

Cell Cultures in Biomedical Research

Code: 103977
ECTS Credits: 3

Degree	Type	Year	Semester
2502445 Veterinary Medicine	OT	5	0

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

Since the content of this subject is eminently practical, there is no indispensable requirement. However, it is advisable to have completed the subject of Cell Biology (or equivalent) in previous years. The knowledge of the English language is also recommended.

Objectives and Contextualisation

CONTEXTUALIZATION:

Cell Culture in Biomedical Research is taught in the 2nd semester of the 5th year of the Veterinary degree in the Faculty of Veterinary Medicine. This is a subject with a certain degree of specialization in which the student will acquire basic notions about cell culture methodologies used for the manipulation and culture of mammalian eukaryotic cells. For this reason, the subject has a strong practical component.

This subject aims to provide the Veterinary student with the basic knowledge regarding the basic theoretical and practical knowledge to perform cell culture techniques of animal cells. The students will also learn techniques used for the characterization of the cells and for the detection of cytotoxic and mutagenic effects of various compounds (medications, additives, etc.). These are techniques that are very useful in research labs and frequently used in derivative industries, such as pharmaceuticals.

OBJECTIVES:

- 1) Describe the origins of cell culture, the requirements and basic techniques used in the cell culture laboratory to initiate, maintain and characterize a cell culture.
- 2) To learn about the equipment and basic material of a cell culture laboratory
- 3) To learn the basic methodologies and protocols used to characterize mammal cells to start, maintain and characterize an animal cell culture.

Competences

- Comunicar la informació obtinguda durant l'exercici professional de manera fluïda, oralment i per escrit, amb altres col·legues, autoritats i la societat en general.

- Demonstrate knowledge and understanding of the physical, chemical and molecular bases of the main processes in the animal organism.
- Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

Learning Outcomes

1. Communicate information obtained during professional exercise in a fluid manner, orally and in writing, with other colleagues, authorities and society in general.
2. Use techniques for obtaining and maintaining cell cultures and characterising cells in cultures.
3. Work effectively in single or multidisciplinary teams and show respect, appreciation and sensitivity for the work of others.

Content

*Unless restrictions imposed by health authorities impose prioritization or reduction of this contents.

THEORY PROGRAM

1. Introduction to cell culture: Basic review of cell biology: organelles and functions of the cell. History of cell culture. Applications of cell culture. Advantages / disadvantages of cell culture.
2. Equipment and aseptic environment: Cell culture room or laboratory, laboratory equipment, cell culture equipment, flow hoods, biological security cabinets, aseptic technique.
3. Establishment of a cell culture: Types of cell culture: monolayer, suspension, 3D. Tissue isolation, explant cell culture, primary cell culture, cell separation: centrifugation, cytometry, matrix, magnetism. Cellular requirements: environment, media components, pH control, cell growth, cell count, viability assessment, cell proliferation, cryopreservation: freezing media, cryoprotectors and cooling rate. Establishment of a cell line.
4. Mortal and immortal cell lines: primary cell culture, cell transformation, cell immortalization, stem cells: types, culture, differentiation and applications. Hybridomas: immortal cells and antibodies synthesis.
5. Transfection: transfection, transduction and transformation. Viral transfection. Chemical and physical transfections. Advantages and disadvantages.
6. Cell characterization: cellular morphology, microscope types, fluorescence microscopy. DNA characterization: fluorescence in situ hybridization (DNA and RNA), DNA extraction, PCR, sequencing. Protein characterization: fluorescence immunodetection of protein markers, western blot.

PRACTICE PROGRAMM

1. Maintenance and subculture of cell lines. Growth control of in vitro cultured cells. Morphology assessment.
2. Fixing and targeting of cells by immunofluorescence. Cellular characterization through antibodies.
3. Cytotoxicity tests: Control of cell viability and proliferation and toxicity testing: apoptosis and DNA damage.
4. Freezing and thawing of cell lines.
5. Discussion of results.

Methodology

The Cell Cultures in Biomedical Research subject consists of theoretical and practical lessons in the laboratory.

The theoretical lessons will be carried out using audiovisual material prepared by the teachers, available for students at the Virtual Campus of the UAB before the sessions.

The practical activities will have two parts and are designed for students to learn how to use laboratory instruments and become familiar with the basic protocols of cell culture, as well as to complement the theoretical training.

1- Practices in the laboratory: The students will realize a total of 4 sessions of practices of 4h each one. These sessions will take place during the same week. In these practices, cells will be cultured, subcultured, frozen and thawed, characterized and the action and effects of cytotoxic components will be evaluated.

Students will work individually or in groups of 2 (depending on the size of the group) and, at the end of each internship day, will have to fill out a lab sheet with the results obtained that day. Each day they will do a brief questionnaire or present an exercise related with the practical lesson.

In order to attend practical lessons, students must justify having passed the biosafety and safety tests found on the Virtual Campus and be knowledgeable and accept the rules of operation of the laboratories of the Faculty of Biosciences.

2- Presentation and discussion of an article related to cell cultures in biomedical research: Students will choose one of the articles related to cell culture techniques (offered by teachers at the Virtual Campus) and will present it in class, contextualizing it within the contents of the subject. Students will work in groups of 2 or 3 people to prepare their presentation.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical lessons	16	0.64	3, 2
Theory lessons	10	0.4	2
Type: Autonomous			
Individual study	42.5	1.7	1, 2
Practical lessons report elaboration and presentation	3	0.12	1, 3
Scientific paper presentation	2	0.08	1, 3

Assessment

*The proposed evaluation can change if face-to-face restrictions are imposed by health authorities. In order to pass the subject of Cell Culture in Biomedical Research, a minimum score of 5 out of 10 points is required. The theoretical part holds for 50% of the mark and the practical part for the 50% of the remaining mark. A minimum of 4 must be obtained in each part in order to average both the theoretical and the practical marks.

The scheduled evaluation activities are:

THEORETICAL BLOCK: brief test type exam, which will represent 50% of the mark.

PRACTICAL BLOCK: 2 practical activities that will represent 50% of the mark.

1. Practical activities in the laboratory: Attendance at the practical lessons is mandatory. Non-attendance at one or two sessions reduces the practice mark by 25% and 50% respectively. Non-attendance to 3 or more practice sessions implies a NO ATTENDANCE mark of this part. The mark of the practices in the laboratory will be obtained from the questionnaires and exercises of practices and will represent 35% of the mark (8% CT02 + 9% CT04 + 8% CE04.26). In case of the exercises that are done in pairs the mark will be the same for the two components of the group.

2. Presentation and discussion of an article related to cell cultures in biomedical research: The presentation will take place the last day of class and the attendance of all students is compulsory. Non-attendance reduces the practice mark by 25%. An article related to cell culture in biomedical research will be presented and discussed in pairs. This will represent 15% of the mark (9% CT02 + 8% CT04 + 8% CE04.26). The students will be evaluated by their own colleagues (30% of the mark) and by the professor (70% of the mark). The purpose of this presentation is to:

- Make an understandable summary of the objectives and results presented in the research article chosen.
- Develop a brief discussion and draw conclusions contextualizing the article within the syllabus of the subject.
- Be able to evaluate the presentations of classmates and ask questions about their presentations within the syllabus of the subject.

3. FINAL EXAM: In the event that a student does not pass one of the theoretical parts or does not attend the theory exam for a justified reason, they can attend a final exam. This exam will be a test exam.

OTHER CONSIDERATIONS

- In order to average the theoretical and practical marks, the mark of each part must be greater than or equal to 4.
- To pass the subject, students must obtain an average mark equal to or greater than 5.
- Students who do not attend 3 or more practical lessons or the theory exam will be considered as non-evaluable.
- In the event that students pass the practice part, but not the theory part, the practice mark will be saved for 3 consecutive enrollments.
- Students who do not attend to a test for a justified cause (such as a health problem, death of a second-degree relative, accident, forced attendance competition as an elite sportswoman, etc.) and provide the corresponding official documentation (official medical certificate that explicitly certifies the inability to carry out an examination, police attestation, justification of the competent sports body, etc.) to the degree coordinator, will have the right to perform the test on another date. The degree coordinator will ensure the specification of the new date after consulting with the teacher of the affected subject.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical evaluation	50%	0.5	0.02	1, 3, 2
Theory evaluation	50%	1	0.04	1, 2

Bibliography

BIBLIOGRAPHY:

R.I. Freshney. *Culture of Animal Cells: A manual of basic technique* 6th Edition. John Wiley & Sons, 2010.

WEBS:

<http://bcs.wiley.com/he-bcs/Books?action=index&bcsId=5959&itemId=0470528125>

https://www.youtube.com/results?search_query=gibco+cell+culture

Software

There are no specific program/software requirements for this subject.