Universitat Autònoma de Barcelona

2022/2023

New Perspectives in Plant Biology

Code: 43871
ECTS Credits: 6

Degree	Type	Year	Semester
4316231 Plant Biology, Genomics and Biotechnology	OT	0	2

Contact

Name: Laia Guardia Valle

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Use of Languages

Principal working language: english (eng)

Teachers

Maria Soledad Martos Arias

External teachers

Maria del Mar Marquès

Prerequisites

The student might have studied the subjects of the previous modules of the master's degree.

Objectives and Contextualisation

Objectives and Contextualization:

In front of the current and future human energy requirements (food, medicines, biofuel, cloths, phytochemicals), and environmental challenges (soil and air contamination, land use, climate alterations, pests, etc) emerges an urgent need to develop new ways to improve existing food and animal feed crops (and to develop novel crops). Plant biotechnology is a main tool to improve actual plant production and derived resources to meet future challenges.

The objective of the course is to:

- Provide new knowledge and widening of the knowledge acquired in previous courses by students, specially in modern plant and fungal biotechnology processes.

- Deal with plant and fungal potentialities in current biotechnological processes, allways with the objective of improving plant characteristics and production in different contextualizations

- Understanding that biotechnological processes have applicative values in pharmaceutical and food industry, agriculture and in ecology, among other.

- Learn the methodology of its study and biotechnological management in order to develop subsequent activities in both research and professional environments.

- Share experiences with researchers developing their own projects on plant/ fungal biotechnology.

Competences

- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Conceive, design, manage and develop a scientific, technical or industrial project in Biology and Biotechnology of plants and fungi, and be able to interpret and extract knowledge of the same.
- Develop critical reasoning in the area of study and in relation to the scientific and business environment.
- Identify and use Bio-Computer Science tools to be applied to the genetic, evolutionary and functional study of plants.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Propose and analyze ad hoc solutions derived from plant research, in accordance with the situations and needs of each case.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Synthesize, and analyze alternatives and debate critically.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use scientific terminology to argue the results of research and present them in English both orally and in writing in an international environment.

Learning Outcomes

1. Apply advances in knowledge of the processes that regulate gene expression in plants and their regulation through internal and external factors in the study of plants.
2. Choose and apply IT tools to the reconstruction of plant and fungus phylogenies.
3. Choose and apply new techniques to investigate plants' functional mechanisms and their interaction with fungi.
4. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
5. Develop critical reasoning in the area of study and in relation to the scientific and business environment.
6. Handle different computer programmes for the reconstruction of plant and fungus phylogenies on the basis of molecular data.
7. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
8. Propose innovative projects in the field of biotechnology, based on an integrated perspective on the scientific and methodological knowledge acquired in the field of the molecular evolution of plants and fungi.
9. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
10. Synthesize, and analyze alternatives and debate critically.
11. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
12. Use scientific terminology to argue the results of research and present them in English both orally and in writing in an international environment.

Content

PART 1 (Dr. Laia Guàrdia) (16h: 12h theory (including guest professors) + 4h theoretical-practical session

1.1- Current context. Climate change and the loss of fertile soil in the agricultural sector: Future perspectives of "Nature-based solutions" (3h)

1.2- Plant-endophyte interactions and biotechnological applications (3h).

The concept and importance of symbiosis. Evaluation of the symbiosis balance. Types of endophytes. Resistance to biotic and abiotic stress. Secondary metabolism of endophytes present in forage plants. Alkaloid

production. Poisonings. Other bioactive metabolites from endophytic fungi. Essential oils. Volatile organic compounds (VOCs). Experimental methods in the study and biotechnology of endophytes in the agricultural and forestry sector.

1.3- Interactions of plants with mycorrhizal fungi and biotechnological applications (2h)

Introduction. Dynamics of symbiosis. Types of mycorrhizae. Importance of symbiosis: from the individual to the plant community. Nutrient mobilization. Mediation of biotic and abiotic stress in plant crops. Importance in agriculture and forestry. Biotechnology of ECM fungi.

1.4- Guest speaker - New expectations of plant biotechnology in the Mediterranean context. (2h)

1.5- Theoretical-practical session (2h- LAB to be determined)

PART 2 (Dra Soledad Martos)

New perspectives in crop sciences (14h: 8h Theory + 6h Seminars, C5b/027), Dra. Soledad Martos

1. New pests and diseases. Control tools to fight against them
2. Plants to clean polluted soils
3. Plants to reduce hunger and human diseases
4. Phytonanotechnology
5. Bioenergy production by algae and plants
6. Local adaptations of plants to stressful environmental conditions

Part 3 (CRAG SEMINARS)

- *"Research cases in Biotechnology"*- (3h) Dr. Mar marques-

- "*Case studies on sustainable crop systems*"-(3h)Dr. Jordi Moreno

Methodology

The course includes theorical sessions, seminars and theorico-practical sessions, structured as indicated in the table.

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			
Seminars (CRAG)	6	0.24	1, 5, 6, 7, 9, 4, 2, 3, 10, 11, 12
Theorical sessions	21	0.84	1, 5, 8, 7, 9, 3, 10, 11, 12
Theorico-practical ssession	3	0.12	5, 8, 9, 4, 3, 10, 12
Type: Supervised			
Seminars	12	0.48	1, 5, 6, 8, 7, 9, 4, 2, 3, 10, 11, 12
Type: Autonomous			

Preparation of class-presentation in seminar sessions	25	1	5, 7, 9, 4, 3, 10, 11, 12
Student personal working	80	3.2	

Assessment

PART 1 (Dra. Laia Guàrdia) (50%)

- Lectures: - 1 Tests with multiple-choice questions at the end of the lectures. We will also evaluate the attitude of the student in the class, seminars and practices.

PART 2 (Dra. Soledad Martos) (33%)

-Lectures (50%):- 1 Test with 10 multiple-choice questions at the end of the lectures.

-Seminar (50%) on the basis of:- Selected article; Oral expression; Article presentation; Question deffending; Questions Posed to seminar colleagues.

PART 3 (CRAG SEMINARS) (17%)

- The evaluation will be on the basis of active participation in each seminar, Questions Posed to seminar colleagues, test and/ or memory of the seminars, according to each seminar professor.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Multiple-choice test 1 (LGV)	40%	1	0.04	5, 9, 4, 10, 11
Multiple-choice test 1 (SMA)	20 %	0.5	0.02	5, 7, 9, 4, 10, 11
Seminar (CRAG)	20%	1	0.04	1, 5, 8, 7, 9, 4, 3, 10, 12
Seminar (Dra Soledad Martos- SMA)	20%	0.5	0.02	1, 5, 6, 8, 7, 9, 4, 2, 3, 10, 11, 12

Bibliography

A list of references will be provided to the students along the course.

Software

The students will be informed about any specific program recomended by the teachers at the beginnig of the theorical sessions.