Universitat Autònoma de Barcelona

2022/2023

Molecular Biology and Biotechnology of Plants

Code: 100963
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OT	4	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Jordi Moreno Romero
Maria del Mar Marquès Bueno

Prerequisites

There are no mandatory prerequisites.

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 a social impact, based on contrasting knowledge. The topics that will be addressed in the subject can be seen in the content section.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply the principal techniques for the use of biological systems: recombinant DNA and cloning, cell cultures, manipulation of viruses, bacteria and animal and plant cells, immunological techniques, microscopy techniques, recombinant proteins and methods of separation and characterisation of biomolecules.
- Comply with ethical principles and legislation in the manipulation of biological systems.

- Describe the molecular, cellular and physiological bases of the organisation, functioning and integration of living organisms in the framework of their application to biotechnological processes.
- Interpret experimental results and identify consistent and inconsistent elements.
- Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
- Learn new knowledge and techniques autonomously.
- Read specialised texts both in English and one's own language.
- Reason in a critical manner
- Search for and manage information from various sources.
- 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.
- Work individually and in teams

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Describe European Union legislation on plant biotechnology.
3. Describe the characteristics and organisation of the genome of the different organelles in plant cells, and their coordinated expression.
4. Describe the different methods for obtaining transgenic plants.
5. Describe the processes involved in the interaction and communication of plants with their environment and their adaptation to situations of environmental stress.
6. Explain and evaluate the application of transgenic plants to plant improvement.
7. Explain the molecular bases of the principal biological processes in plants, including development and immunological responses.
8. Interpret experimental results and identify consistent and inconsistent elements.
9. Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
10. Learn new knowledge and techniques autonomously.
11. Perform a diagnosis in plant biotechnology. Identify plant varieties by analysing genetic markers.
12. Read specialised texts both in English and one's own language.
13. Reason in a critical manner
14. Search for and manage information from various sources.
15. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
16. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
17. Work individually and in teams

Content

The subject will be organized in two sections: a first section in which theoretical knowledge will be imparted and a second one in which students will learn by the resolution of different scientific problems.

In relation to the first section of the subject, students will learn the following concepts and knowledge:

-Structure of a plant gene: from the transcription to the functional protein.

-Plant transformation: via Agrobacterium tumefaciens, via bio-ballistics, via chemical mutations.

-Generation of transgenic plants by over-expression of a gene of interest (with the promoter 35S), or repression with the technique of RNAi.

-Gene-editing using the CRISPR-Cas technique.

-Mutants: what they are, why they are used for, how are they generated, the importance of mutant collections.

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

-Use of bioinformatics platforms for molecular biology studies.

-omics techniques for the study of the regulation of gene expression.

In relation to the second section of the subject, students will have to solve proposed problems in the field of plant molecular biology.

The theoretical content will be evaluated with an exam that will be the main body of the final mark.

*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

Methodology

The formative activities will be: theory, seminars and laboratory.

Theory

Teachers will explain the contents of the subjects using material available on the Internet. These lectures will be the first part of the subject. The knowledge of some parts of the subjects will have to be also developed by the students, by means of autonomous learning. To facilitate this task, we will provide information on textbooks, web pages, scientific articles related to the topic ...

Seminars

The seminars will be given by the students, individually or in groups, depending on the number of students and the availability of time.
The students will have to present in 10 minutes a current problem of plant molecular biology and emphasize the objectives for its resolution.

The topics that will cover the seminars will be decided at the beginning of the course. The aim of these sessions is to deepen the knowledge given in the lectures, as well as to have discussion on topics of special interest for the students.

The seminars will be evaluated, with an impact on the final mark.

Laboratory

The practical classes of laboratory will consist of 3 sessions of 4 hours each one. The protocols used will be provided at the beginning of the academic year. During these sessions, experimental skills in some of the basic issues of plant biotechnology will be acquired.
The practices will be evaluated, having an impact on the final mark.

*The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

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.

Activities

Title	Hours	ECTS	Learning Outcomes

Type: Directed			
laboratory training	12	0.48	8, 13, 11, 17
lectures	28	1.12	14, 4, 5, 2, 3, 6, 7, 12, 13, 11
seminars	12	0.48	14, 2, 8, 12, 13, 17
Type: Supervised			
Examination (seminars and theory)	7	0.28	14, 4, 5, 3, 6, 7, 12, 13, 17
tutoring	5	0.2	1, 16, 15, 14, 4, 5, 3, 6, 7, 8, 9, 12, 13, 11
Type: Autonomous			
elaboration of practical report	5	0.2	14, 8, 13, 11, 17
seminar elaboration	5	0.2	14, 12, 13, 17
studies	69	2.76	10, 14, 4, 5, 3, 6, 7, 12, 13, 17

Assessment

Laboratory practices, seminars and the acquisition of knowledge corresponding to the subject explained and worked in theoretical classes will be evaluated separately. Attendance to the laboratory sessions is mandatory. Failure to meet this requirement will imply that the student loses the right to be evaluated in the rest of the evaluation parts. Students missing more than 20% of programmed sessions will be graded as "No Avaluable".

Once the practices have been approved, it will not be necessary to do them again, even if the student may enroll in this subject again. The following aspects will be evaluated: 1) attitude and participation; 2) experimental results obtained; 3) final report. The report, with a length of between 5 and 10 pages, will consist of a presentation of the results obtained and in the elaboration and critical discussion of these results. The maximum mark for laboratory practices is 2 points.

The seminar corresponds to the elaboration and a brief exposition of a research project in the presence of the whole class. The maximum possible mark for the seminars is 1 point.

The acquisition of knowledge corresponding to the subject explained in the theoretical classes will be evaluated by means of:

An exam in the middle of the teaching period, which will be qualified with a maximum mark of 4 points.

An exam at the end of the teaching period, which will be qualified with a maximum mark of 3 points.

The final mark of the subject will be obtained by the sum of all the marks obtained in the different parts (laboratory, seminars and theory). Approving the subject will involve obtaining a minimum of 5.0 total points. In addition, to approve the subject, the sum of the marks of the theory exams may not be under 3 points, with a maximum of 7.0 points. Otherwise, the subject will be suspended, although the sum of the different notes gives a score of 5.0 or more.

Students who have not passed the subject will have the option to be re-evaluated of the theoretical part. To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course. Thus, the student will be graded as "No Avaluable" if the weighting of all conducted evaluation activities is less than 67% of the final score"

The students who wish to improve their mark will have also access to the retake process. In this case it is understood that they renounce the previously obtained theory mark.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
design research project and oral presentation	10	1.5	0.06	14, 8, 12, 13
final exam	50	3	0.12	10, 14, 4, 5, 3, 6, 7, 12, 13
laboratory training	15	0	0	14, 2, 6, 8, 13, 11, 17
seminars	10	1.5	0.06	1, 16, 15, 14, 6, 8, 9, 12, 13, 17
test of concepts	15	1	0.04	5, 6, 13

Bibliography

1. Biochemistry and Molecular Biology of Plants (Buchanan, Gruissem and Jones) ASPP.
2. Biology of Plants (Raven, Evert, and Eichhorn) Worth publishers,Inc.
3. Plant Physiology (Salisbury and Ross) Wadsworth Publishing Company
4. Plants, Genes, and Agriculture (Chrispeels and Sadava). 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. ARTÍCULOS Y REVISIONES DE DIFERENTES REVISTAS CIENTÍCAS DEL CAMPO. PRÁCTICAMENTE LA TOTALIDAD DE ESTE TIPO DE BIBLIOGRAFÍA ES EN INGLÉS.

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

Software

The required websites will be provided during the courses.