1. OVERVIEW

Subject Area	Cell Cultures and Tissue Engineering
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 semester
Academic Year	2024-2025
Coordinating professor	Elena Pérez Izquierdo
Teacher	

2. INTRODUCTION

Cell Cultures and Tissue Engineering is a compulsory subject worth 6 ECTS and is taught in the second semester of the third year of the Bachelor's Degree in Biotechnology. This subject belongs to the Biology of Systems and Physiological Integration module worth a total of 27 ECTS.

This subject provides students with a global outlook on cultivation and the applications of all types of animal and plant cells in the field of biotechnology, together with a review of the main biomaterials and the most common techniques used in tissue engineering.

This subject aims to provide a knowledge base for other subjects on the same course such as Experimental Biotechnology, or on higher courses like Work Placement. It also allows students to put the most common techniques for cell culture and characterisation into practice (in on-campus and virtual laboratories), as well as the synthesis of biomaterials used in Regenerative Medicine.

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.

- Understand cell culture technique.
- Understand what cell lines are.
- Understand the types of cultures: primary, organotypic and three-dimensional.
- Understand the industrial uses of cell cultures.

• Be aware of the biological safety measures for cell cultures used in the production of biological and biotechnological products.
• Understand what a biomaterial is and its application in regenerative medicine and tissue engineering.
• Understand the different scaffolds for cell cultures.

Skills

COMP01. Acquire an integral vision of cellular function and its different behaviour with regard to both metabolism and gene expression.
COMP21. Identify and describe the principles of 2-D and 3-D cell culture and their application in advanced therapy.

4. CONTENTS

• Introduction to cell culture technique.
• Primary cultures.
• Cell lines.
• Organotypic and three-dimensional cultures.
• Industrial uses of cell cultures.
• Biological safety of cell cultures used in the production of biological and biotechnological products.
• Biomaterials: Materials used in regenerative medicine and tissue engineering.
• Scaffolds for cell cultures.

This subject is organised into 2 units which contain a total of 9 topics as follows:

Unit I. Cell cultures
Topic 1. BIOLOGICAL SAFETY OF CELL CULTURES IN BIOTECHNOLOGY.
Biological hazard groups and levels of biological safety. Other safety considerations. Legislation and technical reference documentation.

Topic 2. INTRODUCTION TO CELL CULTURE TECHNIQUE.
Historical development. Plant and animal cultures. Types of cultures of animal cells. Differences between in vivo and in vitro cell growth. Laboratory culture equipment.

Topic 3. REQUIREMENTS FOR CELL CULTURES. SUBCULTURE.
Cell-microenvironment interaction. Asepsis and contamination. Substrate. Culture media and supplements. Gaseous phase and temperature. Subculture and culture maintenance. Freezing and thawing.

Topic 4. CELL DISSOCIATION: PRIMARY CULTURES AND CELL LINES.
Biology of dissociated cells. Primary cultures: concepts and types. Stages in establishing a primary culture. Concepts of cell line. Cell transformation. Characterisation of cell lines.

Topic 5. QUANTIFICATION OF CELL PARAMETERS AND CYCLE ANALYSIS.

Number and size of cells. Estimation of content and DNA and protein synthesis rate. Cell proliferation: growth curves. Cell migration. Flow cytometry. Analysis of cell cycle using flow cytometry. Cell synchronisation. Viability and cytotoxicity.

Topic 6. INDUSTRIAL USES OF CELL CULTURES.
DNA transfer. Biotechnological applications (hybridomas and in vitro fertilisation). Co-culture techniques. Organotypic and three-dimensional cultures: Types, uses and particularities. Use of mother cells.

Block II: Tissue engineering
Topic 7. INTRODUCTION TO BIOMATERIALS.
Historical evolution and association with tissue engineering. Purpose and components of tissue engineering. Characteristics, properties and classification of biomaterials.

Topic 8. BIOMATERIALS AND SCAFFOLDS FOR CELL CULTURES.
Concept of scaffolds for tissue regeneration. Hydrogels and Scaffolds

Topic 9. BIOLOGICAL RESPONSE.
Biodegradation. Interaction between cells and biomaterials. Inflammation and hypersensitivity. Immune response against exogenous materials.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Lecture
- Case studies
- 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	40
Asynchronous master lectures	10
Debates and discussions	2
Case Studies	11
Written reports and essays	6
Independent working	50
Tutorials	15
Workshops and/or lab work	10

On-campus knowledge tests	6
TOTAL	**150**

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
Knowledge test	60%
Reports and written work	10%
Case study/problem scenario	15%
Laboratory practice	15%

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 to accredit attendance to at least 50% of classes. This requirement is essential to the assessment process and qualifies students for the right to obtain academic counselling, support and monitoring from the professor. To this end, students must use the technological means made available by the University to accredit their daily attendance to each of their classes. This system will also serve to guarantee an objective record of the active role of the students in the classroom. 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. (http://www.uem.es/myfiles/pageposts/reglamento_evaluacion_titulaciones_oficiales_grado.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
Activity 1. Cell culture basics virtual laboratory	Week 4
Activity 2. Experimental case study analysis 1	Week 6
Activity 3. Cancer Pharmacology - virtual laboratory	Week 6
Activity 4. First on-campus objective test	Week 7
Activity 5. On-campus laboratory work	Weeks 9-15 4 (different groups)
Activity 6. Laboratory work reports	1 week after each practice group
Activity 7. Experimental case study analysis 2	Week 12
Activity 8. Debate on the use of mother cells	Week 14
Activity 9. Tissue engineering - virtual laboratory	Week 15
Activity 10. Second objective test	Ordinary exam period

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 recommended bibliography is indicated below:

- Cooper, G.M. and Hausman, R.E., (2007), The cell: a molecular approach, 4th, ASM Press; Sinauer Associates. Nota: Bibliografía de Biología 1er curso
- Freshney, R.I., (2005), Culture of animal cells: a manual of basic technique, 5th, Wiley-Liss.

- Langdon, S.P., (2004), Cancer cell culture: methods and protocols, Humana.
- Minuth, W.W., Strehl, R. and Schumacher, K., (2005), Tissue engineering: essentials for daily laboratory work, Wiley-VCH.
- Morgan, S.J. and Darling, D.C., (1995), Cultivo de células animales, Acribia. Nota: Práctico libro básico sobre las principales técnicas de cultivo celular traducido al castellano.
- Ratner, BD;Hoffman, AS; Schoen, FJ; Lemons, JE (2013) Biomaterials science: an introduction to materials in medicine, (Third edition) Elsevier
- Prasad Shastri, V., Altankov, G; Lendlein, A. (2010) Advances in Regenerative Medicine: Role of Nanotechnology, and Engineering Principles, Springer 8.
- Burdick,JA; Mauck; RL (2011) Biomaterials for Tissue Engineering Applications, Springer Wien New York
- Davis, J. (2011). Animal cell culture. Chichester, West Sussex; Hoboken, NJ: Wiley-Blackwell
- Davey, M. R., & Anthony, P. (2010). Plant cell culture. Chichester, West Sussex, UK; Hoboken, NJ: Wiley- Blackwell
- Meyer, U. (2009). Fundamentals of tissue engineering and regenerative medicine. Berlin: Springer
- Annals of Biomedical Engineering. ISSN: 0090-6964 (Print) 1573-9686 (Online)

Other sources of interest:
http://www.cultek.com/aplicaciones.asp?p=Aplicacion_Cultivos_Celulares&opc=soporte
http://www.hpacultures.org.uk/technical/technicalinfo.jsp
https://www.thermofisher.com/es/es/home/references/gibco-cell-culture-basics/introduction-to-cell-culture.html
http://learn.genetics.utah.edu/content/cells/

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.