DEPARTMENT OF CELL AND MOLECULAR BIOLOGY

C5F6082, Quantitative Chromosome Biology, 1.5 credits (hec)

Kvantitativ kromosombiologi, 1,5 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus was approved by The Committee for Doctoral Education on 2025-09-13, and is valid from spring semester 2026.

Responsible department

Department of Cell and Molecular Biology, Faculty of Medicine

Prerequisite courses, or equivalent

No prerequisite courses, or equivalent, demanded for this course.

Purpose & Intended learning outcomes

Purpose

The biomedical field has undergone a revolution with the advent of high-throughput sequencing technologies. Nevertheless, genomic data often provide only a "static" view of the genome, while crucial kinetic information is frequently missing to fully understand mechanisms of gene regulation.

This course is designed to bridge that gap by introducing students to quantitative approaches for investigating chromatin dynamics and gene regulation. The emphasis will be on expanding students' knowledge toward kinetic studies and equipping them with new tools to assess the dynamics of molecules involved in chromatin-related processes.

Intended learning outcomes

By the end of the course, students will be able to:

1. Explain the crosstalk among different levels of gene expression regulation, with particular emphasis on chromatin organization, polymerase activity, and transcriptional control.

2. Compare and critically evaluate quantitative technologies used to study gene expression, discussing their principles, advantages, and limitations.
3. Describe the central aspects of the dynamics of chromatin and gene regulation, and relate the contribution of deregulation to human disease.
4. Critically evaluate and interpret experiments for studying transcription regulation and chromatin dynamics.
5. Evaluate ethical considerations related to technological advances, with attention to data transparency, reproducibility, and dissemination.

Course content

The course covers central quantitative/kinetic approaches to study gene expression regulation and chromatin dynamics in mammalian cells, and how these approaches have become key for biomedical research. Particular attention will be paid to the understanding of advantages and limitations of those approaches, and potential applications to the study of human disease.

Forms of teaching and learning

The learning activities used in the course include lectures, group discussions and problem-based learning activities. The students will receive compulsory individual and group assignments.

Learning groups will analyze a recent publication related to the lecture topics and present their findings through an oral presentation, which will be peer-reviewed. In addition, students will design and develop a research project that allows them to apply the knowledge gained to their own ongoing research.

Active participation is expected throughout the course, particularly during quizzes and Q&A sessions, where learning outcomes will be assessed. The course balances theoretical and practical components equally, with ample time dedicated to practice and discussion.

Language of instruction

The course is given in English

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

The assignments, seminars, quizzes, group discussions, presentations and peer-review are compulsory. Absence can be compensated in agreement with the course director.

Forms of assessment

The assessment is based on the completed course assignments and individual quizzes with SBA type and open questions in the course platform in Canvas, and student presentations and peer-review of other students' presentations.

Course literature

Literature will consist of recent research articles and online documentation.