COURSE GUIDE FOR

# PLANT BIOTECHNOLOGY APPLIED TO PHARMACY

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 Biotechnology | 3rd | 1 | 6 | Optional |

| LECTURER(S) | Postal address, telephone nº, e-mail address |
|---|---|
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| **DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT** | **OTHER POSSIBLE DEGREES** |
| Degree in Pharmacy | Degree in Biology |

**PREREQUISITES and/or RECOMMENDATIONS (if necessary)**

It is strongly recommended the student have completed Plant Physiology, Metabolic Biochemistry and Molecular Biology and be able to translate a scientific journal paper.

**BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)**

In vitro cell, tissue and organ culture. Secondary metabolite production in suspension cultures. Recombinant DNA technology. Biotechnological improvement of medicinal plants. Transgenic plants: Molecular farming. Control and modulation of plant secondary metabolism.

**GENERAL AND PARTICULAR ABILITIES**

General competencies:

- Identify, design, collect, analyze, control and produce drugs and medicines and other health products and raw interest in human or veterinary use materials (CG1).
- Know how to apply the scientific method and acquire skills in handling legislation, sources, bibliography, developing protocols and other aspects considered necessary for the design and critical assessment of preclinical and clinical trials (CG3).
- Develop communication and information skills, both oral and written, to deal with patients and users of the center where play their professional activity. Promoting work and collaboration capabilities in multidisciplinary teams and those associated with other health professionals (CG13).

Specific competencies:

- To develop skills to identify therapeutic targets, biotechnological production of drugs and use of gene therapy (CE21).
- To design, optimize and develop pharmaceutical forms ensuring quality, including the design and quality control of medicines, the development of skillful and prepared oficinales (CE27) formulas.
- To know the processes of liberation, uptake, distribution, metabolism and excretion of drugs, and factors that influence the uptake and disposition depending on their routes of administration (CE29).
- Know the basic technological operations and processes related to the development and control of drugs (CE33).

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

- Provide students with expertise on In Vitro handling of the different plant materials (protoplasts, cells, tissues and organs) and plant genetic engineering for :
    1. To produce secondary metabolites of high pharmaceutical interest
    2. Genetic improvement of medicinal plants
    3. Transgenic plants for the production of recombinant proteins or natural polymers.

- Introduce students to metabolic engineering through the study of genetic manipulation of some secondary metabolism pathways.

## DETAILED SUBJECT SYLLABUS

### I. PLANT CELL, TISSUE AND ORGAN CULTURE

1. Introduction to Plant Biotechnology.
2. General methodology of the In Vitro culture.
3. Morphogenesis and regeneration.
4. Cell cultures.
5. Protoplasts.
6. Somaclonal variation.
7. Vegetative propagation of medicinal plants.
8. Biotechnological improvement of medicinal plants.
9. In Vitro culture and secondary metabolism.
10. Secondary metabolite production in cell cultures.

### II. PLANT GENETIC ENGINEERING

11. Introduction to plant genetic engineering.
12. Recombinant DNA technology.
13. *Agrobacterium* as plant gene vector. I. *Agrobacterium tumefaciens*.
14. *Agrobacterium* as plant gene vector. II. *Agrobacterium rhizogenes*.
15. Plant viruses as gene vectors.
16. Direct gene transfer methods. Biolistics.
17. Genetic engineering applications. I. Recombinant proteins from transgenic plants.
18. Genetic engineering applications. II. Transgenic plants as edible vaccines.

19. Genetic engineering applications. III. Genetic manipulation of secondary metabolism.
20. Genetic engineering applications. IV. Food quality improvement.

**LABORATORY CLASS**

Lab 1. Culture media preparation (two sessions).
Lab 2. Callus initiation from carrot root and potato tuber.
Lab 3. Organogenesis from Petunia leaves.
Lab 4. Hairy roots induction by *Agrobacterium rhizogenes* infection on carrot root and potato tuber explants.

**READING**


- *Azcón-Bieto y Talón (2008) Fundamentos De Fisiología Vegetal (2ª Ed). Interamericana-McGraw-Hill, UBe, Madrid (https://granatensis.ugr.es/discovery/fulldisplay?docid=alma991008237749704990&context=L&vid=34CBUA_UGR:VU1&lang=es).*
- *Bhojwani M.K. and Razdan M.K. (1996): Plant Tissue Culture. Ed. Elsevier.*
- *Buchanan B.B., Gruissen W. y Jones R.L. (2000): Biochemistry and Molecular Biology of plants. Am. Soc. of Plant Physiologists. Rockville, Maryland, USA.*
- *Caballero JL, Valpuesta V y Muñoz Blanco J. (2001). Introducción a la Biotecnología Vegetal: Métodos y Aplicaciones. Ed. Publicaciones Obra Social y Cultural CajaSur.*
- *Charla H.S. (2009). Introduction to Plant Biotechnology. Ed. Science Publisher.*
- *Faye L and Gomord V (2009) Recombinant Proteins from Plants. Ed. Humana Press*
- *Germano Fett-Neto A. (2010) Plant Secondary Metabolism Engineering. Ed. Humana Press*
- *Hall R D (1999) Plant Cell Culture Protocols. Ed. Humana Press.*
- *Izquierdo M. (2001): Ingeniería Genética y Transferencia Génica. Ed. Pirámide.*
- *Kole Ch, Michler Ch H, Abbott A G and Hall T C (2010) Transgenic Crop Plants (Principles and Development) Ed. Springer.*
- *Neumann KH, Kumar A and Imani J (2009). Plant Cell and Tissue Culture, a Tool in Biotechnology. Ed. Springer.*
- *Oksman-Caldentey KM and Barz W H (2002) Plant Biotechnology and Transgenic Plants. Ed. Marcel Dekker, Inc.Peña L (2005) Transgenic Plants (Methods and Protocols). Ed. Humana Press.*
- *Perera J. y Tormo J.L. (2002): Ingeniería Genética, Volúmenes I y II. Ed. Síntesis.*
- *Slater A, Scot, NW y Fowler MR (2008): Plant Biotechnology: The Genetic Manipulation of Plants. (2ª ed.). Oxford University Press*
- *Taiz L. et al. (2015): Plant Physiology and Development (6th ed.). Sinauer Associates, Sunderland, MA, USA.*


**RECOMMENDED INTERNET LINKS**

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