Molecular Biology and Biotechnology of Plants

Code: 100763
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biology	OT	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

There are no mandatory prerequisites, but knowledge in Molecular Biology is highly reccomended.

Objectives and Contextualisation

The general goal of this subject is to provide the required knowledge to understand the molecular bases of plant biology, as well as the techniques and basic aspects of plant biotechnology, with important social implications as well as the use of transgenic plants or Genetically Modified Organisms (GMOs).

At the end of this subject, students should be able to have their own criteria on issues of plant biotechnology with social repercussion, based on contrasting knowledge.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Analyse and interpret the development, growth and biological cycles of living beings.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Isolate, identify and analyse material of biological origin.

- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Perform genetic analyses.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Understand heredity mechanisms and the fundamentals of genetic improvement.
- Understand the processes that determine the functioning of living beings in each of their levels of organisation.

Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Be able to analyse and synthesise.
3. Be able to organise and plan.
4. Critically analyse the principles, values and procedures that govern the exercise of the profession.
5. Describe diagnoses in plant biotechnology and identify plant varieties by analysing genetic markers.
6. Describe the characteristics and organisation of the genome of the different organelles of the plant cell, and also the coordinated expression of this genome and the functions that derive from it.
7. Describe the molecular bases of development in plants.
8. Describe the molecular bases of processes related to post-embryonic growth and to plants' communication with the external environment.
9. Describe the molecular bases of the processes of environmental adaptation, including responses to biotic and abiotic stress.
10. Detect DNA polymorphisms in plant samples.
11. Detect food ingredients deriving from genetically modified plants.
12. Evaluate the applications of transgenic plants to plant improvement.
13. Interpret European Union legislation on plant biotechnology.
14. Isolate, purify and analyse plant DNA.
15. Know the different methods for obtaining transgenic plants.
16. Propose new methods or well-founded alternative solutions.
17. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
18. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
19. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
20. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
21. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
22. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
23. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Content

The subject will consist in two parts: a first part about concepts on Plant Molecular Biology and Biotechnology, and a second part in which students will learn tools in Cell Biology and Molecular Biology. Knowledge will be imparted through theoretical classes and problem solving.

In relation to the first part of the subject, students will learn the following concepts:

-Structure of a plant gene. From transcription to functional protein.

-Transformation of plants: via Agrobacterium, via bio-ballistics, via chemical mutations and others.

-Generation of transgenic plants by over-expression of a gene of interest or repression with the RNAi technique.

-Plant in vitro culture.

-Gene editing using the CRISPR-Cas technique.

-Mutant plants: what they are, why they are useful, how they are produced, importance of existing collections.

-Arabidopsis thaliana as a model organism and comparison with other models.

-Use of bioinformatics platforms for molecular biology studies.

-Massive techniques for studying the regulation of gene expression.

In relation to the second part of the subject.

-Cell biology tools in plant biotechnology and plant molecular biology.

-Generation of transgenic plants (from cloning to selection).

-Techniques for the detection of protein-protein interaction.

-Social and economic impact of transgenic crops.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory training	12	0.48	14, 15, 5, 8, 11, 10, 2, 3
Lectures	28	1.12	23, 22, 4, 1, 15, 5, 8, 7, 9, 6, 13, 16, 21, 20, 17, 18, 12
Seminars	12	0.48	8, 19, 17, 18, 2, 3, 12
Type: Supervised			
Examination (seminars and theory)	7	0.28	4, 15, 5, 8, 7, 9, 6, 13, 16, 21, 20, 19, 17, 18, 2, 12
Tutoring	5	0.2	23, 22, 4, 20, 17, 18

Type: Autonomous			
Elaboration of practical report	5	0.2	14, 15, 5, 8, 7, 11, 10, 21, 19, 17, 18, 2, 3
Practical case preparation	8	0.32	1, 16, 20, 17, 18, 2, 3
Seminar elaboration	5	0.2	22, 4, 1, 8, 13, 16, 21, 20, 19, 17, 18, 2, 3, 12
Studies	61	2.44	23, 22, 4, 15, 5, 8, 9, 6, 13, 20, 17, 2, 3, 12

The training activities will consist of theorethical classes, seminars and laboratory.

Theorethical classes

The teachers will explain the contingut of the subject with the support of material accessible to the internet. These expositive sessions will constitute the main part of the course. The connections of some parts of the subject matter have to be an object of in-depth study by the students, through autonomous work. To facilitate this task, information will be provided from textbooks, web pages, scientific articles related to the subject…

Seminars

The seminars will be given by the students themselves, individually or in groups, depending on the number of students enrolled and the availability of time.

The students will have to explain in a period of 10 minutes the resolution of a case study in the molecular biology of plants and propose some objectives aimed at its resolution. In addition, apart from the seminar and the question-and-answer discussion, the students will have to deliver a poster.

The seminars will be subject to evaluation, having an impact on the final grade.

Practical laboratory classes

The practical laboratory classes will consist of 3 sessions of 4 hours each. The protocols for carrying out the practices will be made available to students at the beginning of the academic year. During these sessions, some of the basic topics of plant biotechnology will be explored at an experimental level.

The practices will be mandatory and subject to evaluation, having an impact on the final grade.

Use of AI
For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as bibliographic or information searches, text correction, or translations. For seminar/case study submissions, students must clearly identify which parts were generated using AI technology, specify the tools used, and include a critical reflection on how these tools influenced both the process and the final outcome of the activity. Lack of transparency regarding AI use in this assessed activity will be considered academic dishonesty and may result in partial or full penalties to the grade, or more serious sanctions in severe cases.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes

First part exam	15%	1	0.04	15, 5, 8, 7, 9, 6, 21, 12
Laboratory training	20%	0	0	14, 15, 5, 9, 11, 10, 21, 20, 19, 18, 2, 3, 12
Poster	10%	3	0.12	23, 22, 4, 15, 16, 21, 19, 17, 18, 2, 3, 12
Practical case report	25%	0	0	21, 20, 19, 17, 18, 2, 3
Second part exam	30%	3	0.12	1, 15, 5, 8, 7, 9, 6, 13, 21, 19, 17, 18, 2, 3, 12

Laboratory practices, seminars and the acquisition of knowledge corresponding to the subject explained and worked on in the theoretical classes will be evaluated separately.

Attendance at practical classes is mandatory. failure to meet this requirement will mean that the student loses the right to be assessed in the other parts. Students will be graded "Not Assessable" when the absence is greater than 20% of the scheduled sessions. Once the practicals have been approved, it will not be necessary to do them again, even if the student must register for this subject in another academic year. The following concepts will be evaluated: 1) attitude and participation during the development of the classes; 2) the experimental results obtained; 3) the memory. The report will consist of a presentation of the results obtained personally and the elaboration and critical discussion of these results.

The maximum possible grade corresponding to laboratory practices is 2 points out of 10 finals.

The grade for the seminars (development of a project and oral presentation) is 1 point out of 10 finals. The project will have to be briefly presented orally in the presence of the whole class.

The acquisition of knowledge corresponding to the subject explained in the lectures will be assessed through:

- The first part of the subject will be evaluated in the middle of the teaching period with a written test (First part) that will be graded with a grade of 1.5 points and a delivery of a practical case that will be graded with a grade of 2.5 points from 10 ends

- The second part of the subject will be assessed with a written test at the end of the teaching period, which will be graded with a maximum mark of 3 points out of 10.

The final mark of the subject will be obtainedby adding up the marks obtained in the different parts (practices, seminars,theory, practical case). Passing the subject willinvolve obtaining a minimum of 5.0 total points. In addition, to pass the subject, the sum of the two theory exams cannot be less than 5 points (out of 10). Otherwise, the subject will be suspended, even if the sum of the different grades gives a score of 5.0 or higher.

To participate in the recovery exam, students must have previously been assessed in a set of activities, the weight of which is equivalent to a minimum of two-thirds of the subject's total grade. Therefore, the student will obtain the qualification of "Not Assessable" when the assessment activities carried out have a weighting of less than 67% in the final qualification.

Students can also take the recovery exam to raise their grade in the theoretical part, even if they have passed the subject. In this case, they loose the previous theory grade.

Single assessment

Students who take the single assessment must do the laboratory practices (PLAB) in face-to-face sessions.

The single assessment consists of a single summary test (with test-type questions and a topic/s to develop). The grade obtained in the synthesis test (which incorporates the first and second parts of the theory) is 70% of the final grade of the subject. The practice report will be 20%. The presentation of the poster (creation of the poster and recording of its defense) will be the remaining 10%. The practice report, the poster and its recording may be delivered on the dates set for the continuous assessment or be delivered to coincide with the date of the single synthesis test.

The single assessment test will coincide with the same date fixed in the calendar for the last continuous assessment test. The review of the final grade follows the same procedure as for continuous assessment.

The minimum grade for the synthesis test will be 5 points (70% of the grade). To pass the subject you must obtain a minimum final grade of 5 points out of 10. Students will receive a grade of "Not Assessable" when the completed assessment activities account for less than 67% of the final grade.

Bibliography

1. Biochemistry and Molecular Biology of Plants (Buchanan, Gruissem and Jones) 2015 ASPP.
2. Biology of Plants (Raven, Evert, and Eichhorn) 2012 Worth publishers,Inc.
3. Plant Physiology (Salisbury and Ross) 1992 Wadsworth Publishing Company
4. Plants, Genes, and Agriculture (Chrispeels and Sadava) 1994 Jones and Bartlett Publishers
5. Fundamentos de Fisiología Vegetal. Joaquín Azcón-Bieto y Manuel Talón (2000). McGraw-Hill Interamericana y Edicions de la Universitat de Barcelona.
6. Huellas de DNA en genomas de plantas (Teoría y protocolos de laboratorio). Ernestina Valadez Moctezuma y Günter Kahl (2000). Mundi-Prensa México.
7. Biotecnología Vegetal. Manuel Serrano García y M. Teresa Piñol Serra (1991). Colección Ciencias de la Vida. Editorial Síntesis. Madrid.
8. Papers and reviews from different scientific journals. Practically all of them in english.

Student will find all the required theory information through the online tools that are available at the University.

Software

The websites of interest will be provided during the course.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	441	Spanish	first semester	afternoon
(PLAB) Practical laboratories	442	Spanish	first semester	afternoon
(SEM) Seminars	441	Catalan	first semester	morning-mixed
(TE) Theory	44	Catalan	first semester	morning-mixed