UAB
Universitat Autònoma de Barcelona

Molecular Biology and Biotechnology of Plants

Code: 100763
Credits: 6

2026/2027

Degree programme	Type	Course
Biology	OP	4

Contact lecturer

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Teaching staff

Jordi Moreno Romero

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Group languages

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

Prerequisites

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

Objectives

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.

Learning outcomes

1. Be able to analyse and synthesise.
2. Be able to organise and plan.
3. 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.
4. 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.
5. 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.
6. Students must be capable of communicating information, ideas, problems and solutions to both

specialised and non-specialised audiences.
7. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
8. Analyse a situation and identify its points for improvement.
9. Propose new methods or well-founded alternative solutions.
10. Critically analyse the principles, values and procedures that govern the exercise of the profession.
11. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
12. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
13. Detect food ingredients deriving from genetically modified plants.
14. Detect DNA polymorphisms in plant samples.
15. 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.
16. Describe the molecular bases of the processes of environmental adaptation, including responses to biotic and abiotic stress.
17. Know the different methods for obtaining transgenic plants.
18. Evaluate the applications of transgenic plants to plant improvement.
19. Describe diagnoses in plant biotechnology and identify plant varieties by analysing genetic markers.
20. Interpret European Union legislation on plant biotechnology.
21. Isolate, purify and analyse plant DNA.
22. Describe the molecular bases of development in plants.
23. Describe the molecular bases of processes related to post-embryonic growth and to plants' communication with the external environment.

Contents

The course is divided into two parts. The first part introduces the fundamental concepts of Molecular Biology and Plant Biotechnology, while the second part focuses on experimental tools and applications in Plant Biotechnology, Cell Biology, and Molecular Biology. The course combines lectures with problem-solving sessions.

Part I

The first part covers the following topics:

- Organization of plant genomes.
- Gene expression analysis.
- Gene function analysis: forward and reverse genetics.
- Fundamentals of Plant Biotechnology.
- Introduction.
- *In vitro* plant culture.
- Classical plant breeding.

Upon completion of this part, students will be able to:

- Describe the structure of a plant gene, from transcription to the production of a functional protein.
- Understand high-throughput techniques for studying gene expression regulation.
- Apply the principles of *in vitro* plant culture.
- Explain the use of *Arabidopsis thaliana* as a model organism and compare it with other plant model species.
- Understand the generation, applications, and relevance of mutant plant collections.
- Use bioinformatics platforms for molecular biology studies.
- Describe molecular tools used in classical plant breeding.

Part II

The second part covers the following topics:

- Plant genetic engineering.
- Introduction and key concepts.
- Tools and methodologies for plant genetic engineering.
- Genome editing in plants using CRISPR-Cas technology.
- Applications of plant biotechnology in research.
- Cell biology techniques.
- Protein-protein interaction studies.
- Agronomic applications.

Upon completion of this part, students will be able to:

- Understand plant transformation methods, including *Agrobacterium*-mediated transformation, biolistic transformation, chemical mutagenesis, and related approaches.
- Describe the generation of transgenic plants through gene overexpression or RNA interference (RNAi), from cloning to selection.
- Apply the principles of genome editing using CRISPR-Cas technology.
- Understand cell biology tools used in plant biotechnology and plant molecular biology.
- Describe methods for detecting protein-protein interactions.
- Evaluate the social and economic impact of transgenic crops.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Examination (seminars and theory)	7	0.28	1, 3, 4, 5, 6, 7, 9, 10, 15, 16, 17, 18, 19, 20, 22, 23
Seminars	12	0.48	1, 2, 4, 5, 6, 18, 23
Tutoring	5	0.2	4, 5, 7, 10, 11, 12
Lectures	28	1.12	3, 4, 5, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 22, 23
Seminar elaboration	5	0.2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 18, 20, 23
Practical case preparation	8	0.32	1, 2, 4, 5, 7, 8, 9
Studies	61	2.44	1, 2, 4, 7, 10, 11, 12, 15, 16, 17, 18, 19, 20, 23
Elaboration of practical report	5	0.2	1, 2, 3, 4, 5, 6, 13, 14, 17, 19, 21, 22, 23
Laboratory training	12	0.48	1, 2, 13, 14, 17, 19, 21, 23

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. The practical course language will be English.

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

Continuous assessment activities

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

Continuous assessment

Assessment of the course is based on laboratory practicals, seminars, assessment of theoretical knowledge, and the completion of a practical case study.

Attendance at laboratory practical sessions is compulsory. Failure to comply with this requirement will result in

the loss of the right to be assessed in the remaining assessment activities of the course. Students will receive a Not Assessable (NA) grade if their absence from laboratory practical sessions exceeds 20% of the scheduled sessions.

Once passed, laboratory practicals will remain valid in subsequent academic years and will not need to be repeated if the student re-enrols in the course.

The laboratory practical assessment will consider: (1) attitude and participation during the practical sessions; (2) the experimental results obtained; and (3) the laboratory report. The report will consist of the presentation of the student's own results together with their interpretation and critical discussion.

Laboratory practicals account for 2 points out of the final grade (20%).

The language of the practical sessions will be English (this is the only part of the course that will be taught in this language).

Seminars will be assessed through the preparation of a project and its oral presentation to the class (typically in poster format). This activity accounts for 1 point out of the final grade (10%).

Knowledge acquired from the lectures will be assessed as follows:

- The first part of the course will be assessed halfway through the teaching period by means of a written examination (first midterm), worth a maximum of 1.5 points towards the final grade, together with the submission of a practical case study, worth a maximum of 2.5 points.
- The second part of the course will be assessed by a written examination (second midterm) at the end of the teaching period, worth a maximum of 3 points towards the final grade.

The final course grade will be calculated as the sum of the marks obtained in the different assessment activities.

To pass the course, students must obtain a final grade of at least 5.0 out of 10. In addition, they must obtain a minimum grade of 5.0 out of 10 in the combined theoretical examinations (first and second midterms). Otherwise, the course will not be passed, even if the weighted average of all assessment activities is 5.0 or higher.

To be eligible for the resit examination, students must have completed assessment activities accounting for at least two-thirds (67%) of the final course grade. Otherwise, they will receive a Not Assessable (NA) grade.

Students may also take the resit examination to improve their theoretical grade, even if they have already passed the course. In this case, the grade obtained in the resit examination will replace the previous theory grade.

Single assessment

Students who choose the single-assessment option must attend all scheduled laboratory practical sessions.

The single assessment consists of a comprehensive examination including multiple-choice questions and essay questions covering both the first and second parts of the course. This examination accounts for 70% of the final grade.

The laboratory report accounts for 20% of the final grade, while the preparation of a poster and the submission of a recorded oral defence account for the remaining 10%.

The laboratory report, the poster and the recorded presentation may be submitted on the same dates established for continuous assessment or on the day of the comprehensive examination.

The single-assessment examination will take place on the same date scheduled for the final continuous-assessment examination.

To pass the course, students must obtain a minimum grade of 5.0 out of 10 in the comprehensive examination and a final course grade of at least 5.0 out of 10.

The review of grades will follow the same procedure established for continuous assessment.

Students will receive a Not Assessable (NA) grade when the assessment activities completed account for less than 67% of the final course grade.

Academic misconduct

Any irregularity committed during an assessment activity (academic misconduct, plagiarism, or improper use of AI, unless such use is expressly authorized in the course syllabus) that may lead to a significant alteration of the grade will result in that activity being graded as 0. If the course syllabus stipulates that obtaining a minimum mark in this assessment is an essential requirement to pass the course, or if multiple irregularities occur in the assessment activities of the same course, the final grade for the course will be 0. Furthermore, disciplinary proceedings may be initiated against any student who incurs any of these irregularities.

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.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE