



Module syllabus: *Mechanisms of plant development*

1. Overall information

Module coordinator	prof. dr hab. Dorota Kwiatkowska
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ECTS	4
Method for the verification of learning outcomes	<p>The module is composed of lectures and laboratories. The final grade is calculated as the weighted average based on the following student activities:</p> <ul style="list-style-type: none">- The lecture part ends with written final exam (0.5) on the knowledge presented during the lectures, supplemented with that gained during the students' own work with the literature.- After each class students prepare a written report containing a description, analysis and presentation of the results along with their conclusions. The average of all of the reports is 0.2 of the final laboratory grade.- During the laboratory sessions, students are evaluated by three written lab tests. The average of all of the tests is 0.3 of the final laboratory grade. <p>To be awarded a final grade, the student must pass each activity of the module. Grades: below 51% – fail (F); 52-60% – with minimum academic criteria (E); 61-65% – satisfactory (D); 66-75% – good (C); 76-85% – very good (B), ≥ 85% – excellent (A)</p>

2. Description of student activity and work

Lecture/discussion sessions	
Responsible instructor	prof. dr hab. Dorota Kwiatkowska
Content	<p>The main objective of this module is to provide knowledge about the mechanisms for the regulation of the embryonic and post-embryonic development of plants. Students learn the detailed characteristics of the different phases of development, the influence of endogenous and exogenous factors as well as the molecular basis of plant development regulation. Students acquire skills to recognise the plant developmental phases, to analyse mutant phenotypes and to indicate the mechanisms of plant development regulation.</p> <p>Lectures/discussion sessions combine topics of plant development with anatomy, physiology and molecular biology.</p> <p>Lecture/discussion session content: The mechanisms of plant development is a term that includes a broad spectrum of processes starting from the formation of an embryo, through seed germination to the development of a mature plant that is ready for reproduction. The following topics will be considered within the frames of the module:</p> <ol style="list-style-type: none">1. Life cycle of angiosperms, gametophyte development, fertilisation, embryo





	development – the role of genetic factors. 2. Model plants in molecular biology and plant developmental biology. 3. Morphogenesis in 2D – the epidermis as a monolayer that has a pattern of various cell identities 4. Simple morphogenesis in 3D – root development 5. Complex morphogenesis in 3D – shoot apical meristem generating primordia
Number of didactic hours (contact hours)	15
Literature	The Arabidopsis Book (available on-line) Romberger JA, Hejnowicz Z, Hill JF. Plant Structure: Function and Development. 1993. Springer-Verlag

Laboratory	
Responsible instructors	Staff of the Department of Biophysics and Morphogenesis of Plants and the Department of Cytogenetic and Plant Anatomy
Laboratory projects	Project 1: Methods for analysing the gene expression pattern. Project 2: Development of female and male gametophytes, double fertilisation in angiosperms and their genetic regulation. Project 3: Embryo and seed development and their genetic regulation. Project 4: Development of the shoot apical meristem – genetic and hormonal regulation. Project 5: Development of seedlings (photo- and scoto- morphogenesis). Project 6: The role of the cytoskeleton in growth and morphogenesis. Project 7: Differentiation of the root epidermis. Initiation and development of lateral roots. Project 8: Differentiation of the leaf epidermis. Project 9: Development of flowers. The ABC(D)E model. Project 10: Regulation of the transition to flowering. Inflorescence architecture.
Methodology of laboratory classes	The instructor will introduce the topics in the form of a short presentation. Students will observe fixed or fresh plant material using different microscopic techniques by following the instructions. At the end of each project, students will prepare a report.
Number of didactic hours (contact hours)	30
Literature	The Arabidopsis Book (available on-line)

3. Forms of verification

Reports from realised laboratory projects	
Evaluation	Evaluation is based on student knowledge related to laboratory project purpose and methods of the laboratory project, engagement in its realisation, quality of assessing and presenting the experimental results, use of reference materials. Grades for reports are awarded on a scale: A-F, where A is the best and F is a fail. An excellent report (A) – without any essential errors





Fail (F) – no report

Lab tests

Grades	Grades are awarded on a scale of A-F, where A is the highest and F is failing. Excellent (A) – the student presents a fluent knowledge concerning the last lab topics, makes minimal errors that do not affect the quality of the presentation. Good (C) – the student presents a good knowledge concerning the last lab topics, makes rare and subtle errors. Satisfactory (E) – the student exhibits a satisfactory knowledge, but with a poor understanding of the last lab topics, and makes subtle errors. Fail (F) – the student does not present a satisfactory knowledge concerning the last lab topics, and makes many substantial errors, which disqualify their presentation.
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Final exam

Grades	Grades are awarded on a scale of A-F, where A is the highest and F is a fail. Excellent (A) – the student presents a fluent knowledge of the mechanisms of plant development and its regulation, makes minimal errors that do not affect the quality of the presentation. Good (C) – the student presents a good knowledge of the mechanisms of plant development and its regulation, makes rare and subtle errors. Satisfactory (E) – the student exhibits a satisfactory knowledge, but with a poor understanding of the mechanisms of plant development and its regulation, and makes subtle errors. Fail (F) – the student does not present a satisfactory knowledge of the mechanisms of plant development and its regulation, and makes many substantial errors, which disqualify their presentation.
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