Universitat de Lleida

DEGREE CURRICULUM

INSTRUMENTAL TECHNIQUES I: CELL CULTURE

Coordination: LLOVERA TOMAS, MARTA

Academic year 2023-24

INSTRUMENTAL TECHNIQUES I: CELL CULTURE 2023-24

Subject's general information

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<tr><td>Code</td><td>101653</td></tr>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biomedical Sciences</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>3</td></tr>
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<tr><th>Activity type</th><td>PRALAB</td><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>0.9</td><td>0.6</td><td>1.5</td></tr>
<tr><th>Number of groups</th><td>5</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>LLOVERA TOMAS, MARTA</td></tr>
<tr><td>Department</td><td>BASIC MEDICAL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Face-to-face sessions: 30h
Independent student work: 75h</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan</td></tr>
<tr><td>Distribution of credits</td><td>Theory: 1.5 credits
Seminars: 0.6 credit
Laboratory practices: 0.9 credit (Lab 3.05/3.07 Fac Medicine)</td></tr>
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INSTRUMENTAL TECHNIQUES I: CELL CULTURE 2023-24

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

Unit 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.

Unit 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.

Unit 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.

Unit 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.

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

Unit 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 .

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

Unit 8. The laboratory notebook and the data management plan. The importance of keeping a record of everything that is done in the laboratory and of the organization of the data that is generated in research.

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 individualy 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

CONTINUOUS EVALUATION

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

Block 1: Theory (50%)

The entire theoretical syllabus will be evaluated in an exam

* You must get a minimum of 4.5 to make an average and be able to compensate with the grade of the other exam

and the grades of seminars and attendance.

Block 2: Seminar tasks performed in small groups (20%)

Block 3: Laboratory practices (30%): written report or exam

FINAL GRADE: 50% Block-1 + 20% Block-2 + 30% Block-3

The final mark must reach 5 to pass the subject

ALTERNATIVE ASSESSMENT

The student who takes the alternative assessment modality will have to take a single exam on the day and time scheduled for the theory assessment. **This exam is worth 100% of the grade**.

Composition of the exam: 50% theory questions + 30% practice questions + 20% problems

The student will be exempt from the obligation to attend the seminars and practical sessions of the subject.

The exam mark must reach 5 to pass the subject

SECOND-CHANCE EVALUATION

Written exams may be evaluated in a second round when the grade obtained does not reach the minimum established. The date and time of the second-chance exam will be established by the teaching office on the official calendar.

EXAMINATION FORMAT

The assessment exams may contain different types of questions:

• Test-type question, with 5 possible answers and only one is true (mistakes discount 0.2 p.)

• Short answer, fill-in-the-blank or matching question

• Long answer question (half page)

• Problems

If it is necessary to carry out the virtual assessment through the “Test and questionnaire” tool, the type of exam will be similar, but with questions and options randomized.

Failed students may request that their seminar and practical grades be kept for the following year.

Bibliography

Basic books

Freshney. (2010). Culture of animal cells a manual of basic technique and specialized applications (6th ed.). Wiley-Blackwell.

https://onlinelibrary.wiley.com/doi/book/10.1002/9780470649367

Bhatt. (2011). Animal cell culture: concept and application. Alpha Science International.

Specialized books

Andersson, & Van den Berg, A. (Eds.). (2004). *Lab-on-chips for cellomics: micro and nanotechnologies for life science* (1st ed. 2004.). Springer Science Business Media, B.V. https://doi.org/10.1007/978-1-4020-2975-2

Lanza, Langer, R. S., & Vacanti, J. (2007). Principles of tissue engineering (3rd ed.). Elsevier Academic Press.

https://www.sciencedirect.com/book/9780123706157/principles-of-tissue-engineering

Eberli D. (Ed.) (2011). *Regenerative Medicine and Tissue Engineering :* Cells and Biomaterials. IntechOpen. ProQuest Ebook Central:

https://ebookcentral.proquest.com/lib/udl/detail.action?docID=30390301

Guilak (Ed.). (2003). Functional tissue engineering (1st ed. 2003.). Springer. https://doi.org/10.1007/b97260

https://link.springer.com/book/10.1007/b97260

Methods in Cell Biology / book series from Elsevier

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

Specialized Journals

Methods in cell science (Online)Methods in cell science. (1995). Kluwer Academic Publishers.

https://link.springer.com/journal/11022/volumes-and-issues

Engineered regeneration. (2020). Elsevier B.V. on behalf of KeAi Communications Co. Ltd. https://www.sciencedirect.com/journal/engineered-regeneration

Organs-on-a-chip. (2019). Elsevier B.V.

https://www.sciencedirect.com/journal/organs-on-a-chip