

Molecular Plant Breeding (C003100)

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

Credits 3.0 **Study time 80 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	English	Gent	seminar excursion group work lecture	0.0h
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Lecturers in academic year 2024-2025

Ruttink, Tom WE09 lecturer-in-charge

Offered in the following programmes in 2024-2025

	crdts	offering
Master of Science in Bioinformatics(main subject Systems Biology)	3	A
Master of Science in Biochemistry and Biotechnology	3	A
Master of Science in Plant Biotechnology	3	A
Exchange programme in Biochemistry and Biotechnology (master's level)	3	A

Teaching languages

English

Keywords

Plant breeding, genetics, genomics, DNA-marker, linkage map, association mapping, quantitative trait locus (QTL), marker assisted selection (MAS), climate change.

Position of the course

This course is meant for students who want to specialize in the field of molecular plant genetics. The use of modern molecular techniques for the characterisation of plant genomes in the context of molecular plant breeding will be discussed, with emphasis on breeding for climate change. This course is related to the courses 'Genetics II' (3rd Bachelor in Biochemistry and Biotechnology) and 'Biostatistics' (1st Master in Biochemistry and Biotechnology).

Contents

- 1 Principles of plant breeding.
- 2 DNA-marker detection techniques, Next Generation Sequencing, and high-throughput molecular markers.
- 3 Genetic relationships and diversity based on DNA markers.
- 4 Crossing over, linkage, 'Linkage Disequilibrium' (LD) and association genetics.
- 5 Dissect the interactions: germplasm - genotype - environment - phenotype.
- 6 Strategies for the identification of markers linked to traits of agricultural relevance.
- 7 Marker assisted selection.

Initial competences

A general knowledge of plant genetics and successfully fulfilled the courses 'Biostatistics' and 'Genetics II' or have reached the final competences of these courses by alternative means.

Final competences

- 1 Has insight in the objectives of molecular plant breeding (MPB). Understands how life-science disciplines are embedded in MPB, and how MPB is positioned in

- biotechnology, agrobusiness and primary production.
- 2 Has insight in the interaction between germplasm, genotype, environment, and phenotypic trait expression.
 - 3 Has knowledge of sources of variation and methods to quantify (phenotype), control (environment), identify (genotype), and explore/create (germplasm) these sources.
 - 4 Understands the concepts of cross-over, linkage, and LD, and can apply these in linkage mapping and QTL analysis.
 - 5 Has a comprehensive overview of the breeding cycle.
 - 6 Has practical knowledge of the basic principles of quantitative genetics.
 - 7 Can implement a practical application of MBP (breeding scheme, phenotypic selection, marker assisted breeding) in a topical case. Can develop a breeding program for a crop and trait of choice in the frame of climate change and discuss it with colleague-students.

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

Group work, Seminar, Excursion, Lecture

Extra information on the teaching methods

Lecture: theoretical concepts are discussed and illustrated using examples from literature.

Seminar: two sessions with active participation to prepare the group assignment and to discuss the content, the structure, the bottlenecks and the progress. One session with an interactive exercise (a kind of boardgame) to demonstrate the concept of QTL identification.

Excursion: visit to the field station and explanation of breeders and researchers on plant breeding in practice, at ILVO.

Groupwork: in teams of 3 students, with rotating team captain, you choose a breeding goal (crop + trait) in the frame of climate change, research literature to describe all steps of the breeding process, and write an 6-page report that describes an idea to start up a real breeding program.

Study material

Type: Handbook

Name: Principles of Plant Genetics and Breeding

Indicative price: € 97

Optional: yes

Language : English

Author : George Acquaah

ISBN : 978-1-11962-669-5

Number of Pages : 848

Oldest Usable Edition : 3rd edition, december 2020

Online Available : No

Available in the Library : No

Available through Student Association : No

Usability and Lifetime within the Course Unit : regularly

Usability and Lifetime within the Study Programme : one-time

Additional information: paperback copy can be checked out during classes, upon request to the teacher.

Type: Slides

Name: slides of the course Molecular Plant Breeding

Indicative price: Free or paid by faculty

Optional: no

Language : English

Oldest Usable Edition : 2024-2025

Available on Ufora : Yes

Online Available : Yes

Available in the Library : No

Available through Student Association : No

Additional information: Slides are updated yearly. It is highly recommended to use the version provided in UFORA in the academic year of the course itself, and not to use older versions.

References

None.

Course content-related study coaching

Personal: through electronic appointment.

Per group: for questions and feedback for groupwork, on campus or online after electronic appointment.

Interactive support via Ufora and/or the MS Teams channel coupled to the course.

Assessment moments

end-of-term and continuous assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

Written exam: open questions on theory and concepts, or links between them, and questions related to applications (case study of the groupwork).

Groupwork: evaluation of the written report (6-pager) is carried out in group with one common score. In exceptional cases of clear differentiation of individual contributions, individual scores may be adjusted.

Only the written exam is possible in the second examination period.

If the student fails based on the final score (written exam + groupwork) in the first examination period, the score given for the permanent evaluation (groupwork: assignment), will be retained for the second examination period.

Calculation of the examination mark

The written assessment accounts for 70% in the calculation of the final score.

The groupwork score (assignment, 6-pager) accounts for 30% in the calculation of the final score.

This applies to both examination periods, where the score for the groupwork in the first examination period is retained for the second examination period.