

Physiological Regulation in Plants (C003329)

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)	English	Gent		
			practicum	12.5 h
			seminar: coached	7.5 h
			exercises	
			lecture	30.0 h
			online lecture	0.0 h
			online seminar	0.0 h

Lecturers in academic year 2020-2021

Van Der Straeten, Dominique	WE11	lecturer-in-charge
Depaepe, Thomas	WE11	co-lecturer

Offered in the following programmes in 2020-2021

	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Biology)	5	A
Master of Science in Bioinformatics (main subject Systems Biology)	5	A
Master of Science in Biology	5	A
Exchange Programme in Biology (master's level)	5	A

Teaching languages

English

Keywords

Plant hormones, receptors, second messengers, signal transduction, signaling networks

Position of the course

This course aim at providing a thorough insight in the signaling network of internal and environmental factors that govern plant growth and development. The course builds on prior knowledge and competences acquired upon successful completion of Plant Physiology I and Genetics and Molecular Techniques I. Students will also be introduced to practical applications in agriculture and horticulture.

Contents

Part 1 Internal Signals

1.1. General introduction to signaling in plants; intra- and intercellular communication.
Receptors: GCRs, 2-component receptors, RLKs, ion-channel linked receptors
Second messengers: Ca²⁺, cAMP, cGMP, cADP-R, IP3/DAG1
Kinases (MAPK cascades, CDPK, Raf kinases, ...) and phosphatases in plants.
Plant specific transcription factors (AP2/EREBPs, ARFs, ARR,...).

1.2. Mutations: types of mutagens, principles of loss and gain-of-function mutations.

1.3. Hormone signaling routes in plant growth and development

Including principles of screening, phenotypic characterization of mutants, analysis of gene function, feedback control:

1.3.1. gibberellins

1.3.2. cytokinins

1.3.3. ethylene

1.3.4. abscissic acid

1.3.5. brassinosteroids

1.3.6. auxins

1.3.7. Non-traditional plant hormones: peptides, jasmonates, strigolactones

1.4. Pathways for light signaling, circadian clock regulation

Part 2. Integration of internal signals and communication with the environment

2.1. Co-regulation of photosynthesis and photorespiration by C1-metabolism¹ 1
(interrelation cytosol/plastids/mitochondria/peroxisomes; folate metabolism)

2.2. Effect of global climate change: IPCC predictions of CO₂, precipitation, temperature variation and impact on agriculture. Effects of increased CO₂ levels on plants; relation to NO₃ uptake, effects on growth, interactions with hormones.

2.3. Integration of hormone and light signaling pathways (shade avoidance, phototropism and gravitropism)

Wherever relevant, applications in agriculture and horticulture will be mentioned.

Practicals and tutorials, journal club.

Class room problem solving sessions will consist of the presentation and discussion of research articles in the above-mentioned areas.

The students will investigate signaling pathways through phenotypic analysis of Arabidopsis mutants, reporter gene detection, physiological tests.

Initial competences

General knowledge of plant physiology, biochemistry, genetics and cell biology. Having successfully completed the courses Plant Physiology I and Genetics and Molecular Techniques I.

Final competences

- 1 To have acquired a profound insight in the network that integrates endogenous and environmental signals in plants.
- 2 To understand the impact of signaling cross-talk on the plant phenotype and on crop productivity. To be acquainted with the possibilities offered by modern biotechnology to unravel these processes and to develop innovative strategies to alter plant growth.
- 3 To critically evaluate scientific papers in this research area; summarize their contents and report it in a group, as a training in scientific communication and discussion.

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

Lecture, practicum, seminar: coached exercises, online lecture, online seminar

Extra information on the teaching methods

In principle, all teaching activities will be held on campus. Under COVID19 restrictions, didactic work forms may be subject to amendments. This can include online classes and/or tutorials, or through a rotation system (partially on campus, partially online). Class room problem solving sessions will consist of the presentation and discussion of research articles in the above-mentioned areas.

Practical course illustrating a few concepts related to the discussion topics. Students will investigate signaling pathways through the phenotypic analysis of Arabidopsis mutants, reporter gene detection, and physiological tests.

Learning materials and price

Syllabus consisting of presentations. Review and research articles. Estimated cost: 25 EUR

References

The Molecular Life of Plants, Jones et al., 1st edition, Wiley-Blackwell, 2013.
Taiz and Zeiger, Plant Physiology, Sinauer Press, 2010.

Online publications of The American Society of Plant Biology, The Arabidopsis Book.

Course content-related study coaching

Relevant websites will be communicated. Tutorials should be prepared; prior discussion is encouraged. Individual coaching for students with specific questions.

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, job performance assessment, report

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Oral examination with written preparation. Under COVID19 restrictions, the evaluation format may be amended to a written examination.

Non-periodic evaluations are based on performance and active participation during classroom problem solving sessions. Task based on research papers, presentation and permanent evaluation.

Participation to practicals and tutorials is essential to successfully complete this subject. Examination during the second examination period is possible; an alternative task will have to be fulfilled.

Students will be evaluated on their ability of knowledge integration and logical analysis of scientific problems in the area of Physiological Regulation, besides their factual knowledge.

Calculation of the examination mark

Periodic and continuous evaluation during classes. Final marks will be assigned by weighing different evaluations (80% for periodic evaluation, 20% for non-periodic evaluation)