COURSE DATA

DATA SUBJECT

Code: 33170
Name: Plant biology
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1111 - Grado en Biotecnología	Facultat de Ciències Biològiques	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1111 - Grado en Biotecnología	Foundations of functional biology	COMPULSORY

COORDINATION

ROS PALAU ROQUE LUIS

SUMMARY

The Plant Biology course is a compulsory part of the Fundamentals of Functional Biology Subject along with Biodiversity, Genetics, Animal Biology and Microbiology.

Plants are the mainstay of the food chain. They are also the main contributors of O2 release to the atmosphere and are essential for human nutrition, providing energy, fiber and vitamins. To carry out biotechnological approaches, it is necessary to know how plants operate at different levels of organization and how they adapt to the environment in which they develop.

Plant Biology course aims to provide basic knowledge of plant operations and processes taking place in them. In addition, this course covers the mechanisms involved in the growth and development of plants and their interactions with the environment are studied.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

During the first year and the first semester of the second year Biotechnology students have developed and assimilated basic knowledge that will underpin Plant Biology. Specifically, in Biodiversity different major groups of plants and structural models are studied; in Biochemistry plant cell basic metabolism is studied and in Cell Biology the plant cell structure is studied.

COMPETENCES / LEARNING OUTCOMES

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Actuar con autonomía en el aprendizaje, tomando decisiones fundamentadas en diferentes contextos, emitiendo juicios en base a la experimentación y el análisis y transfiriendo el conocimiento a nuevas situaciones

Adquirir, desarrollar y aplicar las principales técnicas de preparación, tinción y observación de muestras biológicas

Apply analytical, synthetic and critical thinking skills in the application of the scientific method.

Aprender a trabajar de forma adecuada en un laboratorio con material biológico (microorganismos, plantas y animales) incluyendo seguridad, manipulación y eliminación de residuos biológicos, y con registro anotado de actividades.

Colaborar eficazmente en equipos de trabajo, asumiendo responsabilidades y funciones de liderazgo y contribuyendo a la mejora y desarrollo colectivo

Conocer la composición, formación y función de cada compartimento celular y de los diferentes tejidos

Conocer y comprender, desde el propio ámbito de la titulación, las desigualdades por razón de sexo y género en la sociedad; integrar las diferentes necesidades y preferencias por razón de sexo y de género en el diseño de soluciones y resolución de problemas

Contribuir en el diseño, desarrollo y ejecución de soluciones que den respuesta a demandas sociales, teniendo en cuenta como referente los Objetivos de Desarrollo Sostenible

Demostrar razonamiento crítico y autocrítico en el ámbito de la titulación, considerando aspectos tales como la ética profesional, los valores morales y las implicaciones sociales de las diferentes actividades realizadas

Disseminate and engage in public debate on issues related to biotechnology and its applications.

Participate in multidisciplinary teams, engaging in teamwork and collaboration.

Propose creative and innovative solutions to complex situations or problems, typical of the area of ¿¿¿¿connection, to donate responses to the various professional and social needs

Que el estudiantado demuestre su capacidad para reconocer la diversidad biológica y conocer la organización de los seres vivos y la ubicación del ser humano y de los organismos modelo en experimentación biotecnológica en dicha diversidad

Que el estudiantado demuestre su capacidad para utilizar las diferentes fuentes bibliográficas y bases de datos biológicos y usar las herramientas bioinformáticas

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

Ser capaz de dar una breve charla a un auditorio no especializado sobre un tema general de Biología con impacto actual en la sociedad.

Ser capaz de observar e interpretar los resultados obtenidos a través de microscopios ópticos

Ser capaz de situar los distintos seres vivos en el árbol filogenético

Understand evolutionary relationships among organisms.

Use English to write reports and to interpret information from protocols, manuals and databases.

Work in laboratories, including safety procedures, waste management and accurate activity logging.

DESCRIPTION OF CONTENTS

1. Plants and plant cells: structure/function relationships

Introduction to Plant Physiology. Concept and biotechnological applications. Plant organs and cells. The cell wall.

2. Mechanisms of uptake and transport of water and nutrients

Water relations. Significance and distribution of water in the plant. Water potential components. Water relations in cells and tissues. Transpiration. Definition and types. Stomatal apparatus. Stomatal movement and control mechanisms. Water absorption by the roots. Water transport mechanisms to the aerial parts. Aquaporins.
Mineral nutrition. Mineral composition of plants. Essential and beneficial elements. Functions of mineral elements; deficiency symptoms and symptoms. Adaptations to nutrient limitations and tolerance to excesses.
Ion uptake and transport by plants. Solute transport through the membrane pumps, transporters and channels. ATPases and other identified transporters. The roots as an organ of absorption of ions. Ion movement through the roots. Mycorrhizae. Correlations between the functions of stem and root in the absorption of minerals. Foliar absorption.
Phloem transport. Structure and function of phloem. Substances transported by the phloem. Transport mechanisms and their control. Mechanisms for loading and unloading

3. Plant Metabolism: photosynthesis, nitrogen and sulfur assimilation, respiration

Photosynthesis: the light reactions. General equation of photosynthesis. The chloroplast and photosynthetic pigments. Light absorption by plants: conservative and non-conservative absorption. Reaction centers and harvesting antennae. Photosystems and oxidant water complex. Transport of electrons, cyclic, non-cyclic and pseudocyclic. Coupling between electron transport and photophosphorylation. Importance of the architecture of the photosynthetic apparatus. Coordination between photosystems. Photoinhibition and mechanisms of photoprotection.
Photosynthetic CO2 fixation and carbohydrate synthesis. Photosynthetic carbon reduction cycle. Calvin cycle regulation. Transport between chloroplast and cytosol. Synthesis of starch, sucrose and fructans. Photorespiration. Nitrogen and carbon photorespiratory cycle. C4 plants. CAM plants. Photorespiration in C3, C4 and CAM plants.; physiological significance
Photosynthesis under natural conditions. Compensation and saturation points. Magnitude of photosynthesis. Use of solar energy. Photosynthetic efficiency.
Fixation of molecular nitrogen. Nitrogen cycle and assimilation by plants. Nitrogen fixation in symbiotic associations.
Assimilation of nitrate, ammonium and sulfate. Nitrate reduction to ammonium: nitrate and nitrite reductase. incorporation of Ammonium to carbón skeletons: glutamine synthetase (GS) and glutamate synthase (GOGAT). Sulfur Assimilation: sulfate reduction pathways and regulation.
Respiratory metabolism. Introduction. Peculiarities of plant glycolysis and mitochondrial electron transport. Glyoxylate cycle.

4. Hormonal and environmental control of plant development

Plant growth. General principles of growth and development. Cellular basis of plant growth: biochemical changes in the cell wall; Physics of plant growth.
Plant growth regulators. Phytohormone concept. Main groups of hormones: auxins, cytokinins, gibberellins, abscisic acid, ethylene, polyamines, brasinolids, jasmonates, salicylic acid. Major synthetic pathways of hormones. General mechanisms of perception and transduction of the hormonal signal. Commercial applications.
Differentiation and morphogenesis. The cell cycle and its control. Totipotency and polarity. Formation of the different plant organs. Mechanisms and regulation of differentiation and morphogenesis.
Juvenility, senescence and abscission. Juvenile and adult stages in the plant. Physiological changes associated with senescence. Control of senescence. Abscission: mechanism, biochemistry and control.
Photomorphogenesis. Concept. Types of photoreceptors. Phytochromes: discovery; characteristics, metabolism, mode of action and response of plants. Responses to blue and ultraviolet light.
Plant movements. Basics. Nutations, nastic movements and Tropisms: types. Phototropism and gravitropism: mechanisms of perception, signal transduction and response
Physiology of flowering. Factors affecting flowering: Flower development: floral transition. Genetic model of flowering.
Physiology of seed and fruit. Structure and development of the seed. Chemical composition of the mature seed. Germination: Metabolism and regulation of the mobilization of reserves. Fruit growth and development.Parthenocarpy. Ripening: climacteric and non-climacteric fruits. Physical and chemical

changes associated with maturation. Dormancy of buds and seeds

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	34,00
Laboratory	21,00
Classroom practices	3,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	38,00
Preparation of lessons	52,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

- Lectures with no compulsory attendance

- Practical and question classes with compulsory attendance

EVALUATION

To request the advancement of the call for this subject, the mandatory activities indicated in the teaching guide of the subject

Theory: There will be a final exam that corresponds to 75% of the course grade. A minimum grade of 4 out of 10 is needed in this section to compensate with other grades up to the 5 needed to pass.

Tutorials: The tutorials will serve the teacher to assess the students' knowledge of the subject. To do this, the teacher will ask questions about theoretical concepts of the subject to the students. This section will be 10% of the final grade.

Practical and problems: The mark of laboratory practicals and problems corresponds to 15% of the mark of the subject. This section will be evaluated by performing an exam on various aspects of the practical sessions carried out. This exam will also include problems related to practical sessions. In order to be evaluated in the practical sessions, it is mandatory to have attended them. The lack of evaluation in the practical section will prevent the evaluation of the subject as a whole. A minimum grade of 4 out of 10 is needed in this section to be able to compensate with other grades up to the 5 necessary to pass.

Other Activities:
This section evaluates the student's active participation in theoretical and practical classes, as well as any additional activities proposed during the course. The maximum score for this section is **0.5 points** of the final grade.

REFERENCES

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