Teaching guide

IDENTIFICATION DETAILS

Degree:	Biomedicine
Scope	Biology and Genetics
Faculty/School:	Experimental Sciences
Course:	CELL CULTURE AND TISSUE ENGINEERING
Type:	Compulsory
ECTS credits:	6
Year:	3
Code:	2156
Teaching period:	Sixth semester
Subject:	Biomedical Research Tools
Module:	Experimental Methodology in Biomedicine
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

Biomedicine aims at in-depth knowledge of diseases from their molecular bases to their physiopathology, which is absolutely necessary for the development of new diagnostic tools, prognoses and therapeutic approaches. Biomedicine is based on sciences such as Biochemistry, Molecular Biology, Molecular Genetics, etc. All of these sciences are aimed at understanding the different biological processes that occur in the cell. In turn, these sciences have required and have been based on the development of cell cultures.
Cell culture is the process by which both prokaryotic and eukaryotic cells can be cultured under controlled conditions. We currently use the term cell culture to refer to the culture of cells that are generally eukaryotic and of animal origin. The historical and methodological development of cell culture is closely linked to those of tissue culture, organ culture and tissue engineering
Tissue engineering (IT) is a discipline of biomedicine that, combining cells, materials and engineering tools,

attempts to design functional biological structures to replace, repair or regenerate damaged tissues. This has made it possible to revolutionize biomedicine and provide a better quality of life to society.
The subject of cell culture and tissue engineering taught in the third year of the degree in biomedicine includes the study of: 1) The study of the different types of cell cultures; 2) The set of techniques associated with cell cultures that allow the identification of phenotypic effects; 3) The basic knowledge of tissue engineering and its application in biomedicine.
To ensure that the student acquires the necessary knowledge, the subject has been organized into theoretical and practical classes. Theoretical classes will occupy the majority of the program, which has been divided into two sections. In the first, we will focus on cell culture and cell culture techniques that allow phenotypic studies. In the second section, we will discuss tissue engineering and its multiple applications in biomedicine.

GOAL

The objective pursued with the subject of Cell Culture and Tissue Engineering is for the student to acquire basic knowledge related to their management and the different techniques associated with them, as well as their usefulness in solving scientific questions.

The specific aims of the subject are:

Learn about the different types of cell cultures.

Understand the effects that in vitro cell management can have on normal cell biology.

Understand the advantages and limitations of the use of cell culture and tissue engineering in biomedicine.

Understand the set of techniques associated with cell culture and their usefulness in solving scientific questions.

Apply the acquired technical knowledge in a critical and reasoned way to test the hypotheses proposed.

Learn the clinical implications and biomedical applications of Cell Culture and Tissue Engineering.

PRIOR KNOWLEDGE

The student studying the subject of Cell Culture and Tissue Engineering must start from a level of knowledge of Cellular and Molecular Biology, Biochemistry, Molecular Genetics and Experimental Methodology I and II.

COURSE SYLLABUS

SECTION I: FUNDAMENTALS OF CELL CULTURE. TECHNICAL APPLICATIONS
Topic 1: Introduction to cell culture. Origin and historical perspective. Applications. Types of animal cell cultures. Cell culture biology.
Topic 2: Growth pattern of cells in culture. Quantification of growth. Calculation of the number of generations (PDL), growth rate and doubling time (PDT). Subcultivation and routine crop maintenance

Topic 3: Requirements for animal cell culture. Growing conditions, media and growing areas. Types of contamination. Cryopreservation. Biosafety and basic equipment.
Topic 4: Guidelines for the isolation of primary cultures and cell lines. Cell morphology. Methodologies for the generation of clones. Cell characterization. Authentication.
Topic 5: Generation of genetically modified cell cultures. Cell transfection. Cell infection. Modified cell selection. Immortalization
Topic 6: Analysis of animal cell cultures I. Cell viability, proliferation, cytotoxicity and survival tests, study of the cell cycle and apoptosis.
Topic 7: Analysis of animal cell cultures II. In vitro cell differentiation tests. Cell transformation, cell migration and in vitro invasion. Angiogenesis and lymphangiogenesis
Topic 8: Study of the living cell using time-lapse microscopy
Topic 9: Production of recombinant proteins and monoclonal antibodies. Definition. Production of recombinant proteins in insect and mammal cells. Hybridomas.
SECTION II TISSUE ENGINEERING
Topic 10: Cell Plasticity and Stem Cell Culture. Basic concepts of differentiation, stem cells and pluripotency. Reprogramming and culture of pluripotent cells. Mesenchymal stem cells and clinical applications
Topic 11: Three-dimensional cell cultures I. Culture of organs and sections. Organotypic crops. Organoid culture.
Topic 12: Three-dimensional cell cultures II. Microfluidics applied to three-dimensional crops
Topic 13: Biomaterials and structures in tissue engineering. Basic concepts in tissue engineering. Biomaterials and printing and bioassembly techniques

SECTION III EXPERIMENTAL DESIGN IN BASIC RESEARCH WITH CELL CULTURE AND CRITICAL ANALYSIS

SECTION IV LABORATORY PRACTICES
Practice 1: Introduction to working in laminar flow cabins and cell culture
Practice 2: Transfection of Exogenous DNA into Mammalian Cells
Practice 3: Analysis of cell migration using a transwell assay
Practice 4: Cell Proliferation Analysis

EDUCATION ACTIVITIES

AF1. Expository classes (100% face-to-face): Participatory master sessions in which the fundamental contents of the subject are presented, doubts derived from autonomous study are resolved and student participation is encouraged through questions, case analysis or brief dynamics. Some of the content may be prepared in advance by the student with materials available in the Virtual Classroom (videos, articles, presentations...).
AF2. Practical classes (100% face-to-face): Activities developed in the laboratory, focused on the management of basic techniques in cell culture. Students apply the knowledge acquired to solve practical and experimental cases following previously provided protocols. Supervised practices, guided exercises and discussion of results are included.
AF3. Tutoring (100% face-to-face): Spaces for individual or group orientation aimed at answering questions, supervising autonomous work, providing guidance on practices or reinforcing key theoretical content. They also include sessions to monitor academic progress.
AF4. Presentation of group work (100% in person)
AF5. Evaluation (100% face-to-face)
AF6. Independent student work (not face-to-face): It includes individual theoretical study, preparation of practical

classes, preparation of seminars, preparation of tutoring and preparation of evaluation tests. All of this work is based on the material provided by the teaching staff in the Virtual Classroom, and requires active planning on the part of the student.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
60 Horas	90 Horas

LEARNING RESULTS

Know the strategies for designing tissue engineering protocols and the techniques necessary to put such design and its applications into practice.

Know the basic concepts related to the cultivation of different types of animal cells (methods of obtaining and maintaining them, culture media) and their applications.

SPECIFIC LEARNING RESULTS

(RA1) Learn about the equipment, structure and distribution of a cell culture room.

(RA2) Describe the different types of cell cultures.

(RA3) It relates the different cell culture techniques to the biological questions to be answered.

(RA4) Learn the basics of tissue engineering and cell culture.

(RA5) Describes the uses of tissue engineering and cell culture in biomedicine and its therapeutic value.

(RA6) Integrates and reasonably applies the strategies and contents learned throughout the subject

(RA7) Identifies the experimental strategies necessary to carry out a research work

(RA8) Recognizes the fundamental objectives included in a proposed experimental work hypothesis

LEARNING APPRAISAL SYSTEM

ORDINARY EVALUATION SYSTEM Based on continuous evaluation. The evaluation will be carried out as follows:
- (65%) Evaluation of the theoretical content of the subject through a written test (SE1)

- (15%) Evaluation of directed works (SE2.1)
- (15%) Carrying out and evaluating practical work in the laboratory (SE3)
- (5%) Resolution of exercises and practical cases during face-to-face classes (SE2.2)

Passing the subject will require a minimum grade of 5 in each of the sections. Attendance at laboratory practices is mandatory. Only in case of extreme gravity (to be determined by the teacher and the directors of the degree) will non-attendance be allowed on the date on which the student is officially invited and the transfer to another internship group on other dates. If they do not attend any of the sessions, the student must justify it properly and recover that practice if there are dates available. Failure to attend any of the practical sessions will mean that you do not pass this section of the subject, so in the extraordinary call you must pass a written exam.

In the extraordinary call, the following percentages will apply:

- (65%) Evaluation of the theoretical content of the subject through a written test (SE1)
- (15%) The score of the directed activities will be saved if they are approved (SE2.1). If you have not completed them or are suspended, your content will be evaluated using theoretical questions that will be included in another independent theoretical exam
- (15%) Carrying out and evaluating practical work in the laboratory (SE3). If this part is approved in an ordinary call, the grade may be saved for the extraordinary call or during an academic year.
- (5%) The note relating to participation in face-to-face sessions (SE2.2) will be saved. To pass the extraordinary call, it will be necessary to pass with a minimum score of 5 points in each of the parts.

ALTERNATIVE EVALUATION SYSTEM

Students in the second call or later, as well as students with academic exemption, can choose to take advantage of the system specified above (in which case they must meet all the requirements), or take advantage of the alternative system in which the following percentages will be applied:

- (70%) Evaluation of the theoretical content of the subject through a written test (SE1)
- (15%) Delivery of directed work and face-to-face evolution tutoring. (IF 2)
- (15%) Carrying out and evaluating practical work in the laboratory (SE3) If this part is approved in an ordinary call, the note can be saved for the extraordinary call.

*Students in second or subsequent enrollment must contact the teacher to request to take advantage of this system during the first 5 days of class. If you do not report, the evaluation will be taken over by the ordinary system.

Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the University's Coexistence Regulations.

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:

a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.

b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.

c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).

d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.

2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the Guide for the Responsible Use of Artificial Intelligence in Studies at UFV. Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.

3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation

shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

Amanda Capes-Davis, R. Ian Freshney Freshney's Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications 8th (2021) WILEY
(Amanda Capes-Davis, R. Ian Freshney Freshney's Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications 8th (2021) WILEY , ISBN: 978-1-119-51304-9||Luis Montuenga Badía, Francisco J. Esteban Ruiz, Alfonso Calvo González Techniques in Histology and Cell Biology 2nd (2014) Elsevier)

Additional

Abraham Kierszenbaum, Laura Tres Histology and Cell Biology Introduction to Pathological Anatomy 5th (2020) Elsevier
(Abraham Kierszenbaum, Laura Tres Histology and Cell Biology Introduction to Pathological Anatomy 5th (2020) Elsevier , ||Robert Lanza, Anthony Atala Essentials of Stem Cell Biology 3rd (2014) Elsevier)