Universitat de Lleida

DEGREE CURRICULUM

BIOTECHNOLOGICAL APPLICATIONS OF IN VITRO CULTURE OF CELLS AND PLANT TISSUE

Coordination: PELACHO AJA, ANA MARIA

Academic year 2023-24

BIOTECHNOLOGICAL APPLICATIONS OF IN VITRO... 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>BIOTECHNOLOGICAL APPLICATIONS OF IN VITRO CULTURE OF CELLS AND PLANT TISSUE</td></tr>
<tr><td>Code</td><td>101642</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>1.5</td><td>4.5</td></tr>
<tr><td>Number of groups</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>PELACHO AJA, ANA MARIA</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST SCIENCES AND ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>60 hours face-to-face on-site/online
90 hours student off-site learling</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English: 100%</td></tr>
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BIOTECHNOLOGICAL APPLICATIONS OF IN VITRO... 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
PELACHO AJA, ANA MARIA	anamaria.pelacho@udl.cat	7,2	

Subject's extra information

Biotechnological Applications of Plant Cell and Tissue Culture is an elective subject in the 4th course. Students will take this course after having had a first contact with plant cell and tissue culture in the 2nd year Plant Physiology and Cell Culture subject or equivalent. The main focus In the Biotechnological Applications of Plant Cell and Tissue Culture subject are the diversity of biotechnological applications that in vitro culture has, from the simplest micropropagation techniques to plant genetic transformation and regeneration, or the most innovative advances in other fields.

The knowledge acquired in this subject will be of particular interest to those who specialize in the agri-food area or that have taken other subjects on plant biotechnology; due to the application of plants and plant compounds to other fields, this subject is also of interest for biotechnologists interested in specializing in other areas (biomedical, animal, environmental or industrial). There will be an update on the development of the in vitro cultivation of plants, both in terms of types of species and on types of processes, and current limitations and challenges will be presented.

After completing this course, the Biotechnology student will be able to develop biotechnological projects related to the manipulation of plants, their parts or their derivatives, for the different productive aspects. Particularly, students will have acquired a solid training that allows them to manage, organize and work autonomously in a plant cell and tissue culture laboratory.

Requirements: 101615 Fisiologia i cultius cel·lulars vegetals UdL course or equivalent knowledge in plant physiology

Learning objectives

• Prepare reports, summaries and presentations.

• Apply the acquired knowledge to solving biotechnological problems related to the in vitro culture of plant cells and tissues.

• Independently consult the appropriate information resources to obtain a synthetic approach of the different processes under study.

• Be qualified to work in private companies and in public institutions dealing with the research, development or production of biotechnological products related to the in vitro culture of plant cells and tissues.

• Have a great capacity to design new biotechnological projects (identification of applications, business ideas, workplans, etc.) and to convince employers of the suitability of a biotechnological innovation related to the topic of the subject.

• Develop biotechnological applications and protocols related to the plant cell and tissue culture to obtain products of human interest.

• Work in biotechnology companies in the research, development or production of bioproducts through the in vitro culture of plant cells and tissues.

• Design innovative biotechnological projects by identifying applications, business ideas, workplans and the implementation of new techniques or equipment for plant cell and tissue culture.

• Know and value the social and economic aspects of biotechnological advances and applications related to the plant cell and tissue culture.

• Establish new challenges and goals to achieve, and propose their attainment through the application of the acquired knowledge and the establishment of own criteria in decision-making.

Competences

General skills

- GC1 Being able to selectively search for and use sources of information necessary to achieve the training objectives.
- GC2 Interpret scientific-technical information with a critical sense, and be able to make presentations based on this information.
- GC3 Working in a team, with a multidisciplinary vision and with the ability to make a rational and efficient distribution of tasks among team members.
- GC4 Knowing and adequately using the scientific and technical vocabulary of the different areas of Biotechnology.
- GC5 Working in the laboratory applying criteria of quality and good practice.
- GC6 Knowing and knowing how to use the specific software and databases in the different fields of biotechnology.
- GC7 Using the scientific method to analyze data and design experimental strategies with biotechnological applications.
- GC11 Acquiring criteria for choosing the most appropriate analytical techniques for each specific practical case.

Specific skills

- CE32 To know the use of animal, plant and microbial cells in biotechnological processes.
- CE34 Be able to design the protocol of a specific biotechnological process with the necessary practical requirements to carry it out and its evaluation parameters.
- CE44 To know the main fields of application of biotechnology and acquire basic training in some of them.

Transversal skills

- CT1 Being able to produce comprehensible written and oral reports on the work carried out, with a justification based on the theoretical-practical knowledge obtained.
- CT2 To be able to communicate and communicate in the international sphere in their professional development.
- CT3 To use information and communication tools and techniques for data analysis and the preparation of oral and written reports and other training and professional activities.

Subject contents

Unit 1. Introduction. Definitions. General characteristics. Basic tissue culture types. Laboratory equipment for in

vitro culture. General applications. Methods for plant genetic transformation.

Unit 2. First generation transgenic plants. Worldwide impact of GM crops. GM crops locally. 1st generation transgenic plants: resistance to herbicides, to pests and diseases and to the physical environment.

Unit 3. Second generation transgenic plants. Improving processing and consumption requirements: Control of fruit ripening. Improved organoleptic properties. Ornamental plants.

Unit 4. Third generation transgenic plants. Improving the nutritional quality of foods. Production of therapeutic proteins. Other objectives of plant transformation. Advantages and limitations.

Unit 5. Plant nutrition and in vitro development. Introduction. Formulation of culture media. Minerals: macro and microelements. Organic compounds. Physical properties. Media preparation.

Unit 6. Micropropagation: concept and phases. Sexual vs. asexual propagation. What is micropropagation?. Micropropagation phases: preparation, establishment of aseptic culture, multiplication, rooting, acclimatization.

Unit 7. Micropropagation: propagation paths and limiting factors. Paths according to plant structure and to propagation pattern, direct and indirect propagation systems. Limitations in the establishment phase of aseptic cultures. Limitations in the multiplication phase. Limitations on transplanting. Other limitations.

Unit 8. Micropropagation: applications. Micropropagation of ornamental crops. Micropropagation of fruit trees and other trees. Micropropagation of field crops. Obtaining pathogen-free healthy plants.

Unit 9. Crop breeding I: Breeding new varieties. Somatic hybridization concept. Requirements for somatic hybridization. Phases of somatic hybridization. Advantages and limitations.

Unit 10. Crop breeding II: Production of haploid plants. Definitions. How to obtain haploid plants?. Applications of haploid plants. Limitations to haploid plant induction.

Unit 11. Applications of in vitro culture for germplasm conservation. Definitions. Biodiversity. In situ conservation. Ex situ conservation. Short and medium term conservation. Long term conservation: cryopreservation.

Unit 12. Cell suspension culture and secondary metabolites production. Cell suspension culture. "Hairy roots". Production of plant secondary metabolites.

Practical activities

- **Seminars.**
- **Individual and group activities**: Course works, flash presentations.
- **Problems and study-cases**: critical reading of papers

Methodology

Due to the special circumstances derived from the health crisis caused by COVID-19, this subject may have both face-to-face classes and virtual teaching, depending on the health situation. In principle, it will be face-to-face in the classroom with the professor, as specified at the schedule of the course. In the event that the circumstances evolve towards a change in attendance, it will be reported in due course.

Type of activity	Description	On-site/online activity of the student		Off-site activity of the student		Assessment	Total time
		Objectives	Hours	Student work	Hours	Hours	Hours

Master Active Lessons	Master lessons with student participation	Understanding and learning of main concepts	**42**	Study: to knowm understand and synthesize knowledge	**62**	4	**108**
Problems, case studies	Active classroom	Case and problem solving.	**4**	Learn to solve problems and cases.	**8**	**-**	**12**
Seminars	Active classroom	Discussions, applied activities.	**10**	Solving and decission-making, dicuss.	**10**		**20**
Others	Other activities	Problem solving, searching information, scientific paper discussions	**4**		**6**		**10**
Totals			**60**		**86**	4	**150**

Evaluation

Type of activity	Evaluation Activity		Mark percentage
	Procedure	**Number**	
Master Active Lessons Secion I	Written exam - General aspects of Plant tissue culture and of transgenic plants*	1	**35**
Master Active Lessons Section II	Written exam - Plant tissue culture objectives and technologies*	1	**35**
Seminars, problems and cases	Writting reports/proofs, documents Writting/oral reports, documents, presentations**	1	**15**
Other guided activities	Presentation of assigned short tasks**	3	**15**
Total			**100**

* Recoverable activities and assessments. Calls according to the calendar (21st November 2023 and 23rd January 2024).
** Non-recoverable activities and assessments

Alternative assessment:

75% of the mark will correspond to a written exam of the theoretical aspects of the course, to be taken on the day of the second exam of the subject call. If less than 5.0 marks out of 10 are obtained, it must be recovered through a recovery exam on the date of the call for the recovery exam of the continuous assessment.

The remaining 25% of the mark will correspond to written tasks assigned to the student on practical aspects of the subject. The student will have to deliver them through the virtual campus prior to the date of the written exam. This 25% qualification does not require a minimum mark and it is not recoverable.

To be eligible for the alternative assessment, the requirements established by the current UdL assessment regulations must be met.

Bibliography

Bibliography. Essential

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Bibliography. Supplementary

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