GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2020-2021

Gene Technology and Plant Biotechnology (I002649)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 5.0 **Study time 150 h** **Contact hrs** 50.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	Dutch	Gent	practicum	8.75 h
			microteaching	3.75 h
			seminar: practical PC room classes	3.75 h
			lecture	28.75 h
			group work	1.25 h
			excursion	2.5 h

Lecturers in academic year 2020-2021

Gheysen, Godelieve	LA25	lecturer-in-charge

Offered in the following programmes in 2020-2021	**crdts**	**offering**
Master of Science in Bioscience Engineering: Agricultural Sciences	5	A

Teaching languages

Dutch

Keywords

Position of the course

Molecular biotechnology is being used to specifically alter organisms and therefor the DNA sequence must first be cloned. On the other hand a variety of molecular techniques is being used to study living organisms or to identify individuals or specific characteristics. A plethora of molecular methods have been optimised and others are being developed constantly.This course will describe and discuss a variety of molecular techniques explaining the basic concepts but also following the latest trends. The student will also become familiar with different techniques used for plant transformation. Several case studies will be discussed with the focus on regulation, usefulness, risk analysis, social aspects, etc.
The first part of this course is identical to "Gene technology and molecular diagnostics" (I000367) and is being taught simultaneously. The second part is a shortened version of "Plant Biotechnology" (I000810).

Contents

1. Introduction
1.1. Introduction pro-and eukaryotic genomes
1.2. Gene structure and gene expression in pro- and eukaryotes
1.3. Basic principles of DNA-analysis
1.4. Basic principles of recombinant DNA

2. DNA-hybridisation
2.1. General principles
2.2. Southern blotting
2.3. Probe technology, detection
2.4. In situ DNA hybridisation
2.5. Colony hybridisation

2.6. Micro array technology

3. PCR and applications
3.1. Basic principles and problems
3.2. Problems of PCR
3.3. Technical variations
3.4. Non-PCR amplification methods
3.5. Semi-quantitative PCR, Q-PCR, dd-PCR
3.6. AFLP
3.7. Other examples of PCR

4. Expression analysis
4.1.RNA extraction and run-on
4.2. Hybridisation
4.3. Sequence analysis
4.4. Q-RT-PCR
4.5. RNA fingerprints
4.6. Transcript and transcriptome
4.7. Reporter genes
4.8. Protein analysis

5. Identification and analysis of genes
5.1. Introduction
5.2. DNA similarity
5.3. Expression patterns
5.4. Encoded protein
5.5. Mutation or polymorfism
5.6. Molecular analysis of a gene
5.7. Functional analysis of a gene

6. Analysis of genetic variation
6.1. Molecular markers introduction
6.2. RFLP
6.3. Current techniques
6.4. Specific DNA regions (mtDNA, rDNA, STR...)
6.4. Applications in crop protection, analysis of relationships, breeding,....
6.5. Comparative overview
6.5. Biotechnology or breeding?

7. Plant transformation techniques
7.1. Plant transformation and regeneration
7.2. Agrobacterium mediated transformation
7.3. Direct gene transfer
7.4. Expression of transgenes
7.5. Inactivation of plant genes

8. Herbicide resistant GMO plants
8.1. Introduction
8.2. Basta or glufosinate resistance
8.3. Roundup or glyphosate resistance

9. Insect resistant plants (Bt, RNAi)
9.1. Introdcution
9.2. Bt corn
9.3. Bt cotton
9.4. RNAi

10. Genetic engineering for disease resistance and stress tolerance
10.1. Resistance to viruses
10.2. Resistance to fungi or bacteria
10.3. Tolerance to abiotic stress

11. Improved product quality and production in GMO's

11.1. Male sterility for hybrids
11.2. Nitrogen use efficiency
11.3. RNAi to inactivate undesirable characteristics
11.4. Modified oil production
11.5. Biofortification
11.6. Blue roses
11.7. Modified wood composition
11.8. Potatoes with modified starch
11.9. Bioplastics, enzymes,...
11.10. Pharming

12. GMO regulation and discussion
12.1. Definition of GMO in EU
12.2. Some aspects of the regulation
12.3. Labeling
12.4. Co-existence
12.5. Discussion

Exercises: group work with ppt presentation, PC, PCR and Q-PCR, reporter genes, plant transformation, GMO-detection, excursion to companies and/or institutes,...--- Klik om te editeren ---

Initial competences

Gene Technology and Plant Biotechnology builds on certain learning outcomes of course unit Biochemistry and Molecular Biology ; or the learning outcomes have been achieved differently

Final competences

1 insight in the combination of molecular analysis and breeding for the production of improved crops
2 Knowledge of GMOs for use in agriculture in combination with other methods to control pests and diseases
3 Knowledge and application of molecular techniques for the study and identification of living organisms
4 Knowledge and application of molecular techniques for genetic engineering of plants
5 insight in policy and regulation on the use of GMOs in food and agriculture at the national and international level
6 to be able to compare different plant transformation techniques
7 to be able to select the best DNA analysis technique for a specific problem
8 to be able to compare advantages and disadvantages of different molecular analysis techniques
9 to evaluate possibilities, limitations, risks and feasibility of genetically modified crops
10 to accurately collect and critically analyse experimental data
11 to be able to discuss on GMO applications with scientific arguments in a multidisciplinary context
12 to be open for new scientific genetic engineering developments and their applications in a broad scientific and socio-economic context
13 to be able to extract correct scientific information from a mass of contradictory data
14 work in a team for experimental work and reporting--- Klik om te editeren ---

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, group work, lecture, microteaching, practicum, seminar: practical PC room classes

Learning materials and price

Syllabus available; powerpoint through Ufora

References

Course content-related study coaching

Additional explanations possible through e-mail, ufora or personal contact before, in between or after excercise classes.

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, oral examination

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

Written examination with open questions, oral examination

Examination methods in case of permanent evaluation

Participation, assignment, peer assessment, report

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Calculation of the examination mark

Theory: period aligned evaluation (75%)
Exercises: non-period aligned evaluation (25%)

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examinator.