1. OVERVIEW

Subject Area	Experimental biotechnology
Degree	Bachelor's Degree in Biotechnology
School/Faculty	School of Biomedical and Health Sciences
Year	3º
ECTS	6
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	Second
Academic Year	24-25
Coordinating professor	Sara Gómez Quevedo
Teacher	

2. INTRODUCTION

Experimental Biotechnology is one of the compulsory subjects in the Degree in Biotechnology syllabus at the Universidad Europea de Madrid. It is taught each semester in the third year of the Degree in Biotechnology and is part of the BIOTECHNOLOGY PROCESSES AND INDUSTRIAL APPLICATIONS module. This subject is a key part of the learning process for future professionals in biotechnology. It provides a solid background in designing and performing experiments in this field.

It is mostly practical and allows students to apply different analytical techniques learnt in the various fields of biotechnology: genetic engineering, molecular biology, biochemistry and so on. We perform specific sessions on basic theory to help students in their learning and handling of the most suitable tools for each experiment.

Experimental Biology gives students the opportunity to apply experimental design to a scientific method-based study and use the techniques required to reach certain objectives and use the data analysis methods proposed. The main objective of this subject is for students to integrate and enhance the knowledge and skills acquired in previous years from a critical and professional point of view, seeking solutions and providing answers to different problems.

Through the teaching method used and learning activities which take place throughout the course, we aim for students to be able to:

- Identify a biotechnology problem within a certain context and come up with an experimental approach to achieve specific results.
- Design experimental protocols which include the techniques to be used and the corresponding control measures.
- Perform experimental and computer-based tasks to deal with a biotechnological problem.

- Suitably complete a laboratory notebook.
- Represent, analyse and interpret the results obtained.

3. LEARNING OUTCOMES (RA, by the acronym in Spanish)

Knowledge (CON, by the acronym in Spanish)

CON04. Identify the techniques and principal methods of cell cultures, protein analysis from a biotechnology standpoint and genetic bases and their application in industry.

· Identify the basic material in a biotechnology laboratory and understand the safety regulations in force in the laboratory.

· Understand the basic techniques of genetic engineering.

Abilities (HAB, by the acronym in Spanish)

HAB04. Design experimental procedures and protocols choosing the most suitable technique in the field of biotechnological research, all the while meeting quality and legislative standards.

· Apply theoretical knowledge to practical work and be able to make group decisions.

Skills

COMP05. Propose, redact and execute small R&D and innovation projects related to biotechnology, following current rules and regulations.

COMP06. Develop the skills needed to use the most common equipment, instruments and basic techniques in biotechnology, following quality standards and current biosecurity regulations.

4. CONTENTS

· Manipulation of plasmids and DNA fragments. cDNA cloning in prokaryotic expression vectors. Site-directed mutagenesis.
· Isolation of recombinant plasmids from bacterial cultures and their characterisation.
· Protein expression: wild and mutant. Factors which affect expression.
· Purification and characterisation of recombinant proteins from bacterial cultures.

To achieve these learning outcomes, the subject is divided into two units which introduce students to the variety of techniques:

Unit I. Designing a purification strategy of an enzyme of industrial interest.

Students are given a problem in the classroom and debate the different solutions. General analysis of the techniques which could be used. At the end of this stage, we ask students to design an experiment. This includes: Bioinformatics analysis of the DNA sequence and the structural and biochemical characteristics of the protein for presenting mutations.

- Safety in the microbiology and genetic engineering laboratory. Waste management for chemical products and those of biological hazard.
- Isolation and manipulation of plasmids and DNA fragments. cDNA cloning in prokaryotic expression vectors.
- Heterologous expression of wild and mutant proteins. Factors which affect expression.
- Purification and characterisation of recombinant proteins.
- Wild and mutant enzyme activity analysis.
- Good laboratory practices and correct completion of the laboratory notebook.

Unit II. Functional characterisation of cell cultures.

- In vitro culture technique of different eukaryotic cell lines. Aseptic technique. Methods of cell counting and viability. Preserving cultures. Cryopreservation.
- Characterisation of cell lines. Flow cytometry. Western-Blot. Densitometry. Immunocytochemistry. Evaluating proteins. MTT Method.

- Safety in cell culture laboratories and biological waste management. Biological hazard. Good practices in cell culture laboratories.

Both experimental units conclude with the processing and analysis of data which involves scientific method principles together with descriptive and quantitative statistics analysis of experimental results.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture.
- Collaborative learning.
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	5
Written reports and essays	5
Tutorials	15
Independent working	40
Workshops and/or lab work	50
On-campus knowledge tests	5
Research (scientific/case studies) and projects	30
TOTAL	**150 h**

7. ASSESSMENT

The assessment methods, together with how much they each count towards the final grade for the subject area, are as follows:

On campus:

Assessment system	Weighting
1. On-campus knowledge tests	25%
2. Laboratory practice	50%

3. Project/Final Degree Project	25%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a mark of 5.0 or more out of 10.0 in all assessed parts of the subject. Any part you do not pass in the ordinary exam period will need to be recovered in the extraordinary exam period (resits).

Your final grade will be the average of the partial marks in each of the learning activities you have passed. The continuous assessment system for the learning activities requires attendance to at least 50% of the classes.

It is compulsory for students studying degrees on-campus to accredit attendance to at least 50% of classes. This requirement qualifies students for the right to obtain academic counselling, support and monitoring from the professor. Failure to accredit attendance to at least 50% of the classes by any of the means proposed by the University will mean that the professor awarding a fail to the student for that subject area in the ordinary exam period in accordance with the grading system outlined in these regulations. All of the above, without prejudice to the other requirements or higher attendance percentages that other faculties may stipulate in their learning guides or internal regulations. Regulations for the assessment of official degree programmes, Art. 1 point 4.

(*https://universidadeuropea.com/documents/1798/6.__Reglamento_evaluacion_titulaciones_oficiales_grado_UEM_v2.pdf*)

7.2. Extraordinary exam period (resits)

To pass the subject area in the extraordinary exam period (resits), the students must obtain a mark equal to or above 5.0 out of 10.0 in all parts of the subject assessment they did not pass during the ordinary exam period.

The student must submit the activities not passed in the ordinary exam period taking into account the corrections or comments made by the teacher. The student must also submit any activities which were not submitted.

The final grade will be the average of the partial marks in each of the activities passed (with a mark equal to or higher than 5 out of 10). The marks for the assessable activities the student passed in the ordinary exam period will be maintained for calculating this grade.

8. TIMELINE

The timeline with delivery dates of assessable activities in the subject area is indicated in this section:

Assessable activities	Date
Final objective test	**May – June**
Internships	All semester (February – June)
Final report	First week of June

The timeline may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The is no list of reference material for this subject area. However, we recommend the following bibliography which will be complemented in class.

The recommended bibliography is indicated below:

1. Molecular Cloning: A Laboratory Manual Third Edition. J. Sambrook & D. Russell, Cold Spring Harbor Laboratory Press, 2000, 2344 pp.

2. Gready, J.E., Dihydrofolate reductase: binding of substrates and inhibitors and catalytic mechanism. Adv. Pharmacol. Chemother., **17**, 37-102 (1980).
3. Blakley, R.L., Eukaryotic dihydrofolate reductase. Adv. Enzymol. Relat. Areas Mol. Biol., **70**, 23-102(1995).
4. Costi, M.P., and Ferrari, S., Update on antifolate drugs targets. Curr. Drug Targets, **2**, 135-166 (2001).
5. Culture of animal cells: a manual of basic technique and specialized applications / R. Ian Freshney. Hoboken, N.J.: Wiley-Blackwell, cop. 2010

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit (ODI in Spanish) offers support throughout your time at university to help you with your academic achievement. Other cornerstones of our educational policy are the inclusion of students with special educational needs, universal access in all our university campuses and equal opportunities.

This ODI unit offers students:

1. Support and monitoring through counselling and personalised student plans for those who need to improve their academic performance.
2. Curricular adaptations to uphold diversity, with assistance for those students who require specific educational support, leading to equal opportunities without significant changes to methodology or evaluation.
3. We offer students a range of extracurricular educational resources to reinforce skills which will enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:

orientacioneducativa@universidadeuropea.es

11. SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the degree.

Many thanks for taking part.