

28909 - Biology

Syllabus Information

Academic Year: 2021/22

Subject: 28909 - Biología

Faculty / School: 201 - Escuela Politécnica Superior

Degree: 583 - Degree in Rural and Agri-Food Engineering

ECTS: 6.0

Year: 1

Semester: Second semester

Subject Type: Basic Education

Module:

1. General information

1.1. Aims of the course

The Biology course aims to understand and assimilate the most important and general concepts, theories and models of Biology (molecular, cellular and structural organization of organisms, about their genetic, physiological and reproductive mechanisms, the evolution and ecological interactions of living beings). The aim is that the student acquires a global vision of the biotic environment and a basic biological training that allows him to apply this knowledge to the theoretical-practical cases of Agri-Food Engineering and Rural Environment.

These goals are aligned with some of the Sustainable Development Goals of the 2030 Agenda (<https://www.un.org/sustainabledevelopment/en/>) contributing to some extent to their achievement:

- Objective 4: Quality education,
- Objective 9: Industry, Innovation and infrastructure,
- Objective 15: Life of terrestrial ecosystems.

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that is designed for this subject is based on the following:

The course is oriented basic character, so the proposed activities are focused on understanding and assimilation of the main foundations of biology, basic for future professionals of Agricultural Engineering and Rural Environment.

The overview of the knowledge acquired in master classes is complemented with practical activity laboratory, where the student shall demonstrate the methods and analysis used and knowledge of the application.

For better monitoring of the learning process, it is favoured individual tutorials.

4.2. Learning tasks

The course includes the following learning tasks:

- *Theoretical classroom sessions*

The beginning of each subject, the teacher provides students with the theoretical content and the relevant literature

class, according to the theoretical Program of the subject, leaving the rest for non-contact work of the student.

- *Laboratory practices*

Before starting the practice period the student will have a practical guide, which includes fifteen practical sessions, as well as preliminary information on the submission of the reports, shall include in your lab notebook.

- *Tutoring sessions*

These sessions are individually developed, in order to advise the student and resolve the doubts that may arise in the study of the subject.

4.3. Syllabus

The course will address the following topics:

Theory. 15 sessions (30 classroom hours) in which the following themes will be studied:

A) Molecular genetics

- 1- The genome. Levels of organization. The prokaryotic genome and organular genomes. The nuclear eukaryotic genome: sizes, structure, function. Repetitive DNA?s and simple copy and low copy DNA?s. Genes and genetic families.
- 2- Replication of the DNA. Fundamentals and mechanism of replication. The replisome. Repairing the DNA and mutations by substitution. Mutagenic agents.
- 3- Transcription of DNA to RNAs (Ribonucleic acids). Mechanisms of transcription. The maturing of the eukaryotic RNAs. Post-transcriptional alterations. Packaging of the ribosomal subunits.
- 4- Translation. Characteristics of the genetic code. Variations of the code. Protean synthesis into prokaryotes and eukaryotes. Mechanisms and cellular location.
- 5- Mechanisms of regulation of the genetic expression. Regulation of the transcription in prokaryotes: the cascade of sigma factors, operon. Regulation of the transcription in eukaryotes: heterochromatization. Editing function of the RNA messenger.

B) Reproduction

- 6-The eukaryotic cellular cycle. Phases of division and interphase. Mitotic cellular division. Cellular division in animals and plants. Mitotic mutagenes. Meiotic cellular division. Meiotic divisions I and II: phases and mechanisms. Genetic meaning of meiosis: recombination and chromosomal reduction in gametogenesis.
- 7- Sexual reproduction in animals. Spermatogenesis and oogenesis. Hormonal control of gametogenesis. Fertilization.
- 8- Sexual reproduction in plants. The flower. Formation of gametophytes and masculine and feminine gametes. Pollination.
- 9- Self-incompatibility. Asexual reproduction: vegetative reproduction and apomixes. The agamic complex.

C) Physiology and Metabolism

- 10- Animal and plant development. Embryogenesis (blastulation, gastrulation, neurulation). Genetic and hormonal control of animal development.
- 11- Development of the seed. Dormancy and germination. Plant hormonal regulators. Photoreceptors.
- 12- Photosynthesis I. Photosynthetic pigments. Photochemistry of the reactions of electronic transport. Photophosphorylation.
- 13- Photosynthesis II. Fixation of CO₂ and synthesis of carbohydrates. Metabolic routes C₃, C₄ and CAM. Photosynthetic rates. Alterations of photosynthesis in the face of diverse stresses.
- 14- Physiology and metabolism of nitrogen. Bacterial fixation of N₂. Symbiosis with nitrogen fixers. Absorption of nitrate and reductions of nitrate and nitrite in plants. The agronomic importance of nitrogen assimilation in plants.

D) Ecology

- 15- Ecology. Ecology of populations. Exponential and logistic models of the growth of populations. Ecology of ecosystems. Ecologic succession. The flow of energy, structure and trophic levels of the ecosystem. Overexploitation of natural resources.

Practicals. 15 sessions (30 classroom hours) in which the following themes will be studied:

- 1- Concepts of microscopy: optical and electron microscopy.
- 2- Electron microscopy: interpretation of electron slides of animal and plant tissue.
- 3- Observation of eukaryotic cells: the animal cell and the plant cell.
- 4- Observation and identification of plastids.
- 5- Cultivation and identification of bacteria. The Gram technique. Sporing bacteria and nitrogen-fixing bacteria.
- 6- Observation of fungal structures. Recognition of fungi.

- 7- The genetic code.
- 8- Mitosis. Observation of the mitotic phases.
- 9- Elaboration of karyotypes.
- 10- Meiosis. Observation of the meiotic phases.
- 11- Sexual reproduction and embryonic development in animals and higher plants. Observation of gamete cells of animals and plant gametophytes. Observation of the embryonic development in animals and plants.
- 12- Enzyme activities I. Hydrolytic enzymes. Detection of enzymatic activity of invertase and amylase.
- 13- Enzyme activities II. Plant defences against phytophages. Breakdown of cyanogenic glycosides.
- 14- Extraction and separation of photosynthetic pigments.
- 15- Photosynthesis: the Hill reaction.

4.4. Course planning and calendar

Calendar for attended sessions and presentation of works

It is estimated that an average student should devote to this subject, 6 ECTS, a total of 150 hours or so, which should encompass both classroom activities and non-attendance.

With this allowance the student weekly charge, in hours, is reflected in the following schedule:

Activity Type / week

	1	2	3	4	5	6	7	8	9	10
Classroom activity										
<i>Theory</i>	2	2	2	2	2	2	2	2	2	2
<i>Practices</i>			2	2	2	2	2	2	2	2
<i>Evaluation</i>										
Activity distance										
<i>Individual work</i>	4	4	5	5	5	5	5	5	5	5
TOTAL	6	6	9	9	9	9	9	9	9	9

Activity Type / week	11	12	13	14	15	16	17	18	19	Total
Classroom activity										66
<i>Theory</i>	2	2	2	2	2					30
<i>Practices</i>	2	2	2	2	2	2	2			30
<i>Evaluation</i>								2	4	6
Activity distance										84
<i>Individual work</i>	5	5	5	5	5	4	4	3		84
TOTAL	9	9	9	9	9	6	6	5	4	150

4.5. Bibliography and recommended resources

- BB** Curtis, Helena. Biología / Helena Curtis ; N. Sue Barnes ... [et al.]. 7ª ed. en español. Buenos Aires [etc.] : Editorial Médica Panamericana, 2008
- BB** Freeman, Scott. Biología / Scott Freeman. 3a. ed. Madrid : Pearson Educación, 2009
- BB** Solomon, Eldra Pearl. Biología / Eldra Pearl Solomon, Linda R. Berg, Diana W. Martin. 5a. ed. México [etc.] : McGraw-Hill Interamericana, cop. 2001
- BB** Vida : la ciencia de la biología / William K. Purves ... [et al.]. 6a ed. Buenos Aires [etc.] : Editorial Médica Panamericana, 2003
- BC** Berg, Jeremy M. Bioquímica / Jeremy M. Berg, John L. Tymoczko, Lubert Stryer ; contenidos web de Neil D. Clarke. 5a ed. Barcelona [etc.] : Reverté, D.L. 2003
- BC** Biología molecular de la célula / Bruce Alberts ... [et al.] ; traducido por Mercé Dufort i Coll, Miquel Llobera i Sande. 4ª ed. Barcelona : Omega, cop. 2004
- BC** Evolución / Theodosius Dobzhansky ... [et al.] ; [traducido por Montserrat Agudé]. [1a ed., 3a reimp.]. Barcelona : Omega, 1993
- BC** Fisiología y bioquímica vegetal / coordinación, J. Azcón-Bieto, M. Talón. 1a ed. Nueva York [etc.] : Interamericana-McGraw-Hill, 1993
- BC** Fontdevila Vivanco, Antonio. Introducción a la genética de poblaciones / Antonio Fontdevila, Andrés Moya. Madrid : Síntesis, DL 1999
- BC** Margulis, Lynn. Cinco reinos : guía ilustrada de los phyla de la vida en la Tierra / Lynn Margulis, Karlene V. Schwartz ; [traducción de Ana Avila]. 1a ed. Barcelona : Labor, 1985
- BC** Tamarin, Robert H. Principios de genética / Robert H. Tamarin ; [versión española por Alfredo Ruiz ... (et al.)]. Barcelona [etc.] : Reverté, D.L. 1996

The updated recommended bibliography can be consulted in:
<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28909>