Faculty of Science

BIOR49, 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 2007-03-01 and was last revised on 2014-08-31. The revised syllabus applies from 2014-08-31, autumn semester 2014.

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 also offered as a single subject course. The language of instruction is English.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Biology	A1F, Second cycle, has second-cycle course/s as entry requirements
Molecular Biology	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

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 presentation of scientific facts

Judgement and approach
On completion of the course the student shall be able to:

- critically review scientific articles in molecular genetics
- relate molecular genetics to 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: 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: 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: 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, group discussions, and oral presentations of scientific articles. Participation in all course parts, except the lectures, is compulsory, as well as the submission of a written laboratory report.

Assessment

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

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 participation in all compulsory parts, are required. The final grade is decided through a weighing of the results of the parts that are included in the examination.

Entry requirements

For admission to the course, English 6 and 120 credits of scientific studies including knowledge corresponding to MOBA01 Cell Biology 15 credits, BIOA01 Genetics and Microbiology 15 credits, MOBA02 The Chemistry of the Cell 15 credits, Chemistry 30 credits, MOBA03 Molecular Biology 15 credits, and an optional advanced course in molecular biology 15 credits, are required.

Further information

The course may not be included in a degree together with BIO784 Eukaryotic Molecular Genetics 15 credits.

Subcourses in BIOR49, Biology: Molecular Genetics of Eukaryotes

Applies from H14

0711 Theory, 10,0 hp
Grading scale: Fail, Pass, Pass with distinction
0712 Laboratory Work and Mandatory Assignments, 5,0 hp
Grading scale: Fail, Pass

Applies from H08

0701 Biology: Molecular Genetics of Eukaryotes, 15,0 hp
Grading scale: Fail, Pass, Pass with distinction