Faculty of Science

# KEMM35, Chemistry: Structural Biochemistry, 15 credits

*Kemi: Strukturbiokemi, 15 högskolepoäng*

**Second Cycle / Avancerad nivå**

## Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2021-11-24. The syllabus comes into effect 2021-11-24 and is valid from the autumn semester 2022.

## General information

The course is an elective second-cycle component of a Master of Science (120 credits) degree in Chemistry and Molecular Biology, and compulsory for a Master of Science (120 credits) degree in Protein Science.

*Language of instruction:* English

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

## Learning outcomes

The general aim of the course is to enable students to acquire an advanced understanding of proteins with an emphasis on their three-dimensional structures, the connection of structures to biological function and how these structures are produced. The course covers both the principles that determine the properties of proteins and the experimental methods that are used to study these properties in modern molecular protein science.

### Knowledge and understanding

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

- account for the three-dimensional structure, stability, interaction and dynamics of proteins
- describe the principles behind the most important methods in structural biochemistry such as X-ray crystallography, Small Angle X-ray scattering and cryo-electron microscopy
- account for how the information about the three-dimensional structure of proteins can be used in drug design
- account for how modelling of the structure and complex formation of proteins can be used to interpret experimental data and provide understanding of the biological functions of proteins

### Competence and skills

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

- use electronic databases and computer-based tools for the analysis of protein sequences and structures
- perform simple modelling assignments and simulations, based on structures
- perform simple protein crystallisation experiments

### Judgement and approach

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

- interpret and critically assess protein structures deposited in public databases as well as published and self-generated models regarding resolution, quality and information content
- interpret and critically assess the scientific literature on protein structure and function

## Course content

The course contains two modules:

*Part 1 Theory 7.5 credits*

The theoretical part covers the following:

- Polypeptide conformations
- Secondary and three-dimensional structures of proteins, structural classes and structure databases
- Prediction and modelling of protein structure
- The stability, dynamics and interaction of proteins
- Ligand bonding and structure-based design of drugs
- Principles of X-ray crystallography and other methods such as cryo-electron microscopy, Small Angle X-ray scattering, neutron scattering

*Part 2 Practical Compulsory Components 7.5 credit*

In this part, students focus on compulsory components with regard to:

- Exercises in relevant computer-based methods to study protein structures and dynamics
- Searching in sequence and structure databases, and modelling of proteins of unknown structure
- Exercises in all critical stages of a typical structure determination using X-ray crystallography: crystallisation, data collection, data processing, structure determination, model construction, refinement and validation
- Basic exercises using other experimental methods A number of exercises are carried out as demonstrations.

## Course design

The teaching consists of lectures, computer exercises and laboratory sessions. Compulsory participation is required in computer exercises, laboratory sessions and associated elements.

## Assessment

The assessment is based on a written exam at the end of the course, and on compulsory components throughout the course.

Students who fail an 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 the grade of Pass on the whole course, the student must have passed the final exam, the laboratory reports and the compulsory components. The grades awarded for the exam in Part 1 Theory are Fail, Pass and Pass with Distinction. The grades awarded for Part 2 Compulsory Components are Fail and Pass.

The final grade is determined by the grade for 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 from Swedish upper secondary school, and have passed 90 credits in science courses including courses equivalent to:

- KEMA20 General Chemistry 15 credits, or KEMA10 General Chemistry 7.5 credits and KEMA12 Inorganic Chemistry - Basic Course 7.5 credits, KEMA01 Organic Chemistry - Basic Course 7.5 credits and KEMA03 Biochemistry - Basic Course 7.5 credits, and

- MOBA02 Chemistry of the Cell 15 credits

Students who have obtained the equivalent knowledge by other means may also be admitted to the course.

## Further information

The course cannot be include in a degree together with KEMM15 Structural Bioinformatics 15 credits and KEMM25 Structural Biochemistry 15 credits.