SYLLABUS

PLANT GENETIC ENGINEERING

1. Information regarding the programme

1.1 Higher education institution	Babeş Bolyai University
1.2 Faculty	Faculty of Biology and Geology
1.3 Department	Department of Molecular Biology and Biotechnology
1.4 Field of study	Biology
1.5 Study cycle	Master
1.6 Study programme / Qualification	Molecular Biotechnology

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			Plant Genetic Engineering (BME1304) Inginerie Genetica Vegetala				
2.2 Course coordinator			Res. Dr. Aurori Adriana Carolina				
2.3 Seminar coordinator			Res. Dr. Aurori Adriana Carolina				
2.4. Year of study	**2**	2.5 Semester	**3**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**DS**

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	**4**	Of which: 3.2 course	**2**	3.3 seminar/laboratory	**2**
3.4 Total hours in the curriculum	**56**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**28**
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					40
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					30
Tutorship					4
Evaluations					4
Other activities:					

3.7 Total individual study hours	98
3.8 Total hours per semester	154
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	• General Genetics, Molecular Genetics
4.2. competencies	• Recombinant DNA technology

5. Conditions (if necessary)

5.1. for the course	• Basic Informatics
5.2. for the seminar /lab activities	• Bibliographic reports preparation

6. Specific competencies acquired

Professional skills	• Knowledge of international norms and European legislation regarding genetically modified organisms. Understanding and accepting their usefulness for a sustainable development of agriculture, bio-industries and application in other fields of activity. • Understanding the need to apply a complex methodology to increase the efficiency of plant improvement, through biotechnological methods, in the context of population growth and global climate changes. • Ability to interpret raw and processed data obtained through plant genetic engineering techniques.
Transversal skills	• Acquisition of basic knowledge regarding the genetic modification of plants for the purpose of their breeding by biotechnological methods. • The graduates will develop abilities to carry out standard work activities in the laboratory.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Familiarization of graduates with the methodology and purpose of genetic modification of plants.
7.2 Specific objective of the discipline	• Acquiring basic knowledge regarding the totipotency of the plant somatic cell and its genetic manipulation. • Acquiring the methodology of genetic modification of plants. • Formation of a general knowledge regarding the applicability, benefits and possible risks of genetically modified plants.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction and brief history of plant genetic engineering [1; 3]	Frontal lecture	2 hours
2. The main methods of in vitro cultures, necessary for the genetic modification of plants. [1].	Frontal lecture	2 hours
3. Generalities regarding the main branches of genetic engineering and their applicability. [1; 3]	Frontal lecture	2 hours
4. Somaclonal variability and its role in obtaining stress-resistant plants. [1]	Frontal lecture	2 hours
5. Cellular genetic engineering – plant protoplasts as the basic experimental model. [1; 2; 3; 5]	Frontal lecture	2 hours
6. Cell fusion: fusion methods and their applicability. [1; 2]	Frontal lecture	2 hours
7. The genetic consequences of plant cells fusion; the somatic incompatibility. [1; 2]	Frontal lecture	2 hours
8. Obtaining and analyzing of the somatic hybrids: cytogenetic and molecular analysis.[1; 5]	Frontal lecture	2 hours
9. The practical importance of symmetrical and asymmetrical somatic hybrids, examples. [1, 2, 3]	Frontal lecture	2 hours
10. Endocytobiotic engineering and its importance: the transfer of organelles or bacterial cells in plant protoplasts. [1]	Frontal lecture	2 hours

11-12. Gene engineering, stages and methods for genetic transformation of plant cells [1]	Frontal lecture	4 hours
13. The importance of marker and reporter genes in fundamental and applied research. [1]	Frontal lecture	2 hours
14. Bioethical problems associated with the application of transgenesis to plants. New biotechnologies using RNAi and genome editing [1; 3; 4]	Frontal lecture	2 hours

Bibliography

1. Elena Rakosy-Tican. *Inginerie genetică vegetală* – note de curs, Casa Cartii de Stiinta Cluj-Napoca, 2005, ISBN 973-686-704-8 (242 pp.). (BCU, biblioteca de zoologie, alte biblioteci ale facultatii)

2.. Lenuţa Rakosy-Tican. *Utilizarea tehnicilor de electrofuziune în hibridarea somatică a plantelor*. Cluj University Press, Cluj Napoca, 1998, 187 pp (Biblioteca de zoologie)

3. V. Soran, Lenuţa Rakosy-Tican, A. Ardelean, 1993. *Elemente de biotehnologie*. Universitatea de Vest "Vasile Goldiş" Arad, Ed. Mirton, 250 pp (BCU, Biblioteca de zoologie).

4. Lenuţa Rakosy-Tican. *Ingineria genetică şi clonarea organismelor*, In: Biologie - Pregătirea examenului pentru gradul II în învăţământ, teme de specialitate şi metodica predării disciplinei. A. Barna, I. Pop (coordonatori), Editura Albastră Cluj-Napoca, 2002, p. 117-134. (BCU)

5. Cachiţă-Cosma D, Deliu C, Lenuţa Rakosy-Tican, Ardelean A (2004) *Tratat de Biotehnologie Vegetala*. Vol. 1. Ed. Dacia, Cluj-Napoca

Titlurile 1- 5 sunt disponibile la biblioteca de zoologie a facultatii; o parte sunt disponibile si la BCU Cluj

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Introduction to Plant Genetic Engineering: syllabus, educational objectives, work protection and laboratory presentation.	Frontal lecture;	
2. Organ and tissue in vitro culture: computational techniques in biology. Sterilization techniques. Preparation of culture media.	Frontal lecture and work activity in the laboratory, splitting in teams;	
3. In vitro organ and tissue culture: *in vitro* seed germination - Species used: tobacco (*Nicotiana tabacum*) and wheat (*Triticum aestivum*); organ culture - transfer of plant fragments from *in vitro* to *in vitro* (multiplication), species used: potato (*Solanum* spp).	Frontal lecture and work activity in the laboratory, individually;	
4. Genetic transformation with *Agrobacterium tumefaciens* I: principles and initiation of *in vitro* cultures - Species used: potato (*Solanum* spp.).	Frontal lecture and work activity in the laboratory, splitting in teams;	
5. Genetic transformation with *Agrobacterium tumefaciens* II: co-culture and regeneration of putatively genetically transformed plants.	Frontal lecture and work activity in the laboratory, splitting in teams;	
6. Somatic hybridization I: principles; initiation of plant material for protoplast isolation - species used: sunflower (*Helianthus annuus*) and wheat (*Triticum aestivum*).	Frontal lecture and work activity in the laboratory, splitting in teams;	
7. Somatic hybridization II: isolation of plant protoplasts I.	Frontal lecture and work activity in the laboratory, splitting in teams;	
8. Somatic hybridization III: isolation of plant protoplasts II.	Frontal lecture and work activity in the laboratory, splitting in teams;	
9. Somatic hybridization IV: determination of the protoplast	Frontal lecture and work	

number in the cell suspension using a hemocytometer; encapsulation of protoplasts in alginate.	activity in the laboratory, splitting in teams;	
10. Somatic hybridization V: fusion of plant protoplasts – electrofusion and chemical fusion with PEG.	Frontal lecture and work activity in the laboratory, splitting in teams;	
11. Elements of cytogenetics: observation of the chromosomes in mitotic division in onion roots (*Allium cepa*); determination of the ploidy level by the indirect method, in correlation with the number of somatic chloroplasts; statistical interpretation.	Frontal lecture and work activity in the laboratory, individually;	
12. Genetic transformation III: DNA isolation I - species used: potato (*Solanum tuberosum*).	Frontal lecture and work activity in the laboratory, individually;	
13. Genetic transformation IV: DNA isolation II; PCR of nucleic acids.	Frontal lecture and work activity in the laboratory, splitting in teams;	
14. Genetic transformation V: electrophoresis of nucleic acids; identification of genetically modified organisms - species used: potato (*Solanum tuberosum*); observation of plants transformed with the *gfp* gene - species used: tobacco (*Nicotiana tabacum*).	Frontal lecture and work activity in the laboratory, splitting in teams;	

Bibliography

1. Rakosy-Tican L(ed.) (1998) Manual de laborator de inginerie genetica vegetala – romana si engleza – disponibil la biblioteca de zoologie in 10 exemplare.
2. Manualele de laborator de la Universitatea Nottingham (2 vol.) 1998 – disponibile la biblioteca de zoologie.
3. Articole de specialitate, inclusiv publicatii relevante ale colectivului, vor fi selectate pentru prezentari.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course has a similar content to courses from other European universities, being constantly updated and adapted to the level of training of students.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of informational content	Written exam	50%
10.5 Seminar/lab activities	Ability to interpret raw and processed data from the received content	Written colloquium	50%
	Knowing the informational content		
10.6Minimum performance standards			
• Knowing 50% of the information contained in the course			

• Knowing 60% of the information from the laboratory

Date	Signature of course coordinator	Signature of seminar coordinator
11.07.2024	Res. Dr. Adriana Carolina Aurori	Res. Dr. Adriana Carolina Aurori

Date of approval	Signature of the head of department
16.07.2024	**Assoc. Prof. Beatrice Kelemen**