

**Molecular Plant Biology**

Code: 44781  
ECTS Credits: 6

Degree	Type	Year	Semester
4318297 Plant Biology, Genomics and Biotechnology	OT	0	1

## Contact

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## Teaching groups languages

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

## Teachers

Teresa Altabella Artigas

Narciso Campos Martínez

Albert Ferrer Prats

Jordi Moreno Romero

Maria del Mar Marquès Bueno

## Prerequisites

Although there are no official prerequisites for studying this module, it is recommended to have previously acquired basic knowledge in Biochemistry, Molecular Biology and Genetics, preferably in the area of plants.

## Objectives and Contextualisation

The overall objective of this module is to acquire solid and updated skills in Biology and Plant Biotechnology, to be competent in the knowledge of relevant aspects of plant molecular biology and Genetic Engineering, and their applications in research, encouraging at the same time an active participation of the students and their critical spirit.

The specific objectives of the module are:

- To understand and to be able to identify the main characteristics of the plants which are applied in plant molecular genetic studies.
- To understand the main characteristics of plant gene structure and expression.
- To describe the techniques of manipulation and production of genetically modified plants.
- To understand the process of genetic transformation of plants and the related concepts of cisgenesis and transgenesis.
- To understand and to be capable of using tools for the study of the genome, proteome, transcriptome and

metabolome.

- To integrate the acquired knowledge to solve practical subjects on the context of a laboratory of Molecular Biology and Genetic Engineering

## Learning Outcomes

- CA03 (Competence) Recognise the ethical, social responsibility and legal considerations in the use of genetically modified plants, assessing the social, economic and environmental impact in order to apply them to the scientific and professional environment in accordance with the Sustainable Development Goals.
- CA04 (Competence) Assimilate knowledge of molecular biology and face the complexity of making judgements based on incomplete or limited information, including reflections on the social and ethical responsibilities linked to the application of your knowledge and judgements.
- KA03 (Knowledge) Recognise the most appropriate processes for obtaining genetically modified plants and their uses.
- KA04 (Knowledge) Identify the results of research into plant genetic engineering in terms of obtaining new viable products or processes, at an industrial and commercial level, to transfer to society.
- SA05 (Skill) Manage bibliographic information and computer resources in the field of gene structure, expression and regulation.
- SA06 (Skill) Critically discuss problems derived from research into plant molecular biology.
- SA07 (Skill) Apply knowledge of plant molecular genetics in different scientific and industrial fields.
- SA08 (Skill) Apply bioinformatics tool to the genetic, evolutionary and functional study of plants and the processing of plant omics data.

## Content

The subject is divided into two parts. the first one (genetic transformation of plants), is constituted of more theoretical concepts related to functional tools, and it is given just before the subject of Plant Genomics. The rest of the course is given after Plant Genomics.

The general concept of the first block of the subject corresponds to the functional tools of plant genetic transformation:

- Nuclear transformation: the biology of agrobacterium, agrobacterium as a transformation vector, bombardment transformation, stable transformation to transient, selection of transformant plants and regulation of transgene expression (constitutive, specific and inducible promoters)
- Transformation of plastids: integration of exogenous DNA in the genome of the plastid, vectors and genetic design (genetic markers), nuclear transformation to plastid, applications.

The second part of the course consists of the following parts:

- A first session of general knowledge is carried out, all of them related to molecular techniques or tools.
- A bioinformatics session is held in the computer classroom of the faculty. This session aims to introduce students to computer programs related to molecular biology. We don't deal with -omics.
- There is an internship exercise in the classroom. It is based on working with mutants and GMOs. How to make them, which ones are appropriate and which ones are not. Several phenotypes will be given and it is necessary to discuss which alterations are logical and which are not. This exercise is a good complementation of what it is given in the first part of the course.
- Familiarity with molecular biology techniques related to ChIP-Seq, ChIP-QPC, RNA-Seq and QPCR. Students work in groups and have to elaborate an experiment.

## Methodology

Training activities include the following elements:

- Conferences. There will be face-to-face classroom classes that develop the theoretical contents.
- Resolution of practical cases. Case studies from recent research articles will be carefully analysed.
- Bioinformatics sessions in which practical cases will be presented to train in the main applied bioinformatics tools
- Preparation and presentation of seminars by each student in relation to the contents of the module.
- Autonomous activities include autonomous comprehension and study of the contents of the module, bibliographic search and preparation

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			
lectures	33	1.32	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08, CA03
Type: Supervised			
seminars	16	0.64	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08, CA03
Type: Autonomous			
autonomous studies	90	3.6	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08, CA03

## Assessment

The evaluation of this module will be based both on a continuous evaluation, in order to encourage the efforts of the student to the activities developed during the course, and on a final examination of the concepts treated.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Proactive attitude, class participation, scientific rigor in discussions, etc	20	3	0.12	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08
Seminar preparation	20	4	0.16	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08
Seminar presentation	25	2	0.08	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08
written exam related to the theoretical classes	35	2	0.08	CA03, CA04, KA03, KA04, SA05, SA06, SA07, SA08

## Bibliography

All the recommended bibliography is available at the UAB library.

- Biotechnology and plant disease management. Editor(s): Z.K. Punja, S.H. De Boer and H. Sanfaçon. Wallingford: CABI, 2007, ISBN: 9781845932886.
  - Handbook of Plant Biotechnology Online. Editors-in-chief Paul Christou, Harry Klee. John Wiley and Sons, 2005. Online ISBN: 9780470869147; DOI: 10.1002/0470869143.
  - Plant Biochemistry (Fourth Edition). Editor(s): Hans-Walter Heldt and Birgit Piechulla. London Academic, 2010. ISBN 9780123849861.
  - Plant Biotechnology: Current and Future Applications of Genetically Modified Crops. Editor(s): Nigel G. Halford. John Wiley & Sons, 2006, Print ISBN: 9780470021811, Online ISBN: 9780470021835, DOI: 10.1002/0470021837.
  - Plant biotechnology and genetics: principles, techniques, and applications. Editors: C. Neal Stewart. Wiley, 2008. ISBN 9780470043813.
  - Plant Biotechnology and Molecular Markers. Editors: P.S. Srivastava, Alka Narula, Sheela Srivastava. Kluwer Academic Publishers, 2004. ISBN: 978-1-4020-1911-1 (Print) 978-1-4020-3213-4 (Online).
- Journals in the area of Molecular Biology and Biotechnology of Plants (the 10 journals with highest impact factor in the area of "Plant Sciences" of the Journal Citation Reports):
- ANNUAL REVIEW OF PLANT BIOLOGY. Publisher: ANNUAL REVIEWS. ISSN:1543-5008.
  - TRENDS IN PLANT SCIENCE. Publisher: ELSEVIER SCIENCE LONDON. ISSN: 1360-1385
  - ANNUAL REVIEW OF PHYTOPATHOLOGY. Publisher: ANNUAL REVIEWS. ISSN: 0066-4286
  - PLANT CELL. Publisher: AMER SOC PLANT BIOLOGISTS. ISSN: 1040-4651
  - CURRENT OPINION IN PLANT BIOLOGY. Publisher: CURRENT BIOLOGY LTD. ISSN: 1369-5266
  - NEW PHYTOLOGIST. Publisher: WILEY-BLACKWELL. ISSN: 0028-646X
  - PLANT JOURNAL. Publisher: WILEY-BLACKWELL. ISSN: 0960-7412
  - PLANT PHYSIOLOGY. Publisher: AMER SOC PLANT BIOLOGISTS. ISSN: 0032-0889
  - PLANT BIOTECHNOLOGY JOURNAL. Publisher: WILEY-BLACKWELL. ISSN: 1467-7644
  - MOLECULAR PLANT. Publisher: OXFORD UNIV PRESS. ISSN: 1674-2052

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.