

M4403	Molecular Physiology of Plant Development			
Coordinator (responsible lecturer) Prof. Dr. Peter Westhoff (west@uni-duesseldorf.de)				
Lecturers Prof. Dr. Peter Westhoff & research/teaching assistants				
Contact and organization Prof. Dr. Peter Westhoff (west@uni-duesseldorf.de)				
Workload 420 h	Credit points 14 CP	Contact time 300 h	Self-study 120 h	Duration 1 semester
Course components Practicals: 18 SWS Lectures: 2 SWS		Frequency Each winter semester (February/March)		Group size 16 students
Learning outcomes/skills Students have learned the concepts and methods of plant developmental physiology and are able of using them. They have adopted genetic, molecular biological and biochemical techniques and can apply these techniques independently- Students are familiar with the major scientific equipment and are able of using the instruments precisely and independently.				
Forms of teaching Lectures, practicals				
Contents <u>Lectures:</u> (1) <i>Cell proliferation</i> : cell cycle; excursus: ubiquitin-mediated protein degradation; excursus: G proteins; excursus: vesicular transport; cytokinesis. (2) <i>Cell differentiation</i> : concepts of asymmetric cell divisions; cell polarity in baker's yeast; asymmetric division of the zygote and the establishment of apical-basal polarity in the embryo; differentiation of cortex and endodermis in roots; stomata development. (3) <i>Light as an inducer of growth and development</i> : photoreceptors (phytochromes, cryptochromes, phototropins); Cis- and trans-regulatory elements of light-controlled gene expression; genetic approaches for dissecting light signaling pathways; physical interaction of photoreceptors with transcription factors and other effector proteins; light-controlled protein degradation: the roles of COP1 and SPA proteins. (4) <i>Circadian clock</i> : circadian rhythms; regulatory principles and models of a circadian clock; the circadian clock of Drosophila; the circadian clock of Arabidopsis. (5) <i>From seeds to seedlings</i> : seeds of angiosperms; embryogenesis and pattern formation; seed maturation (regulatory genes, roles of abscisic acid and gibberellins, dormancy); seed germination: light and cold as inducing factors; physiology of seed germination; development of chloroplasts and the biogenesis of the photosynthetic apparatus. (6) <i>Stems and leaves</i> : shoot apical meristem: genetic regulators, roles of phytohormones; formation of leaf primordia and phyllotaxis; leaf development: leaf polarity, cell division patterns; differentiation of the vascular system; shoot branching; leaf differentiation in C4 species. (7) <i>Control of flowering time</i> : flowering repressors; vernalisation; photoperiodism; target genes of the inflorescence and flower meristems. <u>Practical course:</u> (1) <i>Molecular evolution of C4 photosynthesis</i> : analysis of transcriptomes of mesophyll and bundle-sheath tissues; dissection of promoters of C4 genes and identification of cis-regulatory elements; comparison of the kinetic and regulatory properties of C3 and C4 phosphoenolpyruvate carboxylases; enhancer trap lines.				

<p>(2) <i>Genetic and biochemical analysis of regulatory genes of thylakoid membrane biogenesis:</i> Northern analysis of plastid RNAs; isolation of intact chloroplasts by density gradient centrifugation; immuno localization of regulatory proteins in chloroplast fractions; tagging of proteins and affinity purification of tagged protein complexes; protein-protein interaction studies by use of the split-ubiquitin system; Blue-native polyacrylamide gelelectrophoresis of membrane protein complexes.</p>
<p>Requirements for admission Formal: None; With regards to content: Students must be familiar with elementary molecular biological and biochemical techniques and the basics of gene regulation and signal transduction.</p>
<p>Type of examination (1) Knowledge base (80 % of final grade): written or oral examination on the contents of lectures and the background of practicals (2) Documentation (20 % of final grade): report (analysis and discussion of the experiments)</p>
<p>Requisites for the allocation of credit (1) Passing the knowledge test (2) Participating regularly and actively in the practical course (3) Delivering a report that meets the minimum standards of scientific documentation</p>
<p>Relevant for following study programmes/major (only MSc programme) M.Sc. Biology M.Sc. Biology International;</p>
<p>Compatibility with other curricula MSc programme in biochemistry</p>
<p>Significance of the mark for the overall grade The mark given will contribute to the final grade in proper relation to its credits. M.Sc. Biology International 14/44 CP</p>
<p>Course language English</p>
<p>Additional information Enrolling into the module is granted by the central study office of the Department of Biology.</p>