

Course name: Embryology of flowering plants

ECTS	2
Course status	<i>facultative</i>
Course final assessment /evaluation of outcomes	The grade based on Student's work
Prerequisite	<i>basic knowledge on plant biology</i>

Main field of study:

Agriculture and Horticulture, Biology and Biotechnology (Erasmus+)

Educational profile	General academic
Code of studies and education level	bachelor/engineer (SI) or master of science (SM)
Semester of studies	winter or summer
Language of instruction	English

Course offered by:

Name of faculty offering the course	Faculty of Biotechnology and Horticulture
Name of department offering the course	Department of Plant Biology and Biotechnology
Course coordinator	Ewa Grzebelus, PhD, DSc

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands			
EmRo_W1	systems of plant reproduction	BIOT1_W04	R, P
EmRo_W2	formation and construction of generative organs, embryological processes (sporogenesis, gametogenesis and embryogenesis)	BIOT1_W04	R, P
EmRo_W3	objectives of experimental embryology and practical use of embryological processes in plant breeding	BIOT1_W04	R, P
SKILLS – student is able to			
EmRo_U1	analyze and identify formation of spores, gametophytes and embryos of angiosperms using microscopes	BIOT1_U05 BIOT1_U07	R, P
EmRo_U2	use a variety of microscopic techniques to assess plant fertility	BIOT1_U10	R, P
EmRo_U3	use different pollination techniques for plants	BIOT1_U09	R, P
SOCIAL COMPETENCIES – student is ready to:			
EmRo_K1	formulating objective assessments of plant fertility in the context of crop improvement	BIOT1_K05 BIOT1_K09	R, P

Teaching contents

Lectures	15 hours
Topics	<p>Characteristics of various reproduction systems (amixis, amphimixis, apomixis). Life cycle of angiosperms. Alternation of generations - diploid and haploid phase.</p> <p>Formation, structure and function of generative organs of angiosperms. Genetic regulation of flower morphogenesis.</p> <p>Formation and structure of male and female gametophytes.</p> <p>Pollination and fertilization. Characteristics of the progamic phase. Double fertilization. Gamete isolation. In vitro fertilization.</p> <p>Prezygotic reproductive barriers. Sporophyte and gametophyte self incompatibility. Genetic background for self-incompatibility.</p> <p>Embryo and endosperm development. Types of embryogenesis. Disorders in the development of</p>

	endosperm and embryo - postzygotic incompatibility. Apomixis and its importance. Classification of apomictic phenomena Experimental embryology. Examples of the use of embryological structures and processes in biotechnology
Accomplished learning outcomes	<i>EmRo_W1-W3</i>
Means of verification, rules and criteria of assessment	<i>test - single choice (50%)</i>
Classes:	15 hours
Topics	Construction of generative organs on the example of selected crop species. Microscopic preparations illustrating the meiotic events. Development of male gametophyte. Events in microsporogenesis and microgametogenesis. Pollen structure on the example of selected plant species. Pollen viability assessment: aceto-carmine staining, Alexander method, pollen germination on sucrose-agar medium. Events in megasporogenesis. Development of mono-, bi- and tetrasporic embryo sacs. Pollination techniques. Analysis of the progamic phase and double fertilization. Types of embryogenesis in plants. Preparation of embryos and determination of their developmental stages. Structure of mature embryos of mono- and dicotyledonous plants.
Accomplished learning outcomes	<i>EmRo_U1-U3, EmRo_K1</i>
Means of verification, rules and criteria of assessment	<i>test - single choice, case report (50%)</i>

References:

Basic	<i>Glover B., 2014. Understanding flowers and flowering. Oxford University Press</i> <i>Raghavan V., 2006. Double fertilization. Springer</i> <i>Lersten N.R., 2004. Flowering plant embryology. Blackwell Publishing</i>
Supplementary	<i>Ainsworth C., 2006. Flowering and its manipulation. Blackwell Publishing</i> <i>Eng-Chong P, Davey M.R., 2010. Plant developmental biology – Biotechnological perspectives, vol 1. Springer</i>

Structure of learning outcomes

Area of academic study: agriculture and horticulture	1,0	ECTS **
Area of academic study: biological sciences	1,0	ECTS **

Structure of student activity

Contact hours	34	hrs.	1,4	ECTS**
Including:	lectures	15	hrs.	
	classes and seminars	15	hrs.	
	consultations	2	hrs.	
	participation in research	-	hrs.	
	obligatory traineeships	-	hrs.	
	participation in examination	2	hrs.	
e-learning	-	hrs.	ECTS**
student own work	16	hrs.	0,6	ECTS**

*areas of academic study in the fields of: P – biological sciences; R – agriculture and horticulture

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes