Module syllabus: ***Advanced light microscope techniques***

1. Overall information

Module coordinator	prof. dr hab. Ewa Kurczyńska
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ECTS	**3**
Method for the verification of learning outcomes	The final grade for the module is weighted on the average of the following student activities: - Active participation in laboratory classes (continuous evaluation of practical skills, tests and reports) (0.7) - Written final exam (0.3) To be awarded a final grade, the student must have passed 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)

2. Description of student activity and work

Lecture/discussion sessions	
Responsible instructor	prof. dr hab. Ewa Kurczyńska,
Content	**The main objective of this module** is to teach the basic knowledge of the advanced light microscopy techniques that are used in studies of plant cells. The basic concepts of light microscopy, construction and principles of microscopy operation and the proper techniques of light microscopy to analyse structure and function of plant cells and tissues will be introduced in order to teach the image interpretation of cells and tissues using different types of microscopes (bright field, fluorescence, phase-contrast, polarising). **Lectures/discussion sessions** consist of core subjects in different microscope techniques: phase-contrast, fluorescence, DIC and polarising and will included the methods that are commonly used to visualise the plant cell structure. **Lecture/discussion session content:** Imaging methods; sample preparation: fixation, embedding into resins, cutting; principles of interpreting images. The student will become acquainted with the construction and principles of operation and applications of bright field microscopy, phase contrast microscopy, polarising microscopy, interference microscopy and fluorescence microscopy. Much emphasis will be placed on the ability of students to use different types of light microscopes to detect and visualize the components of plant and animal cells. The students will acquire the ability to analyse and interpret microscopic images as well as learning the basic principles of microscopic image processing.
Number of didactic hours (contact	**10**

hours)	
Literature	**Students will receive relevant literature.**

Laboratory	
Responsible instructors	Staff of the Department of Cell Biology
Laboratory projects	Project 1: Bright field microscope – analysis of plant cells; calculating the real dimensions of biological objects Project 2: Dark-field microscopy – analysis of a suspension culture Project 3: Phase-contrast microscopy – movement of plant cell organelles; determining the plastids, mitochondria and sferosomes in a cell Project 4. Polarising microscope – determining the cellulose angle in different plant cell walls; starch analysis Project 5: Fluorescence microscopy I – primary autofluorescence of plant cells Project 6: Fluorescence microscopy II – secondary fluorescence after staining with fluorochromes
Methodology of laboratory classes	Theoretical introduction presented by the instructors; individual work with the different types of light microscopy; individual observations of cell structure including *in vivo* observations. Much emphasis is placed on the ability of students to use the different types of light microscopes and to detect and visualize the components of plant and animal cells. Students will acquire the ability to analyse and interpret microscopic images as well as learning the basic principles of microscopic image processing.
Number of didactic hours (contact hours)	36
Literature	For each laboratory, the students will receive the instructions for the reactions to be carried out and/or the worksheets and relevant literature from the person supervising the laboratory.

3. Forms of verification

Continuous evaluation of knowledge, activity and practical skills	
Grades	Grades are awarded on a scale of A-F, where A is the best and F is a fail. An excellent performance (A) – the student actively participates in the laboratory work, demonstrates an excellent understanding of the experimental procedures (their aims, sequence and outcomes), is engaged and creative in solving current problems and in assessing and presenting the results. A good performance (C) – the student demonstrates good judgment and knowledge, correctly performs an experiment, correctly exhibits a sense of the experimental procedure, correctly assesses and presents the results. A satisfactory performance (E) – the student demonstrates satisfactory judgment and knowledge, is poorly engaged and needs additional help to finish the experiment and the final assessment of the experimental results correctly, presents a satisfactory presentation of the results.

	A performance that does not meet the minimum academic criteria (F) – the students is not engaged in the experiment, does not exhibit a sense of the experimental procedures, poorly interprets and presents results.

Reports from realised laboratory projects	
Evaluation	Evaluation comprises judgment and knowledge related to laboratory project sense and methods, engagement in the realisation, quality of assessment and presentation of the experimental results, use of reference materials. Grades for reports are awarded on a scale of A-F, where A is the best and F is a fail. An excellent report (A) – without any essential errors Fail (F) – no report

Final exam	
Grades	Grades are awarded on a scale of A-F, where A is the highest and F is failing fail. Excellent (A) – the student presents a fluent knowledge of the principles of electron microscopy and the sample preparation techniques described. Good (C) – the student presents a good knowledge of the principles of electron microscopy and the sample preparation techniques described, makes rare but subtle errors. Satisfactory (E) – the student exhibits a satisfactory knowledge of described principles of electron microscopy and the sample preparation techniques described, but with a poor understanding of some aspects of electron microscopy and makes subtle errors. Fail (F) – the student does not present a satisfactory knowledge of the principles of electron microscopy and the sample preparation techniques described and makes many substantial errors, which disqualify their presentation.