UNIVERSITY OF GOTHENBURG

DEPARTMENT OF CHEMISTRY AND MOLECULAR BIOLOGY

KEM082 Bioanalytical chemistry - from single molecules to tissues, 15 credits

Bioanalytisk kemi - från enskilda molekyler till vävnader, 15 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Chemistry and Molecular Biology on 2019-09-13 to be valid from 2019-09-13, spring semester of 2020.

Field of education: Science 100%
Department: Department of Chemistry and Molecular Biology

Position in the educational system

The course can be part of the following programmes: 1) Atmosphere, Climate and Ecosystems, Master's Programme (N2ACE), 2) Molecular Biology, Master's Programme (N2MBI), 3) Chemistry and learning, Master's Programme (N2KOL), 4) Environmental Sciences (N2MVN), 5) Master's Programme in Organic and Medicinal Chemistry (N2KEL) and 6) Master's Programme in Chemistry (N2KEM)

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

Entry requirements

For admission to the course, completed and passed courses comprising 120 credits in the field of science, pharmacy or medicin.

Learning outcomes

At the end of the course, the student should:

Knowledge and understanding

- Have acquired necessary knowledge of molecular structure techniques, chemical analysis across tissues, cell and subcellular analysis, and protein analysis.
- Have in-depth understanding of the analytical methods used to analyze molecules in biological systems.
- Understand methods of modern analysis in life sciences including imaging.
- Acquire an in-depth understanding of the analysis of biomolecules in neuronal cells and tissues.

Competence and skills

- Critically consider the choices and limitations of different experimental methods for analysis in life science all the way from nanometer organelles to tissues
- Be able to interpret and discuss experimental results and draw reasonable conclusions from the acqired data.
- Be able to independently formulate, delimit and interpret an analytical chemical problem.
- Be prepared for further research studies in the subject.

Judgement and approach

- Be able to evaluate the course content with regards to current scientific, ethical and society aspects.
- Be able to assess and evaluate the need for additional knowledge.

Course content

The course will give in-depth knowledge of the following four areas:

A. Molecular structure techniques

- X ray methods.
- Single molecule methods.
- Cryo electron microscopy/tomography.

B. Chemical analysis across tissues

- Matrix assisted laser desorption ionisation mass spectrometry.
- Secondary ion mass spectrometry imaging.
- Analysis of biopsies with liquid chromatography/mass spectrometry.
- Immunohistochemistry (fluorescence and mass spectrometry).

C. Cell and subcellular molecular analysis

- Secondary ion mass spectrometry imaging (SIMS and NanoSIMS).
- Electrochemical analysis of cells and organelles.
- Quantitative fluorescence analysis of cells and organelles.

D. Protein analysis

- Quantitative proteomics.
- Molecular level with magnetic resonance imaging (MRI).
- Molecular level with positron emission tomography (PET).
- Application example.

The theoretical and laboratory factors of the course are adjacent to current research and the intention is to prepare students for a degree project in chemistry, neurobiochemistry or for further research studies in the subjects. The materials in the lectures will be supported by several laboratory experiments, both hands on and by observation. The students will be expected to report their results in oral or written form.

Sub-courses

1. **Theory** *(Teori),* 12 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)

2. **Laboratory exercises and demonstrations** *(Laborationer och demonstrationer),* 3 credits
   Grading scale: Pass (G) and Fail (U)

Form of teaching

Module1: The course material will be presented in lectures, exercises and seminars. The sub-course can contain compulsory Components.

Module 2: This part of the course consists of laboratory exercises and demonstrations. The sub-course contains mandatory components.

Language of instruction: English

Assessment

Module 1: Examination takes place by the written exam in the end of the course.
Module 2: Examination takes place based on written and orally presentations of the laboratory sessions and demonstrations.

For students who have not passed the regular examination, additional examination sessions are offered.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the

department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).
In

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Module 1: For the grade Pass, at least 50% of the maximum score in examination is required. For the grade Pass with distinction, at least 75% of the maximum score in examination is required.

Module 2: For grade Pass, active participation and passed presentations in all laboratory sessions and demonstrations are required.

For grade of Pass in the whole course, grade of Pass in both modules is required. For grade of Pass with distinction in the whole course, grade of Pass with distinction on module 1 and grade of Pass on module 2 are required.

Regarding application of the ECTS grading scale please see the vice chancellor's directive 28/05/2007, diary nr G 8 1976/07.

Course evaluation

The course is evaluated after the course, and the results become subject to discussion between the teachers in the course and representatives for the students.

The results of the evaluation and possible changes to the course will be shared with students who participated in the evaluation and new students who are starting the course.