GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Molecular Tools for Agriculture (I003063)

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

Credits 3.0 **Study time 90 h**

Course offerings in academic year 2025-2026

A (semester 1) English Gent

Lecturers in academic year 2025-2026

Kyndt, Tina LA25 lecturer-in-charge

Offered in the following programmes in 2025-2026	crdts	offering
Bachelor of Science in Bioscience Engineering	3	A

Teaching languages

English

Keywords

DNA-, RNA- and protein analysis methodology, PCR and applications, low and high throughput sequencing
technologies, molecular markers, QTL mapping/GWAS, gene isolation and cloning, CRISPR/Cas genome editing, RNAi, transformation, GMO regulation

Position of the course

Molecular techniques are abundantly represented in biotechnology to identify organisms, study their physiology and to targetedly edit their genome. Similar to crime investigations, also in agricultural applications DNA-analysis and -manipulation techniques are often used. For quality analysis of plant- and animal-based foods, the diagnosis of illnesses or pests, the study of gene expression and to clone, molecular methodology is indispensible. In this course we will cover the basic concepts of molecular technology with applications in agriculture.
This course will describe and discuss a variety of molecular techniques explaining the basic concepts but also following the latest trends

Contents

I INTRODUCTION
I.1 Genome
I.2 Transcriptome
I.3 Gene expression
I.4 Basic techniques for DNA-analysis
I.5 Basic principles recombinant DNA

II DNA HYBRIDISATION
II.1 General principles of hybridisation
II.2 What to use as probe?
II.3 Allele-specific probes for SNP detection
II.4 Array or chip technology
II.5 Labels and detection

III PCR & Q-PCR
III.1 Basic principles PCR
III.2 Specificity, accuracy and contamination in the context of PCR
III.3 Technical variants of PCR
III.4 Non-PCR-based amplification methods
III.5 Semi-quantitative PCR, Q-PCR and droplet digital PCR (ddPCR)

III.6 Colony PCR
III.7 PCR for diagnostics

IV HIGH THROUGHPUT SEQUENCING
IV.1 NGS or 2nd generation sequencing: based on amplified single molecule sequencing
IV.2 Next Next generation Sequencing or Third generation sequencing: single molecule sequencing
IV.3 Comparing different sequencing methods
IV.4 Applications of high throughput sequencing

V ANALYSING GENETIC VARIATION BY STUDYING DNA POLYMORPHISMS
V.1 MOLECULAR MARKERS AND POLYMORPHISMS
V.2 Protein markers
V.3 DNA markers
V.4 Typical target regions used for diagnostics
V.5 Applications of molecular marker techniques

VI Agrobacterium-based plant transformation, gene editing, GMO regulation
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Guest lectures: Agricultural applications of molecular techniques in plant and animal production

Initial competences

At least following competences should have been acquired before starting this course:
- Insight in the structure of DNA, RNA and proteins
- Knowledge about gene expression (transcription and translation)

Final competences

1 To understand the basis methodology of molecular techniques important for agricultural applications.
2 To suggest the appropriate molecular techniques for studying, identifying and genetically modifying agricultural organisms.
3 To compare different molecular analysis-methods.
4 To argue GMO-applications in a science-based way, keeping in mind the multidisciplinary context.

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

Seminar, Lecture

Extra information on the teaching methods

Beside theoretical lectures, seminars by guest lecturers are included in this course

Study material

None

References

Course content-related study coaching

Additional information can be obtained by email, UFORA or through personal contact with the teacher before or after the classes.

Assessment moments

end-of-term and continuous assessment

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

Written assessment

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

Written assessment

Examination methods in case of permanent assessment

Participation

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

End-of-term assessment will account for 90% of the grade based onthe written exam. 10% of the grade will be obtained through participation in the guest lectures.

Calculation of the examination mark

The final score is determined by 90% end of term assessment and 10% continuous assessment. The continuous assessment for first sitting remains valid for the second sitting.