynamics of proteins in solution.
- Association processes: Ligand binding; Allostery; Protein aggregation; Isothermal titration calorimetry; Surface plasmon resonance.

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)
Assessment:

The final grade is based on weekly take-home problem assignments (50%) and a written midterm exam (50%). Approved laboratory practicals and oral presentation are needed for a passing grade. If necessary, reexamination (of the midterm exam) will be performed either orally or written.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Modules
Code: 0125. **Name:** Literature Presentation.
Credits: 1.0. **Grading scale:** UG - (U, G). **Assessment:** Grade (fail or pass) is awarded based on participation and the quality of the presentation. **The module includes:** Reading of primary literature (scientific papers), preparation of oral presentation, oral presentation, hand-in of presentation slides, oral feedback on other student presentations and active participation in presentation-session. Opposition on fellow students oral presentations.
Code: 0225. **Name:** Home Assignments.
Credits: 2.5. **Grading scale:** UG - (U, G). **Assessment:** The result on the home assignments contributes 50% of the final grade. **The module includes:** Written reports on home assignments. The course contains 5 weekly home assignments.
Code: 0325. **Name:** Laboratory Practicals.
Credits: 1.5. **Grading scale:** UG - (U, G). **Assessment:** Active participation in the practical exercises and presentation of results. **The module includes:** Four different Laboratory practicals.
Code: 0425. **Name:** Midterm Examination.
Credits: 2.5. **Grading scale:** UG - (U, G). **Assessment:** Written exam. The result of the exam contributes 50% to the total grade points. **The module includes:** Exam (midterm) covering those sections of the textbook and handouts that are included in the course up to the date of the examination.

Admission

Admission requirements:

- **(**FAFA05 Physics - Waves, Thermodynamics and Atomic Physics **or** KFKA05 Molecular Driving Forces 1: Thermodynamics**)**
  and
  (KOKA30 General, Inorganic and Organic Chemistry **or** KOOA15 General Chemistry**)**

Assumed prior knowledge: KFKF01 Molecular Driving Forces 2: Interactions and Dynamics
The number of participants is limited to: No
Kursen överlappar följande kurser: KFK032

Reading list

- The course literature consists of the compendium "Biophysical Chemistry", authored and updated each year by the course teachers, and of manuals for the practicals. For those who want go deeper, the compendium provides a list of selected references and links to the literature.

Contact

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Course homepage: https://www.cmps.lu.se/education/

Further information

The course emphasizes active processing of knowledge through take-home problem assignments and laboratory practicals. Five lectures are devoted to research in protein science, where the students present and critically discuss recent research results.