Faculty of Science

KEMB23, Chemistry: Biochemistry - Function and Regulation, 15 credits

Kemi: Biokemi - funktion och reglering, 15 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-11-27. The syllabus comes into effect 2024-11-27 and is valid from the autumn semester 2025.

General information

The course is a compulsory first-cycle course for a degree of Bachelor of Science in Chemistry and Molecular Biology.

Language of instruction: Swedish and English

Main field of study	*Specialisation*
Chemistry	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements
Molecular Biology	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that the students, after completing the course, will achieve in-depth knowledge and understanding of chemical reactions in the cell with a focus on the structure and function of proteins, enzyme catalysis and cell metabolism and signalling. After the course, students should have a good basis for advanced studies in biochemistry and related fields. It also aims to provide students with practical skills in experimental biochemistry, basic skills in bioinformatics, and the ability to communicate biochemical content using appropriate terminology.

Knowledge and understanding

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

- explain the chemical structure and properties of the 20 amino acids that are the building blocks of proteins
- explain how the structure determines the functions of a protein
- describe how enzymes catalyse vital reactions and how these reactions are regulated
- master the basics of enzyme kinetics and describe how it is used to study enzymes
- explain common catalytic mechanisms
- describe experimental design and analysis of biochemical data, including enzyme kinetic calculations
- account for different forms of cell signalling
- describe the theory behind DNA-based technologies such as PCR, molecular cloning and sequence analysis as well as methods used for the production, purification and analysis of recombinant proteins such as electrophoresis, chromatographic and spectrophotometric methods
- describe the general metabolism of the cell
- explain how energy from storable sugars is converted into chemical energy and how these processes are regulated at the enzyme level
- name key components and summarise events in the cellular turnover of proteins and amino acids
- explain how information is transferred from DNA via RNA to proteins
- summarise how regulation of cellular gene expression works
- summarise photosynthesis from a biochemistry perspective

Competence and skills

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

- use the names and structures of the main biomolecules
- discuss how metabolic processes are regulated to ensure chemical energy within the cell
- discuss the differences and similarities of the components and sub-processes of photosynthesis and the respiratory chain
- practically apply basic knowledge of bioinformatics and its applications, including searching protein and literature databases for bioinformatic and structural biology information, and interpreting this information using computer software
- perform standard laboratory biochemical work, including protein purification, affinity chromatography, electrophoresis, and measurement of enzyme activity
- discuss biochemical knowledge at a higher intellectual level
- communicate biochemical knowledge in a correct way and with an appropriate and specialised terminology

Judgement and approach

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

- evaluate the results of basic bioinformatics searches, such as protein sequence searches
- review protein function and general structure using structural models
- propose molecular biology strategies for the production of recombinant proteins
- propose appropriate strategies for the purification and quality control of a protein
- propose appropriate strategies for the study of individual amino acids within a protein
- evaluate protein purifications with regard to purity and achieved yield
- evaluate the results of enzyme activity measurements, and assess the activity of various enzymes in relation to each other
- reflect on different levels of regulation within the cell, from gene expression via translation to different forms of regulation of protein activity

Course content

The course contains two modules:

Module 1 Theory 7,5 hp

The theoretical part covers the following areas:

- protein structures and bioinformatics
- cell signalling from a biochemical perspective
- basic concepts and kinetics of enzymes
- in-depth study of catalytic and regulatory mechanisms of enzymes
- metabolism: basic concepts and design principles
- glycolysis, glyconeogenesis, pentose phosphate pathway
- photosynthesis, citric acid cycle and oxidative phosphorylation
- amino acid metabolism and protein turnover
- genes and chromosomes
- DNA and RNA metabolism
- experimental methods for recombinant gene technology
- regulation of gene expression
- photosynthesis

Module 2 Laboratory sessions and associated components 7,5 credits

In the module, the students will:

- acquire skills in basic laboratory biochemistry (recombinant protein technology, protein purification, enzyme kinetics) while linking to parts of the theoretical content of the course
- carry out a project where students are trained in biochemical information search, literature search, visualisation of the 3D structure of proteins and scientific writing

- are trained in documenting laboratory work and summarising their laboratory results in a written laboratory report

Course design

The teaching consists of lectures, group exercises, a laboratory session and a project work. Compulsory participation is required in laboratory sessions, project work and associated elements.

Assessment

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

A re-sit examination is offered soon after the examination for students who do not pass.

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 and Pass with distinction, while the grading scale for the project report and the laboratory report is Fail and Pass.

The final grade is determined by the grade on the exam.

Entry requirements

To be admitted to the course, students must have basic eligibility and passed courses equivalent to:

- KEMA20 General Chemistry, 15 credits
- KEMA41 Organic Chemistry - Basic Course 7.5 credits and
- KEMA13 Biochemistry - basic course 7.5 credits or BIOA10 Cell- and Microbiology 15 credits

Equivalent knowledge that has been obtained in another way also provides eligibility for the course.

Further information

The course is taught in English in the autumn term, so a good knowledge of English is essential for understanding the course content.

The course replaces MOBA02 Chemistry of Cells, 15 credits and cannot be included in the degree together with this course.

The course is coordinated with EXTG55 Biochemistry, 15 credits, that is a course given for students at the Faculty of Engeneering, Lund University.

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