COURSE DATA

Data Subject	
Code	33170
Name	Plant biology
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1102 - Degree in Biotechnology	Faculty of Biological Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1102 - Degree in Biotechnology	81 - Foundations of functional biology	Obligatory

Coordination

Name	Department
ROS PALAU, ROQUE LUIS	25 - Plant Biology

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.

OUTCOMES

1102 - Degree in Biotechnology

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

LEARNING OUTCOMES

1. To understand and manage basic scientific terminology related to plant biology
2. To know the structure of a plant and a plant cell
3. To understand the basic physiological processes of plants, which allow them to feed, grow, multiply and interact with the environment
4. To know how to use different literature sources to update and deepen knowledge of a particular plant science topic
5. To understand and interpret scientific work related to Plant Physiology
6. To handle safely and efficiently in a plant biology laboratory
7. To know how to present and interpret results obtained in a laboratory
8. To know the role a plant physiologist can play in science

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

ACTIVITY	Hours	% To be attended
Theory classes	34,00	100
Laboratory practices	21,00	100
Classroom practices	3,00	100
Tutorials	2,00	100
Study and independent work	38,00	0
Preparing lectures	40,50	0
Preparation of practical classes and problem	11,50	0
TOTAL	**150,00**	

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 active participation of the student in the theoretical and practical classes. The maximum mark for this section is 0.5 points of the final mark.

REFERENCES

Basic

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