Universitat Autònoma de Barcelona

2018/2019

Problem-Based Learning in Plant Biology

Code: 43872
ECTS Credits: 6

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

Contact

Name: David Caparros Ruíz
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Use of languages

Principal working language: english (eng)

Teachers

Jordi García Mas
Merce Galbany Casals
Maria Coca
Núria Sánchez Coll
Ignacio Rubio Somoza
Jorge Gómez Ariza

External teachers

Igor Flórez Sarasa
Narciso Campos

Prerequisites

Knowledge of previous subjects of the master:

- Plant Physiology and Metabolism

- Plant Molecular Biology and Genetic Engineering

- Plant Genomics

- Agricultural Biotechnology

Objectives and Contextualisation

With the help of a course tutor, each student will design a methodological approach to a problem on plant biology raised by the teacher. At the end of the semester, the students will present their work as a written report and orally in a seminar.

Skills

- Apply knowledge of functional mechanisms of various different organizational levels in plants to the characterization of growth and development processes of the whole plant organism.
- Apply knowledge of plant molecular genetics in different scientific and industrial areas.
- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Continue the learning process, to a large extent autonomously.
- Develop critical reasoning in the area of study and in relation to the scientific and business environment.
- Explain the processes of obtaining genetically modified plants and their use.
- 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 and manage bibliographical information and computer resources in the area of study.
- 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 genomic information to the improvement of fruit quality.
2. Apply knowledge of genomics in order to design programmes to improve fruit quality.
3. Apply knowledge of the defence strategies of plants in order to improve productivity.
4. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
5. Continue the learning process, to a large extent autonomously.
6. Develop critical reasoning in the area of study and in relation to the scientific and business environment.
7. Explain how to obtain and use genetically-modified plants as biofactories.
8. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
9. Propose and analyse biotechnological solutions based on the modulation of plant development.
10. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
11. Synthesize, and analyze alternatives and debate critically.
12. Use and manage bibliographical information and computer resources in the area of study.
13. Use scientific terminology to argue the results of research and present them in English both orally and in writing in an international environment.

Content

This is a multidisciplinary practical subject that integrates previous knowledge of other subjects of the master. The problems to be solved by the students can deal, between others, on the following topics:

- Defence strategies in plants

- Genomic tools in plant breeding

- Metabolic engineering in plants

- Modulation of plant development for biotechnological purposes

- Phylogenetics, molecular dating and biogeography

- Plant adaptation to the environment

- Plants as bio-factories

Methodology

In the first two **lectures** of the course, the subject coordinator and the tutors will introduce the projects (problems to be solved) and the students will choose their project. In the next few weeks, the students will prepare their methodological approach to the problem. They will have three **preparative sessions with their tutor**, who will guide them and will evaluate the work performed. At the end of the course, the students will present a **written report** on their project and will defend it orally in a **seminar** given to the rest of the class. Therefore, the subject's methodology will consist on the following activities:

- Lectures

- Tutored sessions

- Personal study

- Preparation of a written report

- Seminars

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Lectures	20	0.8	6, 8, 11
tutored sessions	6	0.24	8, 9, 10, 12
Type: Supervised			
preparation of written report	44	1.76	4, 7, 8, 9, 10, 11, 12, 13
Type: Autonomous			
personal study	44	1.76	1, 2, 3, 6, 8, 10, 12
preparation of a seminar	36	1.44	8, 9, 10

Evaluation

The tutor will evaluate the student's work performed between preparative sessions and, most importantly, the final written report. The two aspects together will account for 45% of the subject qualification. The oral presentation of the project (seminar given by the student) will be evaluated by the subject coordinator and will account for another 45%. The remaining 10% will be agreed by the subject coordinator and the student's tutor, on the basis of the interest and questions raised in preparative sessions and other students' seminar.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Seminar given by the students and collective discussion (all the students and teacher are present)	45%	0	0	4, 7, 8, 9, 10, 11, 13

Student's participation in class activities (continuous evaluation)	10%	0	0	1, 2, 3, 6, 8, 9, 11
written report	45%	0	0	4, 5, 7, 8, 9, 10, 11, 12, 13

Bibliography

Bibliography will be chosen from the following, depending on the particular project developed by the student:

- Anderson J.T. et al (2011). *Evolutionary genetics of plant adaptation*. Trends in Genetics: **27**:258-266.

- Boualem A., et al (2015) *A cucurbit androecy gene reveals how unisexual flowers develop and dioecy emerges*. Science **250**:688-691.

- Dodds P.N. & Rathjen J.P. (2011) *Plant immunity: towards an integrated view of plant-pathogen interactions*. Nature Reviews Genetics **11**:539-548.

- Hörandl, E. & Appelhans, M. (eds.) (2015) *Next-Generation Sequencing in Plant Systematics*. Regnum Vegetabile v. 158. Koeltz Botanical Books.

- Laitinen R. (ed.) (2015). *Molecular mechanisms in plant adaptation*. John Wiley & Sons.

- Lemey, P., Salemi, M. & Vandamme, A.M. (eds.). 2009. The phylogenetic handbook. A practical approach to phylogenetic analysis and hypothesis testing. 2nd Ed. Cambridge University Press.

- Lomonossoff G.P. & Daoust M.A. (2016). *Plant-produced biopharmaceuticals: A case of technical developments driving clinical deployment*. Science **353**:1237-1240.

- Soyk S., et al (2017) *Bypassing Negative Epistasis on Yield in Tomato Imposed by a Domestication Gene*. Cell **169**:1-14.

- Tang J. & Chu C. (2017) MicroRNAs in crop improvement: fine-tuners for complex traits. Nature Plants **3** :17077. doi: 10.1038/nplants.2017.77

- Tschofen M., et al (2016). *Plant Molecular Farming: Much More than Medicines*. Annual Review of Analytical Chemistry **9**:271-294.

- Yu S., et al (2015). *Plant developmental transitions: the role of microRNAs and sugars*. Current Opinion in Plant Biology **27**:1-7.

- Zhu J.K. (2016) *Abiotic Stress Signaling and Responses in Plants*. Cell **167**:313-324.