27121 - Genetic Engineering

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	446 - Degree in Biotechnology
ECTS	6.0
Year	3
Semester	Second semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

To enroll in this course it is recommended a previous knowledge on biology, genetics, biochemistry, organic chemistry, microbiology and molecular biology (for more information, see the academic guides of those subjects at the Biotechnology degree in UNIZAR). It is recommended to attend the lectures regularly and the participation in the case studies. The course consists of participatory lectures, problems classes and seminars, as well as a laboratory practicum. Assistance to the laboratory is required.

1.3.Context and importance of this course in the degree

Compulsory 6 ECTS course. It is part of the Basic module Degree and is taught in the second semester of the 3rd year.

The use of genetic engineering is the starting point for most of the current processes related to biotechnology, so that knowledge of the tools and techniques as well as the applications in which this discipline is based, is critical in this degree.

1.4.Activities and key dates

The course consists of participatory lectures, a laboratory practicum, classes of problems and seminars, which will be held during the second semester of the academic calendar.

The schedule of lectures and exams can be found on the website of the Faculty of Sciences in the section for the Degree in Biotechnology: https://ciencias.unizar.es/grado-en-biotecnologia

The dates and times of laboratory practices will be announced in the classroom, on the bulletin board of the Grade in Biotechnology and the ADD.

Job submission deadline will be May 30.

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2.Learning goals

2.1.Learning goals

To pass the exam, the student should achieve and demonstrate the following abilities

- Performance of simple manipulations of genetic engineering.

- Design the most appropriated strategy to build a library and select the gene of interest

- Knowledge of methods for gene transfer in microorganisms, plants and animals.

- Knowledge and use of methods for perform functional analysis of genes.

- Knowledge of the bases for the production of recombinant proteins and alteration of gene information.

- Ability to search and analyze specific information related to the subject

2.2.Importance of learning goals

This course will allow students to carry out tasks essential for the formation of a biotechnologist, such as:

- Making simple manipulations of genetic engineering.

- Design the most appropriate procedure to develop a library and select the gene of interest.

- Knowledge of methods of gene transfer in microorganisms, plants and animals.

- Knowledge of bases of production of recombinant proteins and alteration of genetic information.

- Knowledge and use of methods of functional analysis of the gene.

- Search of information related to the subject and critical analysis.

3.Aims of the course and competences

3.1.Aims of the course

In this course is intended that students learn the tools and techniques used in genetic engineering and be able to apply them correctly in bacterial, yeast, plant and animal systems. Lessons are based on the knowledge acquired in subjects previously studied to introduce students to the fundamentals, tools, techniques and applications of genetic manipulation of living organisms (microorganisms, animals and plants). Therefore, it is a crucial subject in this degree because it provides the starting point for dealing with the subjects taught in the fourth year this degree (Animal biotechnology, plant, microbial, environmental, clinical, etc.).

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3.2.Competences

Passing this course, students will be more competent to ...

- Know the basic tools of genetic engineering and its applications.

- Using the most common systems modification and gene transfer in prokaryotes and understand their basis.

- Using the most common systems of modification and gene transfer into eukaryotic cells and understand their basis.

- Design expression systems and recombinant DNA characterization of gene expression.

- Understand the basic methods of altering gene information and functional analysis of the gene.

- Design and conduct simple operations of Genetic Engineering in the laboratory.

In addition, the student must improve:

1) The ability of observation.

2) The ability to solve problems.

3) The critical analysis of information.

4) The synthesis and integration of information.

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that it has achieved the intended learning outcomes through the following evaluation activities

The specific skills are assessed through written tests consistent on issues of test type and cases, which will provide 75% of the final mark. To pass the course is necessary to obtain at least 5 points out of 10.

For qualifying practice sessions, the students will write a report on a case related to the content thereof. The report will be done in group and weighted 25% in the final grade for the course. It is important to remember that to pass the course is a prerequisite to pass the theoretical exam with a minimum of 5 points out of 10.

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5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The learning process of this subject is based on the attendance, participation and understanding of the lectures, which will serve as bases for solving the problems proposed throughout the course, as well as to successfully perform the practical work in the laboratory. Along the lectures, a number of concepts and techniques will be discussed that will serve as a starting point for solving practical cases proposed in sessions problems. These sessions will begin in mid-semester when the student have adquired the theoretical background to be able to successfully solve most of these practical issues. They will be conducted in groups of 30-35 students maximum.

In addition, the subject has 1 ECTS of laboratory practices to be carried out in small groups of 10-12 students, where students will conduct a series of experiments using basic techniques of genetic engineering.
Finally, a series of conferences / seminars on case studies and applications in everyday life of the major techniques learned are taught.

5.2.Learning tasks

The expected results from this program includes the following activities:

Activity 1: Basic understanding of Genetic Engineering (4 ECTS).
Methodology: participatory lectures. The support material will be available in the ADD (http://bb.unizar.es/)
individualized tutoring.
Activity 2: Troubleshooting and case studies (0.5 ECTS).
Methodology:
Learning problem solving. The support material will be available in the ADD (http://bb.unizar.es/)
individualized tutoring.
Formative Activity 3: Practical work in the laboratory (1 ECTS).
Methodology: Based learning case studies in small groups of 10-12 students per teacher. The supporting material will be available in the ADD (http://bb.unizar.es/).
Teamwork and individual.
Activity 4: Seminars (0.5 ECTS).
Methodology:
Rating bibliographic work and / or attendance at conferences by invited experts related to the topic of the subject. The supporting material will be available in the ADD (http://bb.unizar.es/)
Discussion on the papers presented.

5.3.Syllabus

GENETIC ENGINEERING

PROGRAM

A) Theoretical Lectures (40 hours)

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I. ESSENTIAL TOOLS AND BASIC TECHNIQUES IN GENETIC ENGINEERING.

1.- Isolation, purification and analysis of nucleic acids.

2.- Enzymes for the manipulation of nucleic acids.

3.- Cloning vectors for prokaryotic cells.

4.- Hybridization of nucleic acids.

5.- The polymerase chain reaction and its variants.

6.- Experimental strategies for cloning and identifying genes.

7.- Nucleic acid sequencing.

8.- Site-directed mutagénesis: methods and applications.

II. GENETIC ENGINEERING IN EUKARYOTIC CELLS.

9.- Gene transfer and genetic engineering in yeasts.

10.- Gene transfer and genetic engineering in plants.

11.- Gene transfer and genetic engineering in animal cells.

III. STRATEGIES FOR THE EXPRESSION OF RECOMBINANT DNA.

12.- Overexpression and purification of recombinant proteins in bacteria and eukaryotic cells.

13.- Cell-free transcription and translation.

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IV. REGULATION OF GENE EXPRESSION.

14.- Promoter analysis.

15.- Strategies for the study of protein-DNA interaction.

16.- Antisense technology: principles and applications.

V. APPLICATIONS AND PERSPECTIVES OF GENETIC ENGINEERING

This section will be developed though different case studies at the end of sections I to IV.

B) Practicum (10 hours)

1-Cloning of an insert into a vector. Students will discuss the tools and methodology to be used under the guidance of teachers.
2-Measurement of the expression of a reporter gene under different conditions of induction or repression.
3-Transfection of a derivative of phage M13 in Escherichia coli and visualization of plates formed by the phage vector.

C) Case studies in genetic engineering (5 hours)

D) Seminars related to the content of the course (5 hours)

5.4.Course planning and calendar

Schedule and presentation of works

The lectures will take place over 3 hours per week during the second semester (see schedule at: https://ciencias.unizar.es/grado-en-biotecnologia), and will be carried out according to the Academic Calendar approved for University of Zaragoza.
Problems and seminars will be integrated into the planned schedule for the lectures. Submission deadline for reports will be May 30.
For laboratory practice, the specific dates and composition of the groups will be announced in the classroom, on the bulletin board Degree in Biotechnology, and ADD.

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5.5.Bibliography and recommended resources