DEGREE CURRICULUM

BIOTECHNOLOGICAL APPLICATIONS OF IN VITRO CULTURE OF CELLS AND PLANT TISSUE

Coordination: PELACHO AJA, ANA MARIA

Academic year 2020-21

Subject's general information

Subject name	BIOTECHNOLOGICAL APPLICATIONS OF IN VITRO CULTURE OF CELLS AND PLANT TISSUE
Code	101642
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	Degree: Bachelor's Degree in Biotechnology; Course: 4; Character: OPTIONAL; Modality: Attendance-based
Course number of credits (ECTS)	6
Type of activity, credits, and groups	Activity type: PRAULA / TEORIA Number of credits: 1.5 / 4.5 Number of groups: 1 / 1
Coordination	PELACHO AJA, ANA MARIA
Department	HORTICULTURE, BOTANY AND LANDSCAPING
Teaching load distribution between lectures and independent student work	60 hours face-to-face on-site/online 90 hours student off-site learling
Important information on data processing	Consult this link for more information.
Language	Catalan: 5% Spanish: 5% English: 90%

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. 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, although for biotechnologists interested in specializing in other areas (biomedical, animal, environmental or industrial), this subject is also of interest due to the application of plants and plant compounds to these areas. 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 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.

Significant competences

General competences

- To be able to selectively search and use the required information resources to reach the educational objectives.
- To understand the scientific and technical information from the information resources, interpret it under a critical perspective and to be able to produce presentations based on this information.
- To be able to produce easy to understand oral and written reports on the fulfilled work, with a justification based on the theoretic and practical knowledge attained (UdL strategic competence).
- Team working, with a multidisciplinary approach and with capacity to rationally distribute tasks among the team members.
- To be able to communicate in the international environment of the professional development (UdL strategic competence).
- To use information and communication tools and technologies for data analysis and for producing oral and written reports and other educational and professional outputs (UdL strategic competence).
- To know and to conveniently use the scientific and technical terms specific of the area.
- To work in the laboratory applying good practices and quality standards.
- To know and to be able to use software and databases specific for the area.
- To use the scientific method to analyze data and to design experimental strategies for applications in biotechnology.
- To acquire decision criteria for the analytical techniques more convenient for every specific practical case.

Specific competences (according to the Study Plan document)

- To know plant cell and tissue culture, its applications in the different biotechnological areas (agrifood, biomedicine, animal, environmental, industrial), and the present challenges it faces.
- To know how to apply the knowledge learned in the course to plant and animal production, to the environment, to the industry, and to the biomedicine.
- To acquire precise knowledge of the plants basic principles and physiological mechanisms.
- To transfer information, ideas, problems and solutions to the public, both specialized and non-specialized.
- Lead and manage biotechnology companies and institutions related with plant cell and tissue culture.

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.
- **On line activities**: Through the Virtual Campus
- **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 will have both face-to-face classes and virtual teaching. In principle, exams and a relevant share of theory lessons will be face-to-face in the classroom with the professor. They are specified in 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/online 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.	**8**		**18**
Others	Other online activities	Problem solving, searching information, scientific paper discussions	**4**		**8**		**12**
Totals			**60**		**86**	4	**150**

Evaluation

Type of activity	Evaluation Activity		Mark percentage
	Procedure	**Number**	
Master / online Active Lessons	Exams	2	**60**
Problems and cases	Writting reports/proofs, documents	1	**12**
Seminars	Writting/oral reports, documents, presentations	3	**26**
Other guided activities	Presentation of assigned tasks	2	**12**
Total			**100**

Bibliography

Bibliography. Essential

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