Universitat Autònoma de Barcelona

2017/2018

Plant Biology

Code: 100989
ECTS Credits: 9

Degree	Type	Year	Semester
2500502 Microbiology	FB	1	2

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

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Prerequisites

It is advisable to review: cell structure and function; fundamentals of Biochemistry; taxonomic ranks and geological eras.

Objectives and Contextualisation

The main objective of the subject is to introduce students to the basic knowledge of plant biology from a systematic approach as well as structural and functional fundamentals.

Plants and microorganisms have a close evolutionary and functional relationship that in many cases has led to strong mutual dependence. Significant examples are, among others, symbiosis like mycorrhizae or the symbiotic fixation of atmospheric nitrogen, but also phytopatological interactions, of great importance in agriculture, or saprophytic, essential for the cycling of mineral nutrients in the ecosystems.

In order to understand these complex interactions, which are formative objectives of following years, the student must first obtain the ability to recognize the different levels of organization of plants, its diversity in the environment, its basic vital functions and its regulation pathways.

In order to facilitate the learning process, the subject has been subdivided in three thematic modules, or areas, that include respectively the systematic, structural and functional fundamentals and have the following objectives:

Module 1: Plant Diversity

To study the main plant groups in a phylogenetic (evolutionary), morphological and ecological way. To understand the richness and importance of plant diversity in the biosphere, as well as its interactions with other

organisms.

Module 2: Cytology and Plant Histology

To get a broad knowledge of the diversity of plant cells and how to distinguish the cytophysiological characteristics that define the different tissues in plants.

Module3: Plant Physiology

Integration of the knowledge of plants' functional processes at different organizational levels of the entire organism and its regulation by internal and environmental factors.

Skills

- Communicate orally and in writing.
- Develop critical reasoning skills in the field of study and in relation to the social context.
- Display sensibility towards environmental, health and social matters.
- Obtain, select and manage information.
- Recognise the different levels of organization of living beings, especially animals and plants, diversity and bases of regulation of vital functions of organisms and identify mechanisms of adaptation to the environment.
- Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
- Work individually or in groups, in multidisciplinary teams and in an international context.

Learning outcomes

1. Communicate orally and in writing.
2. Develop critical reasoning skills in the field of study and in relation to the social context.
3. Display sensibility towards environmental, health and social matters.
4. Establish the principles behind the functioning of physiological processes in animals and plants, with a view to using them in practice.
5. Identify animal and plant tissues, taking into account the morphology, microscopic and ultra-microscopic structure and cytophysiology of their components.
6. Identify the differential morphological characteristics of each taxonomic plant group in order to engage in identification and interpretation.
7. Integrate the functional processes of plants, from the different levels of organisation to the whole plant organism
8. Know and interpret animal and plant diversity, its origin and its evolution.
9. Obtain, select and manage information.
10. Recognise plants and the principal types of vegetation.
11. Understand the functional mechanisms of plants globally.
12. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
13. Work individually or in groups, in multidisciplinary teams and in an international context.

Content

Module 1: Plant Diversity and Systematics:

1.1. The origin of life and the evolution of main groups. Key events in the life history of "plants".

1.2. Classification of life. From Aristotle's two kingdoms to the present day. The five kingdoms of Whittaker and Margulis & Schwartz. Woese. Cavalier-Smith. Tolweb.org: "The Tree of Life".

1.3. Taxonomy, Systematics and Phylogeny. Definition of Taxonomy and Systematics. Species concept. Biodiversity. Linnaeus and the Binomial System. Taxonomic categories. Basic concepts of phylogeny.

1.4. Levels of morphological organization, reproduction and biological cycles. Prokaryotes and Eukaryotes. Protophytes. Talophytes. Bryophytes. Cormophytes. Asexual and sexual reproduction. Biological cycles. Monosporic and heterosporic organisms.

1.5. Introduction to Algae. Phylogeny of the algae. Origin and evolution of the chloroplast. Green, red and brown lines. Criteria for classification.

1.6. Heterokonta: Phaeophyceae (Brown Algae). General characteristics. Morphology. Systematics. Dictiotales. Laminariales ("kelp"). Fucales. Uses of the Phaeophyceae.

1.7. Rodophyta (Red Algae). General characteristics. Cell structure. Pit connections. Reproduction and cycles: the trigenetic cycle. Diversity-Morphology. Applications.

1.8. Green Algae: Chlorophyta + Basal Streptophyta. Definition of Viridiplantae. Phylogeny. General Characteristics of Chlorophyta. Diversity. Chlorophyceae. Ulvophyceae: Ulotricales, Ulvales, Cladoforales, Caulerpales. Basal Streptophyta. Streptophyta: Charophyceae: phylogenetic location; Zignematales, Charales and Coleocaetales.

1.9. Colonization of the terrestrial environment. Origin. Adaptations to the terrestrial environment. Vegetative and reproductive structures.

1.10. Bryophyta. Phylogeny. General characteristics. Lifecycle. Gametophyte and Sporophyte. Differential characters between the three groups. Liverworts (Marchantiophyta): Morphology. Biological cycle, diversity. Mosses (Bryophyta): Morphology. Biological cycle, diversity. Hornworts (Antocerotophyta).

1.11. The Vascular Plants. Phylogeny. Apomorphies of Vascular Plants. The corm: root, stem and leaves.

1.12. "Pteridophytes". General characteristics of Pteridophytes. Systematics. Colonization of the terrestrial environment: chronology. First non-bryophytic terrestrial plants. First symbiosis. Pteridophytes Diversity. Cl. Psilotopsida. Lycopodiopsida. Pteridophosida.

1.13. Spermatophyta: seed origin and pollen. Evolutionary trends. The seed. The pollen grain. The origins: Pteridosperms and Progimnosperms. Biological strategies.

1.14. Gymnosperms. Systematics. Cicadpsida. Ginkgopsida. Gnetopsida, Coniferopsida. Morphology. Reproductive elements. Diversity. Ecology and distribution.

1.15. Flower Plants: Angiosperms (Phylum Magnoliophyta) -I. Origin and evolution. The vegetative body. Sinapomorphies.

1.16. Flower Plants: Angiosperms (Phylum Magnoliophyta) -II. The flower. Reproductive systems: Microsporogenesis, Megasporogenesis, Embriogenesis. The seed. The fruit.

1.17. The Angiosperms: systematic-I. Evolutionary characteristics of the characters, coevolution strategies and radiation of flowering plants.

1.18 The Angiosperms: systematic-II. The main clades of Angiosperms.

Module 2: Plant Cytology and Histology:

2.1 Special features of plant cell. Cell wall. Tissue concept in Phanerogams.

2.2 Meristems. Apical meristems, cambium and phellogen.

2.3 Parenchyma: tissue organization. Root endodermis. Transfer cells.

2.4 Mechanical tissues. Collenchyma. Sclerenchyma. Sclerenchyma cells.

2.5 Xylem. Tracheids and vessel elements. Fibers and xylem parenchyma.

2.6 Phloem. Sieve tubes and sieve tube elements. Phloem parenchyma. Sclereids and phloem fibres.

2.7 Dermal tissue. Epidermis. Periderm.

Module 3: Plant Physiology:

3.1. Peculiarities of plant life: nutrition and form.

3.2. Water requirement: Concept of water potential; Osmotic relationships and growth.

3.3. Absorption and transport of water.

3.4. Mineral requirements: plant mineral nutrition. Plant-soil relationships.

3.5. Absorption and transport of nutrients.

3.6. Plants and light. Photosynthetic pigments; Transformation of energy.

3.7. Reductive Carbon Assimilation; C3 metabolism.

3.8. Photorespiration.

3.9. C4 y CAM metabolism.

3.8. Reductive assimilation of nitrogen and sulfur.

3.9. Secondary metabolism, pathways, functions and applications.

3.10. Regulation of growth and development by internal factors: Phytohormones and genetic regulation.

3.11. Regulation by external factors. Sensory and regulation systems for flowering. Photoperiodism, thermoperiodism and vernalisation.

3.12.Seed dormancyand germination.

3.13. Fruit formation and maturation.

3.14. Senescence and abscission.

3.15. Biotechnological applications of plants.

Methodology

MODULE 1 (Plant Diversity):

The contents of Plant Diversity and Systematics will consist of 18 theory classes and 2 seminars of 2 hours (4 hours).

The seminars will deal with topics related to teaching, creating an atmosphere of debate. At the end of the seminars there will be a questionnaire. In theory classes, the faculty will explain the contents following an evolutionary (phylogenetic) thread, from the most primitive plants to the most modern ones.

A group work will be carried out, involving fieldwork and plant recognition to make a virtual herbarium. A forum will be activated (in the Virtual Campus) where students will have to make contributions as determined by the faculty and these will be evaluated.

MODULE 2 (Cytology and Plant Histology):

The contents of Cytology and Plant Histology comprise 12 theory classes and 3 seminars of 1 hour (3 hours).

The 3 scheduled seminars are designed for students to gain group work and critical reasoning skills. The class will be divided into groups of 4 to 6 students with the objective of working on a specific topic of the program and later carry out an oral presentation and a collective discussion. The organization of the groups and the distribution of topics will take place during the first seminar. In the remaining seminars, some groups of students must submit the proposed topic writing to the teacher. The same groups of students will expose the subject to the rest of the class with the available resources in the classroom.

MODULE 3 (Plant Physiology):

The contents of this module will be taught in 25 theoretical classes and 5 seminars (5 hours).

In the seminars the students, in small groups, prepare topics of current interest related to the functionality of plants. The topics are exposed by the students to their classmates and are discussed together with the teacher. In lectures the professor explains the content of the program mentioned above. Personal study with the help of recommended bibliography and class notes is strongly advised. The tutorials will be carried out in person at the teacher's office (hours to be arranged).

Tutorials: They are used to clarify concepts, to establish the acquired knowledge and to facilitate the study by the students. They can also be used to solve doubts that students have about the preparation of the seminars. Each course the professor proposes a topic for a written home work based on literature review; this work has to be delivered through moodle.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Seminars	12	0.48	11, 2, 7, 9, 13, 3, 12
Theory classes	55	2.2	11, 8, 5, 6, 7, 10
Type: Supervised			
Tutorials	9	0.36	2, 9, 3, 12
Type: Autonomous			
Literature review	15	0.6	9, 12
Public speaking preparation	20	0.8	9, 13, 12
Study	75	3	5, 13
Text reading	20	0.8	5
Work composition	10	0.4	2, 9, 1, 13, 12

Evaluation

The specific and transversal competences of this subject will be evaluated through written tests (exams), thematic works, questionnaires, oral presentations and participation in seminars and tutorials.

Each module is evaluated independently. The student must pass the three modules to pass the subject. The final score is the result from the weighting of the scores of each module according to the number of credits of each one [Module 1 (3 credits); Module 2, (2 credits); Module 3 (4 credits)]. Subject can be passed with partial tests (three partial exams corresponding respectively to each module) or with the final test. Students who have not undergone some or all of the partial tests or who, having presented themselves, have not passed it, may

recover by submitting to the corresponding part (s) of the scheduled recovery examination at the end of the semester.

A student is considered as presented, and therefore will be evaluated, if it has sit for to at least one of the partial exams or the recovery examination.

Repeaters will only have to evaluate the particular modules that have not been passed.

A student will obtain the grade of Not Evaluable if the number of evaluation activities performed has been less than 50% of those programmed for the subject.

Score increase

Students will be able to take a score improvement exam for each of the modules they wish. These exams will be held on the same day as the recovery exam. The presentation of the student to score improvement examination entails the renunciation of the score obtained previously in this particular module.

Evaluation Module 1. Plant Diversity.

The final score of this module will be calculated from scores of continuous assessment activities:

- Written test (65%): test and/or short answer questions. A minimum score of 5 is required to be able to balance with the other activities.

- Seminars (15%): questionnaires at the end of sessions and active participation.

- Delivery of group work (20%): realization of a virtual herbarium from its own material.

- Participation in the Virtual Campus forum: the contributions made, both quantitatively and qualitatively, will be assessed. You can reach a maximum of 10%.

To pass the module you must obtain a minimum score of 5.

Evaluation Module 2. Cytology and Plant Histology.

The competences of this module will be evaluated through continuous evaluation, which will include different tests, written works and public presentation. In order to pass this module, a minimum score of 5 must be obtained. The evaluation system is organized into two sections, each of which is evaluated independently and assigned a specific weight in the module's final score:

Written tests (80% of the overall score): in this section, the knowledge acquired by each student is evaluated individually with test exam. A written test will be done at the end of the contents of the Histology program. Students who have obtained a score below 4 (out of 10) in this test will not be able to weight with the score obtained in the seminars and, therefore,must take the recovery exam.

Seminars (20% of the overall score): This section assesses the ability to analyze and synthesize the students in each group, as well as the skills of group work and oral presentation. The seminars will be scored as follows:

Written work 50% The teacher evaluates (over 10) the assignments delivered by each group of students (see deliveries)
Oral work 20% The teacher evaluates (over 10) the skills of each group of students in the public presentation of their work
Inter-group grade 15% Each group of students evaluates (over 10) the groups that perform the oral presentation
Intra-group rating 15% Within each group, each student evaluates (over 10) his or her peers at the last seminar
TOTAL 100%

Attendance to the seminars is mandatory. In case of missing class with not justified cause there will be a penalty in the final qualification of the seminars:

Absence 1 session = 20% reduction of the score.
Absence 2 sessions = reduction of 40% of the score.
Absence ≥3 sessions = reduction of 80% of the score.

Evaluation Module 3. Plant Physiology.

The final grade of the module results from the qualification of the written exam (80%), of the delivery of the written home work (10%) and the participation in seminars and tutorials (10%).

To pass the module you must obtain a minimum global score of 5 and a minimum qualification for the written exam of 4.5.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Citology and Histology Exam	17.8	2	0.08	11, 2, 5, 7, 9, 1, 13
Homework and seminar and tutorial participation, Plant Physiology module	8.9	1	0.04	4, 7, 9, 1, 13, 12
Plant Diversity Exam	21.7	2	0.08	11, 8, 2, 6, 9, 10, 1, 13, 3, 12
Plant Physiology exam	35.6	2	0.08	4, 11, 2, 7, 9, 1, 13, 3, 12
Seminar and work participation: phylogenetic reconstruction. Plant Diversity Module	11.7	1	0.04	6, 9, 1, 13, 3, 12
Work, Oral presentation, Qualific. inter-group and intra-group. Citology and Histology Module	4.4	1	0.04	11, 5, 7, 9, 1, 13, 12

Bibliography

Books:

Module 1:

CARRIÓN, J. S. 2003. Evolución vegetal. DM. Murcia.

IZCO, J. et al. 2004. Botánica. McGraw-Hill-Interamericana. Madrid.

LLIMONA, X. (ed.) 1985. Plantes inferiors. Història Natural dels Països Catalans. Vol. 4. Enciclopèdia Catalana. Barcelona.

RAVEN, P.H., EVERT, R.F. & EICHHORN, S.E. 1991-1992. Biología de las Plantas. Vols. 1 i 2. Reverté. Barcelona.

SIMPSON, M.J. 2009. Plant Systematics. 2ª ed. Elsevier

STRASBURGER, E. et al. 2004. Tratado de Botànica. 9ª edic. Omega. Barcelona.

Module 2:

Esau, K.: Anatomía vegetal (ed. Omega)

Fahn, A.: Anatomía vegetal (ed. Pirámide)

Mauseth, J.D.: Plant Anatomy. (ed. Benjamin/Cummings)

Paniagua, R. y col.: Citología e Histología vegetal y animal (ed. McGraw Hill)

Module 3:

Barceló, J. et al. Fisiología Vegetal, Ed. Piràmide, Madrid 2005

Plant Physiology, L. TAiz y E. Zeiger, 6th edition, Sinauer, Sunderland, MA (USA, 2014)

Website:

http://einstein.uab.es/botanica ; http://www.unex.es/botanica/LHB/

http://www.hiperbotanica.net/

http://6e.plantphys.net/