CB2340 Spatial Molecular Biology 7.5 credits

Spatial molekylärbiologi

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

The official course syllabus is valid from the autumn semester 2026 as decided by the Faculty Board decision PA-2025-0010. Date of decision: 2025-10-01.

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

Completed bachelor's degree project 15 credits, 20 credits in cell biology, biochemistry, microbiology and genetic engineering/molecular biology, 15 credits in mathematics, numerical analysis and computer technology, and courses in programming equivalent to at least 5 credits.

Intended learning outcomes

Upon completion of the course, the student should be able to:

- explain the principles, strengths and limitations of the most important techniques for single-cell and spatial transcriptomics and bioimaging methods, and assess their suitability for specific biological applications.
- perform general analysis workflows of data from single-cell and spatial transcriptomics and bioimaging.
- interpret and critically evaluate differences between, and advantages and disadvantages of, different spatial omics approaches and the associated scientific literature.
- discuss the generation and analysis of spatial biology data and reflect on their potential importance for research in the life sciences.

Course contents

The aim of the course is to introduce students, primarily with backgrounds in life sciences, biology, biochemistry and related fields, to the experimental and computational techniques that are central to generating and analyzing spatial biology data, both based on sequencing and imaging. The course provides a foundation in data generation, data analysis and workflows that are becoming increasingly important in modern biological research.

The course consists of lectures, project work and computer labs. The lectures cover theoretical aspects of sequencing and imaging-based methods in spatial biology and related analyses. The computer labs are designed for practical data analysis, such as data pre-processing, quality control, clustering, dimensionality reduction and spatial mapping. The project work focuses on student-led discussions and presentations of key methods and relevant literature.

Good research practice is emphasized throughout the course – such as ensuring data quality and managing biological variation, critically interpreting analysis results and developing a rigorous and reproducible computational approach. The course prepares students for further studies and research in data-driven biological sciences.

Course content in brief:

- Sequencing-based spatial analysis – principles, technologies and strategies and comparisons with single-cell transcriptomics
- Imaging-based spatial analysis – principles, technologies and strategies
- Computational workflows for analysis of sequencing- and imaging-based spatial biology
- Aspects of reproducible data generation and data analysis
- Spatial multi-omics: data generation and integration
- Applications of spatial biology in basic and translational life sciences

Examination

- TEN1 - Written exam, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 0.5 credits, grading scale: P, F
- LAB2 - Laboratory Work, 0.5 credits, grading scale: P, F

- LAB3 - Laboratory Work, 0.5 credits, grading scale: P, F
- LAB4 - Laboratory Work, 0.5 credits, grading scale: P, F
- LAB5 - Laboratory Work, 0.5 credits, grading scale: P, F
- PRO1 - Project, 2.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability. The examiner may apply another examination format when re-examining individual students. If the course is discontinued, students may request to be examined during the following two academic years.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.