

**COURSE DATA****Data Subject**

<b>Code</b>	34107
<b>Name</b>	Plant Physiology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	4.5
<b>Academic year</b>	2019 - 2020

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1201 - Grado de Farmacia	Faculty of Pharmacy	1	Second term
1211 - PDG Farmacia-Nutrici3n Humana y Diet3tica	Faculty of Pharmacy	1	Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1201 - Grado de Farmacia	43 - Biology	Basic Training
1211 - PDG Farmacia-Nutrici3n Humana y Diet3tica	1 - Asignaturas obligatorias del PDG Farmacia-Nutrici3n Humana y Diet3tica	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
MARCO PICO, FRANCISCO	25 - Plant Biology
PEREZ LORENCES, ESTER	25 - Plant Biology

**SUMMARY**

The primary objective of studying Plant Physiology is the organisms which make up the plant kingdom. Plant Physiology should give students a basic knowledge of how plants work and their processes. Based on that, the basic makeup of the programme looks at all the processes of feeding, growth, continuity, and their relationship with their environment.

Students will study the major structural characteristics and plant anatomy, which is necessary in order to understand thereafter different physiological processes, hydraulics (absorption, transport, and loss of water in plants), mineral nutrition, and transport of photosynthetic products. Metabolic photosynthesis will also be analysed, as well as that of nitrogen and sulphur. Secondary metabolism will also be introduced, where students will cover some of the enormous amount of chemical compounds used to improve colour, scent and flavor of flowers and fruits, to battle against predators and organisms that cause illness, and even against their own neighbours.



Apart from the basic physiological plant processes, it is also important to know and understand the mechanisms which regulate growth and development, as well as their interaction with the environment. To this end, we will study the plant development looking at plant hormones, photoreceptors, plant movement, different processes during the life cycle, and the integration of all of them in space and time.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

It is highly recommended that apart from Biology, students have also studied mathematics, physics, and chemistry

## OUTCOMES

### 1201 - Grado de Farmacia

- Understand and manage the basic scientific terminology related to the subject
- Know how to apply the scientific method and acquire skills for managing the main bibliographic sources.
- Know how the plant body is organised.
- Know the basic principles of how plants work.
- Know the practical assays that can be made in order to test different hypotheses related to plant physiology.
- Know how to operate apparatus and basic techniques related to the subject.

## LEARNING OUTCOMES



- Know and use the scientific terminology related to the subject
- Know plant body organisation
- Know the basic physiological functions of a plant, that allow it to feed, grow, reproduce, and interact with its environment
- Know how the environment effects plant growth and development and the development of mechanisms that help a plant adapt to its environment
- Know how to search for relevant bibliography to update and deepen knowledge on a specific topic
- Know basic techniques and apparatus related to the subject
- Understand and interpret scientific studies about plants
- Work safely and efficiently in a laboratory
- Know how to interpret and present results obtained from laboratory experiments
- Capacity to carry out experiments, analyse and interpret results
- Capacity to design experiments that allow hypotheses or theories to be proved.
- Know how plant physiology fits into science in general

## DESCRIPTION OF CONTENTS

### 1. The plant body

### 2. Water balance of plants

### 3. Mineral nutrition

### 4. Translocation in the phloem

### 5. Photosynthesis: The light reactions

### 6. Photosynthesis: Carbon reactions

### 7. Assimilation of mineral nutrients (Nitrogen, nitrate and sulfur)



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**8. Secondary metabolism and plant defense**

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**9. Phytohormones**

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**10. Overview of plant growth and development**

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**11. Photomorphogenesis and plant movements**

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**12. The control of flowering**

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**13. Fruit formation, growth and development**

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**14. Seed maturation, dormancy and germination**

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**15. Juvenility senescence and abscission**

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**16. LABORATORY SESSIONS**

- The plant body
  - Determination of the water potential of cells
  - Photosynthesis. The Hill reaction
  - Phytohormones Gibberellin and cytokinins bioassays
  - Seed germination
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**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	4,00	0
Study and independent work	30,50	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	7,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	4,00	0
<b>TOTAL</b>	<b>111,50</b>	

**TEACHING METHODOLOGY****Theory classes.**

For theory classes lectures will be given, since this method allows the lecturer to give key concepts to understanding the subject and recommend further detailed study. In some classes student participation will be used, both between students, and between students and lecturer.

**Laboratory sessions.**

In these classes students will be able to learn the practical applications of the knowledge gained in the theory classes.

**Tutorials.**

Tutorials will be carried out in small groups, where the teacher will direct students about everything related to the learning process, both in global and concrete terms, including the supervision of tasks.

**Seminars.**

Practical seminars and monographic work-shops programmed to work out specific aspects of plant physiology in order to reinforce the learning process. These activities will be held according to these options:

1. A conference by a visiting professional
2. A presentation made by the students of a recent development related to plant physiology (this activity will be carried out either individually or as a work group, maximum four students).
3. A presentation made by the professor of a recent development related to plant physiology

After each seminar there will be a debate where the majority of the participation should be between students.



## EVALUATION

Knowledge of theory and practice will be measured according to the following criteria:

### Exams: Counts up to 10 points

The exam will include questions about knowledge acquired in the theory, laboratory sessions and seminars.

- Theory exam: 8 points
- Laboratory session exam: 2 point

**In order to be eligible for examination, students must have attended the laboratory sessions.** Non-attendance will mean students cannot pass the subject.

### Seminars: Counts up to 0,5 points

Content, oral presentation and participation in the discussions raised will be evaluated. The mark obtained in the seminar sessions will count as a bonus on the final grade.

### First Call

There will be an examination of the whole subject at the end of the semester/term. The exam may include short questions, long questions, and multiple choices questions. There will be questions where students must relate different parts of the subject in different lessons or which may be related to matters of current interest or with the seminars. The exam will also include parts related to the laboratory sessions. The final grade will be made up of the sum of the individual parts examined. In order to sum the different parts, at least 50% of the total grade must be obtained in the theory and laboratory sessions exams. In the case where a student has carried out a seminar, the seminar grade will be added to the rest, always assuming that the seminar grade is at least 50%.

### Second Call:

Students who do not obtain a pass in the first call should resit all of the theory and laboratory session exams. The seminar grade obtained during the semester/term will be added if appropriate.

## REFERENCES

### Basic



- Taiz L., Zeiger E., I.M.Moller, Murphy, A. (2015). Plant Physiology and development., Sixth edition. Signer Associates (eds).

Azcón-Bieto J., Talón M. 2008. Fundamentos de Fisiología Vegetal. Interamericana. McGraw-Hill. Madrid.

Barceló J. y col. 2001. Fisiología Vegetal. Ed. Pirámide S.A., Madrid. Hopkins W.G. 1999. Introduction to Plant Physiology. J. Wiley (ed.), New York

Nabors MW (2006) Introducción a la Botánica, Pearson Educación SA, Madrid

Salisbury FB, Ross CW (1994). Fisiología Vegetal. Grupo Editorial Iberoamericana

<http://www.biologie.uni-hamburg.de/b-online/e00/index.htm>

<http://www.plantcell.org/site/teachingtools/teaching.xhtml>

<http://6e.plantphys.net>

<http://croptechnology.unl.edu/pages/>

### **Additional**

- Annual Review of Plant Biology. (desde 1950). Revisiones anuales de distintos Temas de Fisiología Vegetal. Annu. Reviews, INC, Palo Alto, California.

Trends in Plant Science. Revista mensual con actualizaciones sobre temas relacionados con la fisiología de las plantas. Elsevier Science Ltd.

Current Opinion in Plant Biology. Revista mensual con actualizaciones sobre temas relacionados con la fisiología de las plantas. Elsevier Science Ltd.

Alberts B. y col 2004. Biología Molecular de la Célula, 4ª edición. Ed. Omega, Barcelona.

Buchanan B., Gruissem W. Jones R. 2000. Biochemistry & molecular Biology of Plants. American Society of Plant Biology (Ed) Rockville, MD, USA

Fahn A. 1985. Anatomía vegetal. Pirámide S.A., Madrid.

Mohr H., Schopfer P. 1995. Plant Physiology. Springer-Verlag, Berlin

Scott P., 2008 Physiology and behaviour of plants. John Wiley & Sons Ltd. Inglaterra.

## **ADDENDUM COVID-19**

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

### **1. Continguts / Contenidos**

Se reducen los contenidos inicialmente recogidos en la guía docente seleccionando los conceptos indispensables para adquirir las competencias



## 2. Volum de treball i planificació temporal de la docència / Volumen de trabajo y planificación temporal de la docencia

- Las horas correspondientes a las clases de teoría que han quedado sin impartir desde el comienzo de la docencia no presencial (8-13 horas, dependiendo del grupo) pasan al tiempo de aprendizaje autónomo del alumno con los materiales subidos al aula virtual.
- Las 15 horas de prácticas ya han sido impartidas de manera presencial.
- Las actividades planteadas en 2 horas de tutorías presenciales pasan a ser sustituidas por actividades a realizar en el aula virtual (resolución de cuestionarios, dudas)
- En el caso de seminarios (2 horas). Las actividades ya impartidas se tendrán en cuenta en la evaluación final. Por otro lado, en aquellos grupos donde se haya programado la exposición voluntaria de seminarios por parte de los alumnos, pasarán a ser valorados en forma de trabajos escritos a entregar al profesor/a mediante aula virtual o correo electrónico. El resto de actividades programadas que requieran presencialidad no se impartirán.

## 3. Metodologia docent / Metodología docente

- Las sesiones presenciales de teoría están siendo sustituidas por material de estudio (presentaciones utilizadas en las clases), subidas al aula virtual. Este material es el mismo previsto en la guía docente original para la docencia presencial, y en algunos casos está siendo complementado con videos donde la presentación de cada tema es acompañada por comentarios del profesor/a.
- Tutorías: Las sesiones presenciales han sido sustituidas por ejercicios planteados en el aula virtual (cuestionarios, foro de preguntas y respuestas). Las soluciones a estos ejercicios también son facilitadas a los estudiantes a través del Aula virtual según la actividad planteada en cada grupo. Por otro lado, se mantiene el programa de tutorías virtuales (consultas por correo electrónico o mediante el aula virtual). También, se están realizando previa cita, videoconferencias o chats mediante las herramientas del aula virtual.

## 4. Avaluació / 4. Evaluación

Se evaluarán los conocimientos teórico-prácticos de acuerdo con el siguiente baremo:

Examen de clases teóricas: hasta 7 puntos

Examen de clases prácticas: hasta 2 puntos

Laboratorio: hasta 1 punto, se ha valorado la actitud y aprovechamiento de las sesiones prácticas por parte del alumno.

Seminarios: hasta 0.5 puntos. En el caso de disponer de esta calificación, esta nota se sumará a la nota final del alumno/a como un extra.





Los exámenes de clases teóricas y prácticas se realizarán mediante la modalidad de cuestionarios de preguntas de respuesta múltiple y/o preguntas de respuesta corta y/o preguntas de desarrollo o demostraciones experimentales. Estos cuestionarios estarán en forma de tarea programada en el aula virtual, a la hora prevista para el inicio del examen y tendrán un horario limitado para contestar a cada una de las preguntas.

Se mantienen los criterios de la guía docente original en cuanto a cómo debe considerarse la suma de las partes a evaluar para obtener la nota final, así como los criterios de primera y segunda convocatoria.

Si algún alumno/a no dispone de los medios para establecer esta conexión y acceder al aula virtual, deberá contactar con el profesorado por correo electrónico en el momento de publicación de este anexo a la guía docente.

#### **5. Bibliografía/ 5. Bibliografía**

Los manuales recomendados se sustituyen por el material de estudio subido al aula virtual (presentaciones de los temas, videos con los temas locutados) . Se mantienen las direcciones web recomendadas.