GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2019-2020

Molecular Biological Analysis (O000020)

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

Credits	5.0	Study time	150 h
Contact hrs	60.0 h		

Course offerings and teaching methods in academic year 2019-2020

A (semester 2)	English	practicum	25.0 h
		lecture	30.0 h
		seminar: practical PC room classes	5.0 h

Lecturers in academic year 2019-2020

Radwanska, Magdalena	KR01	lecturer-in-charge
Magez, Stefan	KR01	co-lecturer

Offered in the following programmes in 2019-2020	crdts	offering
Bachelor of Science in Environmental Technology	5	A
Bachelor of Science in Food Technology	5	A
Bachelor of Science in Molecular Biotechnology	5	A
Joint Section Bachelor of Science in Environmental Technology, Food Technology and Molecular Biotechnology	5	A

Teaching languages

English

Keywords

DNA/ RNA Purification, PCR, Quantitative PCR, Restriction Enzymes, Cloning in Prokaryotic Vectors, Expression Library Screening, Primer Design, Sanger Sequencing and Next Generation Sequencing, Sequence Alignments, Database Searches, Hybridization, Micro-arrays, Sequence Alignments, Database Searches, Protein Expression and Analysis, Antibody Based Protein Analysis, Chromatography.

Position of the course

The Molecular and Biological Analysis explains and illustrates basic approaches, techniques, and tools used in modern molecular biology while dealing with nucleic acids and proteins.

Contents

1. General aims and applications of Molecular Biological Analysis.
2. DNA/RNA based applications (disease diagnostics, personalized medicine and therapy, ‘omic’ analysis, forensic analysis, pathogen detection, transgene detection).
3. DNA/RNA purification and basic analysis (Restriction Enzyme Analysis, Variable Number Tandem Repeat Analysis, DNA electrophoresis, Hybridization, Sanger sequencing, Next Generation Sequencing).
4. DNA amplification: Polymerase Chain Reaction (PCR), Quantitative Real-Time PCR, LAMP amplification.
5. Cloning and expression using prokaryotic vectors.
6. Screening of expression libraries.
7. Basic principles of gene silencing and gene editing.
8. Protein sequence analysis and applications.
9. Protein production and purification (various chromatographic techniques: HPLC, FPLC, size and affinity chromatography).
10. Protein electrophoresis (PAGE, SDS-PAGE, IEF, 2D-elektrophoresis).
11. Basic concepts of Stuctural Biology.
12. Immunological analytic techniques and applications.
13. Enzyme immunoassays and immunoblotting.

14. Basic bioinformatics: primer design, sequence alignments, database similarity searching, BLAST, FASTA and others.
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Initial competences

Basic knowledge and understanding of the structure and function of the genetic material and proteins are required as well as cellular and microbial function. These competences are acquired in the courses such as General Biology, Microbiology, Biochemistry and Organic Chemistry 1.

Final competences

1 Students have a basic understanding of the principles of molecular biological analysis and know when and how to apply a certain technique while dealing with nucleic acids and proteins. The course gives a comprehensive overview of applications in various fields of Biology, Medicine, and Applied Biotechnology. The student will:
- be aware of the methods used to purify and analyze nucleic acids and proteins;
2 -understand how genome, transcriptome, and proteom determine the basic characteristics of life;
3 - know the basic principles of DNA detection, amplification, and DNA/RNA sequencing;
4 - understand principles underlying protein analysis and detection;
5 - know cloning and expression techniques using prokaryotic vectors;
6 - understand the basic principles of bioinformatics;
7 - be able to discuss the critical molecular components of genetic variation;
8 - be able to assess basic scientific concepts in the field of molecular biology;
9 - be aware of public debates surrounding genetic analysis of induvial genomes and various applications in biotechnology;
10 - be aware of the complementarity of microbiology, genetics, molecular biology, and other disciplines in the study of evolution in general.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, practicum, seminar: practical PC room classes

Learning materials and price

Learning material is provided as PowerPoint presentations and a dedicated booklet was prepared containing all protocols and backgroung information related to practical courses. In addition handouts and movies are provided explaining basic principles of used thechniques. All this material is available on Minerva. A textbook in applied genomics and DNA/RNA technology is followed with respect to the content. It is being advised to purchase the textbook, as its content covers the basic principles that support various other courses throughout the curriculum.

References

From Genes to Genomes. Concepts and applications of DNA technology. Eds. Jeremy W. Dale, Malcolm von Schantz & Nick Plant, Wiley-Blackwell 2012, Gene Cloning and DNA Analysis. T.A. Brown, sixth edition, Wiley-Blackwell 2010.

Course content-related study coaching

Practical courses are designed to directly support the molecular biology principles outlined in the lectures. The latter contain wrap-up and feedback sessions. This, in turn facilitates study coaching.

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, assignment, report

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

Written examination with open questions, assignment, report

Examination methods in case of permanent evaluation

Assignment, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

Participation in the practical courses is mandatory. The final exam will have open questions that directly relate to the lectures and experiments performed during practical courses.

Calculation of the examination mark

Written examination with open questions related to the lecture course material – 80%
Mid-term written examination will evaluate study progress – 10%
Practical course report – 10%

Facilities for Working Students

Study rooms are available for students.