Faculty of Science

BIOR95, Biology: Molecular Genetics of Eukaryotes, 15 credits

Biologi: Molekylär genetik i eukaryota organismer, 15 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2023-06-11 to be valid from 2023-06-11, autumn semester 2024.

General Information

The course is an optional second-cycle course for a degree of Bachelor or Master of Science in Biology and Molecular Biology. The course is a compulsory second-cycle course for a degree of Master of Science in Molecular Biology, with a specialization in Molecular Genetics and Biotechnology.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Molecular Biology	A1N, Second cycle, has only first-cycle course/s as entry requirements
Biology	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of this course is that the student will have knowledge about the genetic information i eukaryote organisms, its structure, organization and the molecular mechanisms of its maintenance and expression.

Knowledge and understanding

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

- account for the various types of genetic information that exists in the eukaryotic cell
- describe how the genetic information is organised: how it is stored in the cell, and how it is maintained
- explain what genes are and how they function, clarify the mechanisms of

information flow, from genes to proteins, and how these processes are regulated
- explain how the environment influences gene function and gene regulation
- describe how the regulation of gene expression is the basis for the organism's embryonic development
- account for how changes in the genetic code is the basis for evolution

Competence and skills

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

- apply certain molecular genetic methodology and bioinformatics
- account for the applications of gene modification in medicine and biotechnology
- give oral presentations of scientific articles

Judgement and approach

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

- critically review scientific articles in molecular genetics
- reflect over his/her knowledge in molecular genetics and how these can be applied within doctoral studies and professional work

Course content

The organisation and evolution of the eukaryotic genomes

- Genome structure, comparative genomics, and bioinformatics
- Mobile DNA elements and the dynamics of genomes
- Methods for gene identification and analysis of gene structure, including cloning, PCR, restriction mapping, in situ hybridisation, DNA sequencing
- Bioinformatic analyses of DNA- and protein sequences

Principles of gene expression

- Molecular mechanisms for regulation of gene expression at different levels, including remodeling of chromatin, initiation of transcription, nuclear transport and signalling, and RNA interference
- Protein sorting and protein maturation by passage through the cytoplasmic organelles of the cell
- Methods for analysis of gene expression, including microarray, hybridisation, promoter analyses

Functional chromosomal elements and chromatin structure

- Mechanisms for maintaining genetic information during cell division and the generation of genetic variation: replication, mitosis, meiosis, recombination
- Epigenetic and RNA-mediated mechanisms.

Developmental genetics and tumour genetics

- Principles for regulation of gene expression through intercellular signalling
- Gene regulation in developmental biology and the cell cycle
- Mechanisms that regulate development from single cell to multicellular organisms
- Principles of how dysregulation causes tumour growth and deviant embryonic development

Gene technology: basic and applied molecular genetic methods

- Genetic model organisms
- Methods to produce transgenic organisms and "knockouts"
- Strategies for gene therapy and production of medicines via genetically-modified organisms (expression vectors and viral vectors)
- Large-scale analyses: Functional genomics, transcriptomics, proteomics, genetic screening of individuals

Course design

The teaching consists of lectures, group studies, laboratory sessions, assignments, and oral presentations of scientific articles. Active participation in group studies, laboratory sessions and associated element, is compulsory.

Assessment

Examination takes place in the form of a written examination at the end of the course, written assignments and lab report during the course and participation in group work and compulsory parts. For students who have not passed the regular examination, an additional examination in close connection to this is offered.

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.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course, approved examination, approved written assignments, approved laboratory report and approved participation in group work and other compulsory parts, are required.

The grading scale for Written examination is Fail, Pass and Pass with distinction, while the grading scale for Assignments, labs and group work is Fail and Pass.

The final grade is decided through a weighing of the results on the written examination, assignments and laboratory report.

Entry requirements

For admission to the course, English 6 and 120 credits of scientific studies including knowledge corresponding to BIOA10 Cell Biology and Microbiology 15 credits, BIOA11 Genetics and Evolution 15 credits, MOBA03 Molecular Biology 15 credits, and Chemistry 30 credits including biochemistry, are required.

Further information

The course may not be included in a degree together with BIOR49 Molecular Genetics

of Eukaryotes 15 credits.

Subcourses in BIOR95, Biology: Molecular Genetics of Eukaryotes

Applies from H24

2401 Assignments, labs and group work, 7,5 hp
Grading scale: Fail, Pass
2402 Written examination, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction