Universitat Autònoma de Barcelona

2021/2022

Molecular Biology and Biotechnology of Plants

Code: 100913
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

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 social repercussion, based on contrasting knowledge.

The topics that will be addressed in the subject can be seen in the content section.

Competences

- Analyse and explain normal physiological processes and alterations in them on the molecular scale, using the scientific method.
- Apply the principal techniques used in biological systems: methods of separation and characterisation of biomolecules, cell cultures, DNA and recombinant protein techniques, immunological techniques, microscopy techniques, etc.
- Collaborate with other work colleagues.
- Integrate scientific and technological knowledge.
- Interpret experimental results and identify consistent and inconsistent elements.

- Manage bibliographies and interpret the information in the main biological databases, and also know how to use basic ICT tools.
- Read specialised texts both in English and ones own language.
- Show initiative and an entrepreneurial spirit.
- Stay abreast of new knowledge of the structure, organisation, expression, regulation and evolution of genes in living beings.
- Use ICT for communication, information searching, data processing and calculations.

Learning Outcomes

1. Apply European Union legislation on plant biotechnology.
2. Collaborate with other work colleagues.
3. Contribute scientific knowledge to the public discussion on transgenic crops and foods.
4. Describe genetic determiners and the molecular mechanism of the transformation of plants by Agrobacterium, and its applications in the generation of transgenic plants.
5. Describe the principal molecular tools available for studies in plant genetics.
6. Detect DNA polymorphisms in plant samples using the RAPDS technique.
7. Detect food ingredients that come from genetically modified plants.
8. Explain the use of mutants and their applications in gene isolation.
9. Interpret experimental results and identify consistent and inconsistent elements.
10. Make use of bibliography and databases to prepare seminars.
11. Perform the isolation, purification and analysis of plant DNA.
12. Read specialised texts both in English and ones own language.
13. Show initiative and an entrepreneurial spirit.
14. Use ICT for communication, information searching, data processing and calculations.
15. Use data-analysis software (detection of polymorphisms in DNA of plant samples).

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	14, 2, 7, 6, 9, 12, 11, 13, 15
lectures	28	1.12	14, 3, 4, 5, 8, 12
seminars	12	0.48	14, 1, 3, 2, 12, 10, 13
Type: Supervised			
Examination (seminars and theory)	7	0.28	14, 1, 3, 2, 4, 5, 8, 9, 12, 10, 13
tutoring	5	0.2	3, 4, 5, 8, 9, 12, 10, 13

Type: Autonomous			
elaboration of practical report	5	0.2	14, 2, 5, 7, 6, 9, 12, 11, 13, 15
seminar elaboration	5	0.2	14, 1, 3, 2, 4, 5, 9, 12, 10, 13
studies	69	2.76	14, 1, 3, 2, 5, 8, 9, 12, 10, 13

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
final exam	50	3	0.12	3, 4, 5, 8, 12
laboratory training	15	0	0	2, 5, 7, 6, 9, 11, 13, 15
seminars	10	3	0.12	14, 1, 3, 2, 9, 12, 10, 13
test of concepts	15	1	0.04	4, 5, 8, 9

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 required websites will be provided during the courses.