GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2019-2020

Molecular Genetics (O000114)

Course size (nominal values; actual values may depend on programme)

Credits	5.0	Study time	150 h
Contact hrs	52.5 h		

Course offerings and teaching methods in academic year 2019-2020

A (semester 2)	English	lecture	25.0 h
		seminar: coached exercises	7.5 h
		practicum	20.0 h

Lecturers in academic year 2019-2020

De Jaeger, Geert	WE09	lecturer-in-charge
Vanneste, Steffen	WE09	co-lecturer

Offered in the following programmes in 2019-2020	crdts	offering
Bachelor of Science in Molecular Biotechnology	5	A

Teaching languages

English

Keywords

Forward and reverse Genetics, laws of heredity for genetic analysis, pedigree analysis, gene mapping, gene interactions, genomics and functional genomics, transgene technology, gene regulation in eukaryotes, epigenetics, genome and chromosome mutations.

Position of the course

The student gets acquainted with the genetical principles that underlie functional gene analysis in eukaryotes. In a research focused manner, the different steps are presented in forward genetics, from gene discovery, over gene mapping, towards the study of gene interactions. Besides, complementary methods in reverse genetics and functional genomics are presented. All this gets illustrated with concrete examples from genetic research on model organisms and human. Further, chromosomal mutations and their impact on human disease and plant breeding is discussed. Finally we focus on regulation of gene expression in eukaryotes and epigenetics

Contents

• Single gene inheritance: Mendel's first law, gene discovery based on segregation ratios, sex-linked inheritance, pedigree analysis
• Independent assortment of genes: Mendel's second law, applications in breeding, polygenetic inheritance, cytoplasmic inheritance
• Gene mapping in eukaryotes: linkage, mapping based on recombination frequency, molecular markers, map-based cloning
• Gene interactions: allelic interactions, genes in the same pathway, epistasis, analysis of double mutants, penetrance and expressivity
• Reverse genetics in yeast, mouse, Arabidopsis, C. elegans and fruitfly: transgene technology, knock-out, RNAi, overexpression technology, CRISPR-CAS
• Functional genomics: micro-array, RNAseq, yeast 2-hybrid, ChIP-seq.
• Genomic mutations in eukaryotes: euploidy, aneuploidy, deletions, inversions and translocations, gene dosage.
• Regulation of gene expression in eukaryotes: transcription factors, chromatin, epigenetics.

Initial competences

Basic knowledge cell biology, biochemistry and molecular biology.
General Biology (O000133)

Molecular Biological analysis (O000020)
Molecular Biology (O000143)

Final competences

1 *The student has profound insight in genetical principles.*
2 *The student uses genetic terms in a correct manner.*
3 *The student can apply genetic principles in advanced genetic exercises.*
4 *The student can systematically perform basic molecular genetic experiments in a small team.*
5 *The student is able to collect data with diverse biological techniques and integrate them for functional gene analysis.*
6 *The student is able to apply basic statistics on genetic problems.*
7 *The student has basic knowledge of genome wide techniques and transgene technology and can apply them in a theoretical and practical research setting.*
8 *The student is able to report, describe and discuss genetic data and experimental results.*

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, practicum, seminar: coached exercises

Extra information on the teaching methods

The student might be asked to prepare the lecture, plenary exercises or practical at upfront.

Learning materials and price

Powerpoint presentations and the syllabus part on Reverse Genetics are available. The other parts are taken from a series of chapters in the student book: Introduction to Genetic Analysis by Griffiths et al., 11th edition.
ISBN-10: 1-4641-8804-1 (60 EUR)

References

Introduction to Genetic Analysis by Griffiths et al., 11th edition.

Course content-related study coaching

Apart from the theoretical courses, the students have always the opportunity to ask particular or general questions to the lecturers concerning particular parts of the course. This can be done by using email or in a personal discussion with the lecturers.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions

Examination methods in case of permanent evaluation

Report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

Students are evaluated on theoretical knowledge and understanding, and genetic problems have to be solved. It is also evaluated whether students can apply the genetic tools in a theoretical research setting. Details on amount and type of questions will be explained during the lectures and on Minerva.

Calculation of the examination mark

The written exam holds 16 of the 20 points, divided in 10 points for theoretical questions and 6 points for solving genetic problems. The remaining 4 points go to the practicum report. To pass this course one has to participate in the practicum, obtain at least 5/10 for theoretical questions, and at least 5/10 on the integration of the practicum report and the solving of genetic problems. Students with unjustified absence on the practicum or a score of less then 4/10 on one of both partial results will obtain a score that is at maximum the highest non-deliberative quotation (7/20). Students with a score of at least 4/10 but less then 5/10 on one of both partial results, and a total that is more

than 10/20 will obtain the highest failing mark (9/20). The partial result Theory or the partial result Genetic Problems and Practicum report can be transferred to the Second chance exam if the student achieves at least 7/10 for this part.