

## Molecular Plant Breeding (I002628)

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

**Credits 5.0**

**Study time 150 h**

**Contact hrs**

50.0h

**Course offerings and teaching methods in academic year 2022-2023**

A (semester 1)

English

Gent

excursion

10.0h

lecture

30.0h

seminar: coached exercises

10.0h

**Lecturers in academic year 2022-2023**

Geelen, Danny

LA21

lecturer-in-charge

Haesaert, Geert

LA21

co-lecturer

**Offered in the following programmes in 2022-2023**

**crdts**

**offering**

[Master of Science in Bioscience Engineering: Cell and Gene Biotechnology](#)

5

A

[Exchange Programme in Bioscience Engineering: Cell and Gene Biotechnology \(master's level\)](#)

5

A

**Teaching languages**

English

**Keywords**

Selection, genetic marker, linkage map, association mapping, quantitative trait locus (QTL), marker assisted selection (MAS), genomics, GWAS, pre-breeding, genome elimination, hybrids, mutation

**Position of the course**

Plant breeding is an ancient discipline that creates new genotypes adapted to specific growing conditions (e.g. abiotic and biotic stress), crop management techniques (e.g. mechanization, one-time harvest) and that addresses consumers and society requirements (e.g. food processing, nutritional value, etc.). With the advent of molecular genetics and genomics, the array of tools and methods has drastically expanded making the plant breeding process more efficient. Moreover, molecular genetics creates the possibility to introduce new characteristics. This course begins with an introduction to the basics of plant breeding (creating diversity and selection methods), which is a prerequisite to understand and implement molecular tools in plant breeding programs. The second part of the course will address molecular techniques for the characterization of genomes in the context of breeding (e.g. diversity screening, developing molecular markers, etc.). The third part of the course will highlight some of the most recent advances in sexual reproduction and genome analysis. This is relevant for the student who has an interest in engaging in research that aims to improve or develop new technologies useful for plant breeding and plant genetic studies.

**Contents**

1. Basic principles of plant breeding e.g. diversity, heritability, back crosses and selection methods.
2. Molecular principles of selection
  - DNA-fingerprinting of plants
  - DNA-marker technologies and interpretation of DNA marker results
  - Estimation of genetic relationships, diversity using DNA-markers
  - Germplasm characterisation
  - Population genetics
  - Linkage, 'Linkage Disequilibrium' (LD) and association genetics

- Strategies for the identification of markers linked to traits of agricultural relevance
  - Marker assisted selection programs
  - Genomics breeding
3. Advanced breeding tools.
- Doubled haploid production,
  - genome elimination,
  - chromosome substitution lines,
  - apomixis,
  - modulation of meiotic recombination,
  - polyploidization,....

#### **Initial competences**

Basic knowledge of plant genetics, molecular biology and statistics

#### **Final competences**

- 1 Have knowledge on the principles of plant breeding
- 2 Have knowledge of methodologies available for the identification of a genetic locus associated with a plant trait.
- 3 Apply DNA-marker technologies in plant breeding
- 4 Have insight into 'marker assisted selection' and 'genomics assisted selection'
- 5 Analyze molecular data used for plant breeding
- 6 Have knowledge on ongoing research in the field of molecular plant breeding

#### **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, Seminar: coached exercises

#### **Learning materials and price**

All materials will be provided in electronic form. Materials include: notes, presentations and research papers. Estimated total cost: 20 EUR

#### **References**

Papers extracted from scientific journals in the field of plant breeding

#### **Course content-related study coaching**

Personal: through electronic appointments. Interactive help using Ufora

#### **Assessment moments**

end-of-term and continuous assessment

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

Written examination with open questions

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

Written examination with open questions

#### **Examination methods in case of permanent assessment**

Report, Participation

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is not possible

#### **Extra information on the examination methods**

Students are evaluated during the lectures when they are presenting an overview of an allocated subject and during the discussion after presentations.

#### **Calculation of the examination mark**

The written exam will have a weight of 65% in the calculation of the final score; the assignment will have a weight of 35% in the calculation of the final score. Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.

