Course Specifications
Valid in the academic year 2018-2019

Molecular Biological Analysis (O000020)

Course

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
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<tr>
<td>5.0</td>
<td>150 h</td>
<td>60.0 h</td>
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Course offerings and teaching methods in academic year 2018-2019

A (semester 2) English
practicum 21.45 h
lecture 30.0 h
seminar: practical PC room classes 5.3 h
excursion 2.45 h

Lecturers in academic year 2018-2019

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

Offered in the following programmes in 2018-2019

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

Position of the course

The Molecular and Biological Analysis explains and illustrates 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 analysis (Restriction Enzyme Analysis, Variable Number Tandem Repeat Analysis, DNA electrophoresis, Hybridization, Sanger sequencing, Next Generation Sequencing, Micro-array analysis, Genomic and Metagenomics analysis).
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. 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. Basic concepts of Structural Biology.

(Approved)
10. Immunological analytic techniques and applications (disease diagnostics).
11. Enzyme immunoassays and immunoblotting.
12. Basic bio-informatics: primer design, sequence alignments, database similarity searching, BLAST, FASTA and others.

Initial competences

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
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;
- understand how genome, transcriptome, and proteome determine the basic characteristics of life;
- know the basic principles of DNA detection, amplification, and DNA/RNA sequencing;
- understand principles underlying protein analysis and detection;
- know cloning and expression techniques using prokaryotic vectors;
- understand the basic principles of bioinformatics;
- be able to discuss the critical molecular components of genetic variation;
- be able to assess basic scientific concepts in the field of molecular biology;
- be aware of public debates surrounding genetic analysis of individual genomes and various applications in biotechnology;
- 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
Excursion, 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 background information related to practical courses. In addition handouts and movies are provided explaining basic principles of used techniques. 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

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

(Approved)
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%
   Written examination with open questions related to the practical course knowledge – 10%
   Practical course report – 10%

Facilities for Working Students
   Study rooms are available for students.