



Universitat de Lleida

DEGREE CURRICULUM
**INSTRUMENTAL TECHNIQUES
I: CELL CULTURE**

Coordination: LLOVERA TOMAS, MARTA

Academic year 2022-23

Subject's general information

Subject name	INSTRUMENTAL TECHNIQUES I: CELL CULTURE			
Code	101653			
Semester	PRIMER QUADRIMESTRE			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Biomedical Sciences	3	COMPULSORY	Attendance-based
	Master's Degree in Biomedical Research		COMPLEMENTARY TRAINING	Attendance-based
Course number of credits (ECTS)	3			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	0.9	0.6	1.5
	Number of groups	5	2	1
Coordination	LLOVERA TOMAS, MARTA			
Department	BASIC MEDICAL SCIENCES			
Teaching load distribution between lectures and independent student work	Face-to-face sessions: 30h Independent student work: 75h			
Important information on data processing	Consult this link for more information.			
Language	Catalan			
Distribution of credits	Theory: 1.5 credits Seminars: 0.6 credit Laboratory practices: 0.9 credit (Lab 3.05/3.07 Fac Medicine)			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LLOVERA TOMAS, MARTA	marta.llovera@udl.cat	7,2	Ask for an appointment by e-mail For an urgent issue you can call by phone 973702949 My office is room 2.25, Biomedicine-I buiding (2nd floor)

Learning objectives

The aim of this subject is to learn the basic techniques of manipulation of animal cells in culture, related techniques and their application in the field of biomedical research.

To pass this course, the student must achieve the following specific objectives:

1. To understand the basic requirements of cultured animal cells and the importance of asepsis
2. To know how to adapt the procedures for the maintenance of animal cells "in vitro"
3. To know the strategies of genetic manipulation of cells in culture and know how to choose the most appropriate in each situation
4. To know and understand the different models of study at the cellular level and of reconstruction of artificial tissues
5. To know that in vitro cell cultures can also be used as a biotechnological tool for drug production
6. Know the new techniques based on isolated cells useful in biomedical research

In addition to knowing how to apply the concepts specified in the theoretical syllabus that are established in the topics of theory and seminars, students must:

- To know the terminology and the basic scientific language related to the techniques of cell culture
- Be able to plan and carry out experiments with animal cells in "in vitro" culture

Competences

Basic Competences

CB1 That students have demonstrated that they have and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

CB2 That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

Specific Competences

CE30. Apply the methodology, perform and use cell cultures in biomedical research.

CE39. Identify the indications for biochemical, hematological, immunological, microbiological, anatomopathological and imaging tests

CE40. Apply the methods of diagnosis and study of genetic variation

CE41. Process a biological sample for study using different diagnostic procedures

Subject contents

Theory classes

Topic 1. Introduction to the laboratory of animal cell culture. The cell culture laboratory. The culture medium. Aseptic technique and contaminants. Biological safety in animal cell culture laboratories.

Topic 2. Techniques of manipulation of animal cells in culture. Basic methods of cell culture: cell isolation, culture maintenance, characterization and preservation. Immortalization techniques and the problem of immortal cells. Continuous cell lines.

Topic 3. Specialized cell cultures and associated techniques. Primary cell culture. Undifferentiated cells vs. differentiated cells. Factors that control cell differentiation, specialized and conditioned media. Examples of primary cultures. Organotypic cultures.

Topic 4. Cell modification systems. Methods of introducing exogenous DNA into cultured animal cells. Establishment of stable expression lines, genetic selection in the culture. Transfection. Electroporation. Microinjection. Viral infection.

Topic 5. Tissue biotechnology and engineering. Strategies: pluripotent stem cells (stem cells) vs. specialized cells. Isolation technology and pluripotent stem cell culture. Cell differentiation techniques. Reconstruction of tissues and organs by co-cultivation of primary cells.

Topic 6. Applications of animal cell culture in Biotechnology. Animal cells as production factories: drugs, proteins, antibodies, etc. Bioreactors for animal cells. Cell cultures as an animal alternative for testing cosmetics and drugs .

Topic 7. New techniques that use cells and artificial tissues in biomedical research. Organoids. Organ-on-a-chip. Single cell analysis. 3D bioprinting

Practical activities

The students:

1. They will carry out the basic procedures for the maintenance of cell lines in culture: thawing, sowing, viability counting, subculture and freezing.
2. They will learn how to do a colorimetric test of cell viability and a transfection assay

Methodology

1. Theory classes (TEORIA) (15h face-to-face): These will be held with the complete group of students and are not compulsory.

2. Seminars (PRAULA) (6h face-to-face GM): There will be: 3 seminars of 2h face-to-face in which tasks and works in small group or individually will be done.

The seminars **are compulsory** and are intended for students to apply the theoretical concepts and do collaborative work in small groups.

3. Laboratory practices (PRALAB): There will be 3 practical sessions of 3 hours/each (within the same week) in groups of 8 students in the Cell culture lab 3.05 (3rd floor of the Faculty of Medicine)

These practices **are compulsory** and aim at to acquire skills in doing *in vitro* cell culture and raise awareness of

the importance of maintaining sterility at all times.

LABORATORY PRACTICES

It is MANDATORY that students bring in the course of teaching practices:

- White lab coat from UdL
- Nitrile protective gloves

You can buy it at the **ÚDELS** store of the UdL

Center for Cultures and Cross-Border Cooperation - Cappont Campus Carrer de Jaume II, 67 25001 Lleida

<http://www.publicacions.udl.cat/>

For more information, check the product listings

<http://www.biomedicina.udl.cat/en/pla-formatiu/equipament.html>

Not carrying the EPI described or not complying with the general security regulations detailed below will mean that the student can not access the laboratories or have to leave the same.

GENERAL SAFETY RULES IN LABORATORY PRACTICES

- Maintain the working place clean and tidy. The work table must be free of backpacks, folders, coats ...
- In the laboratory you can not come with shorts or short skirts.
- Bring closed and covered shoes during the performance of the practices.
- Bring long hair always tied back.
- Keep the lab coat fit to protect against spills of chemical substances.
- Do not carry wide bracelets, pendants or sleeves that can be trapped by the equipment, assemblies ...
- Avoid wearing contact lenses, since the effect of chemicals is much greater if they are introduced between the contact lens and the cornea.
- Do not eat or drink in the laboratory
- Smoking is prohibited within laboratories
- Wash your hands whenever you have contact with a chemical and before leaving the laboratory.
- Follow the teacher's instructions and consult any questions about security

Development plan

The whole subject will be taught by Dr Marta Llovera.

The timetable available at the degree website will be followed through the semester.

(<http://www.biomedicina.udl.cat/en/calendari-horaris/horaris/>)

Evaluation

The evaluation of the subject will be based on the following items:

1) Examination of the theory concepts (60%)

A minimum grade of 4.5 must be taken to average and be able to compensate with the grade of the other parties.

2) Seminar deliverables (10%)

3) Laboratory practices (30%): written report or test

Exam type:

The evaluation exam will be carried out **face-to-face**

It will consist of three parts::

1. Test-type questions, with 5 possible answers and only one is true (wrong answers discount)
2. Short questions
3. Counting problem

Final grade of the subject

60% theoretical exam + 10% seminar deliverables + 30% laboratory practices

You must take at least a **4.5 in the theory exam** and a **5 in the final grade** to pass the course

Bibliography

Books

Culture of animal cells : a manual of basic technique. R. Ian Freshney. Wiley | 2005 | 5th ed.

https://discovery.udl.cat/iii/encore/record/C_Rb1201016?lang=cat

Animal cell culture : concept and application. Sheelendra M. Bhatt. Alpha Science International, | 2011

https://discovery.udl.cat/iii/encore/record/C_Rb1263948?lang=cat

e-books

Culture of animal cells: a manual of basic technique and specialized Applications / R. Ian Freshney

https://discovery.udl.cat/iii/encore/record/C_Rb1310960?lang=cat

Lab-on-chips for cellomics: micro and nanotechnologies for life science/ edited by Helene Andersson and Albert van den Berg. https://discovery.udl.cat/iii/encore/record/C_Rb1204077?lang=cat

Biological, Physical and Technical Basics of Cell Engineering / edited by Gerhard M. Artmann, Aysegül Artmann, Azhar A. Zhubanova, Ilya Digel. https://discovery.udl.cat/iii/encore/record/C_Rb1371952?lang=cat

Principles of tissue engineering/ edited by Robert P. Lanza, Robert Langer, Joseph Vacanti.

https://discovery.udl.cat/iii/encore/record/C_Rb1302866?lang=cat

Cell Engineering and Regeneration / edited by Jeffrey M. Gimble, Darja Marolt, Richard Oreffo, Heinz Redl, Susanne Wolbank

https://discovery.udl.cat/iii/encore/record/C_Rb1373772?lang=cat

Functional tissue engineering / Farshid Guilak, et al. (editors).

https://discovery.udl.cat/iii/encore/record/C_Rb1202613?lang=cat

Methods in Cell Biology / book series from Elsevier

<https://www.sciencedirect.com/bookseries/methods-in-cell-biology>

JoVE video collections

- Science Education collection – Basic Biology: <https://www.jove.com/education/basicbio>
- Science Education collection - Advanced Biology: <https://www.jove.com/education/advnbio>