COURSE GUIDE FOR
PLANT PHYSIOLOGY

Academic year 2020-2021

(Date last update: 09/07/2020)
(Date approved in Department Council: 09/07/2020)

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Biology	Plant Physiology	1	2	6	Required

LECTURER(S)	Postal address, telephone nº, e-mail address
• Group A: F. J. Palma Martín and Noel A. Tejera García • Group B: Francisco Ligero Ligero • Group C: Francisco J. Palma Martín • Group D: Noel Amaurys Tejera García • Groups E and F: Juan Manuel Caba Barrientos	Dept. of Plant Physiology, School of Pharmacy. Rooms 10, 12, 13, 14 and 17. E-mail: fpalma@ugr.es, fligero@ugr.es, natejera@ugr.es, jcaba@ugr.es
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT	TUTORING HOURS
Degree in Pharmacy	• FJPM: Mon, Wed, Fri, 11:30-13:30 • FLL: Mon, Wed, Fri, 11:30-13:30 • NATG: Mon, Wed, Fri, 11:30-13:30 • JMCB: Mon, Wed, Fri, 11:30-13:30
PREREQUISITES and/or RECOMMENDATIONS (if necessary)	
It is strongly recommended the student have completed Structural Biochemistry, Metabolic Biochemistry and Botany, and be able to translate a scientific journal paper.	
BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)	
Fundamentals in Plant Physiology: Water relations in plants. Photosynthesis. Mineral nutrition. Plant development. Hormonal control of development. Secondary metabolism, biosynthetic pathways. Plant Biotechnology.	
GENERAL AND PARTICULAR ABILITIES	
General competencies: • Knowing how to apply the scientific method and acquire skills in handling information sources, literature, development of protocols and other aspects that are considered necessary for the design and critical assessment of preclinical and clinical trials (CG3). **Specific competencies:** • Know the structures of biomolecules and their transformations in the plant cell (CE17).	

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- Develop skills to identify therapeutic targets and drug biotechnological production and use of gene therapy (CE21).
- Knowing medicinal plants: botanical diversity, physiology, use and management (CE26).

Learning outcomes:

- Understand and use the basic terminology in Plant Physiology and Plant Biotechnology.
- Be able to explain the main physiological processes and to understand the basics of plant metabolism.
- Identify the processes involved in the production of secondary metabolites.
- Ability to search, analyze and report information on plant physiology.

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

- Understand the fundamental structures and compartments of the plant cell
- Know the basic differences between animal and plant cells
- Search and manage bibliographic information in Plant Physiology
- Clearly differentiate between plant and animal nutrition
- Understand that life on Earth depends on photosynthesis
- Learn that medicinal plants can be grown in field or under controlled conditions
- Know the nutritional requirements of plants
- Understand the mechanisms of mineral deficiencies
- Relate photosynthesis with the formation of all primary and secondary metabolites
- Understanding the fundamental processes of plant development and internal and external factors that regulate these processes
- Understand the concept of plant growth regulator and how these substances act to cause physiological responses
- Understand the role of these regulators in “in vitro” morphogenesis in cells, tissues and plant organs
- Distinguish between primary and secondary products at the structural, functional, and distribution levels
- Understand the role of secondary products for plant survival
- Understand the diversity and complexity of these products and their metabolic pathways
- Know the main techniques of “in vitro” culture of plant cells and tissues
- Know the methods used for the bioproduction of plant secondary metabolites
- Know the main techniques of genetic manipulation of plant organisms

DETAILED SUBJECT SYLLABUS

I. **INTRODUCTION** (1 h)

1. Introduction to Plant Physiology (1 h).

II. **PRIMARY METABOLISM** (19 h)

2. Water in plants: Water potential (2 h).
3. Absorption and transport of water through the plant (1.5 h).
4. Loss of water by the plant: Transpiration (1.5 h).
5. Mineral nutrition (1.5 h).
6. Nutrient transport across membranes (1.5 h).
7. General aspects of photosynthesis (1 h)
8. Photochemical formation of reducing power (2 h).

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9. Photophosphorylation (1 h).
10. Photosynthetic carbon reduction (Calvin) cycle (2 h).
11. Other pathways of CO_2 fixation: C4 and CAM plants (1.5 h).
12. Metabolism of Nitrogen and Sulphur (1.5 h).
13. Photoassimilate transport through the phloem (1 h).

III. PLANT GROWTH AND DEVELOPMENT (8.5 h)

14. Plant morphogenesis (3 h).
15. Plant hormones. Auxins (1.5 h).
16. Gibberellins (1 h).
17. Cytokinins (1 h).
18. Ethylene (1 h).
19. Abscisic acid and other plant growth regulators (1 h).

IV. SECONDARY METABOLISM (3.5 h)

20. Introduction to Secondary Metabolism (0.5 h).
21. Terpenoids (1 h).
22. Phenolic Substances (1 h).
23. Alkaloids and other nitrogen-containing compounds (1 h).

V. PLANT BIOTECHNOLOGY (2 h)

24. "In vitro" plant cell and tissue culture (1 h).
25. Plant genetic manipulation: gene transfer systems (1 h).

Seminars / Workshops

• Workshop 1. Search and bibliographic information in Plant Physiology: articles, journals and databases.
• Rest of workshops. Throughout the semester, students may present and discuss papers on issues (related to any topic of the syllabus) previously agreed with the corresponding professor.

LABORATORY CLASSES

• Lab 1: Chloroplasts Isolation: Hill Reaction.
• Lab 2: Study of Nitrate Reduction in Photosynthetic Tissues.
• Lab 3: Determination of Water Potential: Densitometric Method (Chardakov).
• Lab 4: Observation of Plant Cells and Tissues

READING

MAIN:

- AZCÓN-BIETO J. & TALÓN M. (2ª ed.) (2008): Fundamentos de Fisiología Vegetal. McGraw Hill-Interamericana, Madrid. Spanish. (https://granatensis.ugr.es/discovery/fulldisplay?docid=alma991008237749704990&context=L&vid=34CBUA_UGR:VU1&lang=es).
- JONES R., OUGHAM H., THOMAS H. y WAALAND S. (2013). The Molecular Life of Plants. Ed. Wiley-Blackwell - American Society of Plant Biologists, Oxford, UK
- SALISBURY F.B. & ROSS C.W. (2000): Fisiología Vegetal. Ed.International Thompson Editores Spain -

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Paraninfo, S.A., Madrid. Spanish.
- TAIZ L. & ZEIGER E. (2006): Fisiología Vegetal. Publicacions de la Universitat Jaume I de Castellón (two volumes, Spanish translation of the English 3rd ed., 2002).
- TAIZ L. & ZEIGER E. (2010): Plant Physiology. Sinauer, USA (5th ed., English).
- TAIZ L., ZEIGER E., MØLLER I.M. & MURPHY A. (2014). Plant Physiology and Development. Sinauer, USA (6th ed., English).
- TAIZ L., ZEIGER E., MØLLER I.M. y MURPHY A. (2018). Fundamentals of Plant Physiology, Sinauer, USA (1st ed., in English inglés).

COMPLEMENTARY:
- BUCHANAN, B. B., GRUISSEN, W. y JONES, R.L. (2015): Biochemistry and Molecular Biology of Plants (2nd ed.). American Society of Plant Physiologists. Rockville, Maryland, USA.
- HOPKINS, W. G. y HÜNER, N. P. A. (2009): Introduction to Plant Physiology. Whiley & Sons, Inc. Hoboken, NJ, USA
- SLATER, A., SCOTT, N.W. y FOWLER, M.R. (2008): Plant Biotechnology: The Genetic Manipulation of Plants. (2ª ed.). Oxford University Press, 2008
- BOWSHER, C., STEER, M., TOBIN, A. (2008) Plant Biochemistry. Garland Science. NY, USA.
- HELDT, H.W. (2011). Plant Biochemistry (4th ed.). Academic Press, NY, USA.

RECOMMENDED INTERNET LINKS

http://www.ugr.es/~fisiofar/

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