Faculty of Science

KEMM53, Chemistry: Advanced Experimental Protein Chemistry, 15 credits

Kemi: Avancerad experimentell proteinkemi, 15 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2025-10-21. The syllabus comes into effect 2025-10-21 and is valid from the autumn semester 2026.

General information

The course is an elective course in the second cycle for a degree of Master of Science in Chemistry.

Language of instruction: English

Main field of study	*Specialisation*
Chemistry	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

On completion of the course, students are to have acquired up-to-date knowledge and experimental skills for biochemical studies of proteins. Through both theoretical and experimental components, the student will develop an in-depth understanding of protein function, structural properties, and dynamics. On completion of the course, student should be well prepared to participate in molecular biology research and development work in the protein field, both theoretically and practically. The student will also be trained to prepare and effectively communicate scientific results through oral presentations in relevant contexts. The student also develops the ability to provide constructive feedback on other students' oral presentations.

Knowledge and understanding

On completion of the course, the student shall be able to:

- explain how the chemical composition of proteins contributes to their structure and function
- explain the basic properties of proteins, including the structure-function relationship
- explain how the properties of a specific target protein are utilised to design a protein purification process
- explain the underlying principles of common and advanced methods used in protein purification and protein studies, such as various types of chromatography, electrophoresis, analysis of secondary structure, spectroscopy, structure prediction, studies of protein interactions, and mass spectrometry
- describe how sequence databases and key tools in bioinformatics and structure prediction can be used in protein research

Competence and skills

On completion of the course, the student shall be able to:

- carry out routine work in a biochemical laboratory in a safe and reproducible manner
- plan, implement, and evaluate strategies for protein purification and characterisation based on given questions
- adapt protocols and working methods to the specific requirements of different biochemical situations
- document and critically evaluate experimental results
- present biochemical information, orally and in writing
- discuss experimental biochemical results, orally and in writing
- search for, interpret, and apply original publications in the field of biochemistry
- use relevant biochemical databases in an appropriate way

Judgement and approach

On completion of the course, the student shall be able to:

- assess which purification methods are suitable for purifying a specific protein
- evaluate results of protein purification protocols
- propose and justify improvements or alternative strategies for a biochemical treatment process
- interpret results from enzyme kinetic analyses
- relate own experimental results to previously published studies
- critically review and discuss both own and others' experimental data
- reflect on experimental work performed, including identification of strengths, weaknesses and possible improvements

Course content

The course consists of two subcourses:

Subcourse 1: Theory, 7.5 credits
The theoretical part of the course includes lectures and exercises that deal with how proteins are studied at the molecular level and provide a deeper understanding of their function. The lectures offer insight into the current reserach front and introduce the theoretical foundations of modern experimental techniques used in protein purification as well as the analysis of protein properties and dynamics. Among the central methods covered are preparative techniques, protein purification using centrifugation, gel filtration, ion exchange, adsorption and affinity chromatography, analytical methods and purification criteria, SDS-PAGE, isoelectric focusing and two-dimensional (2D) electrophoresis, mass spectrometry, studies of protein interaction and post-translational modifications. The course also includes spectroscopic methods focusing on protein structure and dynamics, bioinformatics and an introduction to biochemical literature and relevant databases.

Subcourse 2: Practical elements, 7.5 credits
Experimental work in protein chemistry constitutes a central part of the course and is carried out practically under supervision in the form of laboratory exercises. Students are trained in experimental design, experimental execution, meticulous documentation, as well as critical analysis and evaluation of results. The work is based on relevant biochemical literature, databases, and bioinformatic tools. Students will gain practical experience with key methods for the purification and characterization of proteins, with a focus on their properties, function, and structural dynamics. Results are presented and discussed continuously throughout the course, both orally and in writing. During the course, the student also plans and carries out an independent, well-defined project, which is presented at the end of the course.

Course design

Teaching consists of lectures, computational exercises, laboratory exercises, and project work.

Participation in laboratory sessions and associated elements is compulsory.

Assessment

Assessment takes the form of a written exam at the end of the course, a oral presentation and a written project report at the end of the course as well as participation in laboratory sessions and compulsory components during the course.

Students who do not pass a regular assessment will be offered another opportunity for assessment soon thereafter.

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.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
For a Pass grade on the whole course, the student must have Pass grades on the exam, the project report, the laboratory report, and the compulsory components.

The grading scale for the exam is Fail, Pass, Pass with Distinction, whereas laboratory work and project report and included compulsory parts are graded according to the grading scale Fail, Pass.

The final grade is determined by grade on the exam.

Entry requirements

To be admitted to the course, students must meet the general entry requirements for higher education and requirements for English proficiency corresponding to English 6/B from Swedish upper secondary school, and have passed 90 credits in natural science courses, including knowledge equivalent to:

- KEMA20 General Chemistry 15 credits
- KEMA41 Organic Chemistry - Basic Course 7.5 credits and
- KEMA13 Biochemistry - Basic Course 7.5 credits
- KEMB23 Biochemistry - Function and Regulation 15 credits

Further information

The course replaces KEMC03 Experimental Protein Chemistry, 15 credits and credits from that course cannot count towards a degree together with this course.

The course is offered at the Department of Chemistry, Lund University.