Problem-Based Learning in Plant Biology

Code: 43872
ECTS Credits: 6

Use of Languages
Principal working language: english (eng)

Degree

<table>
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<tr>
<th>Degree</th>
<th>Type</th>
<th>Year</th>
<th>Semester</th>
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<tr>
<td>4316231 Plant Biology, Genomics and Biotechnology</td>
<td>OT</td>
<td>0</td>
<td>1</td>
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</tbody>
</table>

Contact
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Teachers
Merce Galbany Casals
Jose Tomas Matus Picero
Maria Coca
Núria Sánchez Coll
Ignacio Rubio Somoza
Martí Bernardo Faura

External teachers
Igor Flórez Sarasa
Nicolas Bologna

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
Each student will design a methodological approach to a problem on plant biology raised by the course coordinator. The students will develop their subjects with the guidance of a personal tutor. At the end of the course, the students will present their work as a written report and orally in a seminar.

Competences
• 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.
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

*Problem-based Learning* is a multidisciplinary 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 sessions of the course, the subject coordinator will introduce the problems to be solved, from which the students will choose. In the next few weeks, the students will prepare their methodological approach to the problem. They will have several preparative sessions with their tutor, who will guide them and will evaluate the work performed. The students will also receive training on the analysis of omic databases through bioinformatics sessions done at the computer. 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. So, the subject's methodology will consist on the following activities:

- Lectures
- Computer sessions
- Tutored sessions
- Personal study
- Preparation of a written report
- Seminars

Activities

<table>
<thead>
<tr>
<th>Title</th>
<th>Hours</th>
<th>ECTS</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type: Directed</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Computer sessions</td>
<td>8</td>
<td>0.32</td>
<td>6, 8, 10, 5, 11, 12</td>
</tr>
<tr>
<td>Lectures</td>
<td>2</td>
<td>0.08</td>
<td>6, 8, 11</td>
</tr>
<tr>
<td>Seminars</td>
<td>18</td>
<td>0.72</td>
<td>3, 2, 1, 6, 7, 9, 8, 4, 5, 11, 13</td>
</tr>
<tr>
<td>Tutored sessions</td>
<td>6</td>
<td>0.24</td>
<td>6, 9, 8, 10, 11, 12</td>
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<tr>
<td>Type: Supervised</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparation of the written report</td>
<td>44</td>
<td>1.76</td>
<td>6, 7, 8, 10, 4, 5, 11, 12, 13</td>
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<tr>
<td>Type: Autonomous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal study</td>
<td>40</td>
<td>1.6</td>
<td>6, 8, 10, 5, 11, 12</td>
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<tr>
<td>Seminar preparation</td>
<td>32</td>
<td>1.28</td>
<td>6, 8, 10, 4, 5, 11, 12, 13</td>
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Assessment

The tutor will evaluate the student's work in the preparative sessions and the written report. These 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 tutor, on the basis of the student's interest and questions in the preparative sessions and other students' seminars.

Assessment Activities
<table>
<thead>
<tr>
<th>Title</th>
<th>Weighting</th>
<th>Hours</th>
<th>ECTS</th>
<th>Learning Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Seminar given by the student and collective discussion with the other</td>
<td>45 %</td>
<td>0</td>
<td>0</td>
<td>3, 2, 1, 6, 7, 9, 8, 4, 5, 11, 13</td>
</tr>
<tr>
<td>students and the teacher</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Student's participation in class activities (continuous evaluation)</td>
<td>10 %</td>
<td>0</td>
<td>0</td>
<td>6, 8, 11, 12, 13</td>
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<tr>
<td>Written report</td>
<td>45 %</td>
<td>0</td>
<td>0</td>
<td>6, 7, 8, 10, 4, 5, 11, 12, 13</td>
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</table>

**Bibliography**

The bibliography will be chosen from the next list, depending on the particular project developed by the student: