Integrated Laboratory for Reproduction Biology

Code: 42949
ECTS Credits: 9

2024/2025

Degree	Type	Year
4313782 Cytogenetics and Reproductive Biology	OT	0

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

This subject has no prerequisites.

Objectives and Contextualisation

The module "Integrated Laboratory of Reproductive Biology" aims to give basic tools to students in order to acquire the ability to develop the tasks carried out in Assisted Reproductive Centers and in research laboratories focused in cell culture and reproduction.

In the submodule 1: "Embryonic Stem Cell (ESC) culture" students will acquire the skills necessary to work in a cell culture laboratory. They will learn the rules and they will get used to work in sterile conditions. They will also learn the basic techniques of protein detection and acquire the ability to use standard and inverted microscope and fluorescence microscope. They will learn to differentiate between pluripotent and differentiated ESC.

In the submodule 2: "Fluorescent in vitro hybridization in spermatozoa" students will learn how to analyze the chromosomal abnormalities in sperm from a sample of semen, through the technique of FISH and to make a clinical evaluation.

In the submodule 3: "Oocyte and Embryo culture" students will acquire the skills to work in a laboratory of reproductive biology. They will learn how to obtain and manipulate oocytes and embryos, activate oocytes and isolate blastomeres.

In the submodule 4: "Update in histological and cytological techniques," students will learn the basic techniques of histology such as inclusion, microtomy, staining, and protein detection and to observe the samples obtained.

Finally, in the submodule 5: "Confocal Laser Scanning Microscopy" (CLSM) they will learn the characteristics of this microscope, as well as the advantages and limitations and how to use it.

Competences

- Apply knowledge of theory in both research and clinical care contexts.
- Apply the scientific method and critical reasoning to problem solving.
- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Continue the learning process, to a large extent autonomously.
- Design and execute analysis protocols in the area of the master's degree.
- Design experiments, analyse data and interpret findings.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Show an ability to work in teams and interact with professionals from other specialist areas.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use and manage bibliography or ICT resources in the master's programme, in one's first language and in English.
- Use creative, organisational and analytic skills when taking decisions.

Learning Outcomes

1. Apply histology techniques in different tissues of the organism.
2. Apply immunofluorescence techniques in different cell types.
3. Apply knowledge of theory in both research and clinical care contexts.
4. Apply the scientific method and critical reasoning to problem solving.
5. Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
6. Continue the learning process, to a large extent autonomously.
7. Correctly apply the different culture methods used.
8. Demonstrate an ability to work in sterile conditions in the culture laboratory.
9. Design experiments, analyse data and interpret findings.
10. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
11. Manipulate and identify oocytes and embryos at different stages of development before implantation.
12. Recognise pluripotency and differentiation states in embryonic stem cell cultures.
13. Recognise the different uses of a confocal laser microscope.
14. Show an ability to work in teams and interact with professionals from other specialist areas.
15. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
16. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
17. Use and manage bibliography or ICT resources in the master's programme, in one's first language and in English.
18. Use creative, organisational and analytic skills when taking decisions.

Content

Submodule 1: embryonic stem cells (ESC) cultures

- STO (feeders) cultures.
- STO inactivation.
- Coculture ESC/STO.
- Detection of pluripotency (immunofluorescence).
- ESC differentiation.
- Detection of differentiation (immunofluorescence)
- Capture and analysis of images of the different cell types and of the immunofluorescence

Submodule 2: Fluorescent in situ hybridization on sperm

- Fluorescent *in situ* hybridization technique in a fixed semen sample
- Evaluation of hybridization
- Analysis of chromosomal abnormalities in the sample

Submodule 3: Mouse oocytes and embryos culture

- Mouse embryos collection and culture.
- Embryo partition
- Mouse oocytes collection and in vitro maturation.
- Mouse oocyte activation

Submodule 4: Update on histological and cytological techniques

- Development of histological technique: inclusion and microtomy.
- Staining of histological samples of ovary and/or testicle.
- Flow cytometry and its use in research.
- Microscopic visualization and digital imaging.
- Processing images using Photoshop / Image J - FIJI.

Submodule 5: Confocal laser scanning microscopy

- Basics of Fluorescence and Confocal Microscopy
- Sample preparation for fluorescence
- Capturing the image in Confocal Microscope
- Processing series

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Confocal Laser Scanning Microscopy	10	0.4	5, 6, 10, 13, 15, 16, 17
Embryonic Stem Cell (ESC) culture	15	0.6	2, 4, 5, 6, 7, 8, 9, 10, 12, 15, 16, 17, 18
Oocyte and Embryo culture	10	0.4	3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18
Sperm fluorescent in situ hybridization	5	0.2	2, 3, 4, 5, 9
Update in histological and cytological techniques	20	0.8	1, 2, 4, 5, 6, 9, 10, 16, 17, 18
Type: Supervised			
How to prepare a Photographic composition	8	0.32	5, 6, 17

How to prepare a laboratory report	10	0.4	5, 6, 10, 14, 15, 16, 18
How to solve problems and case studies	10	0.4	4, 5, 6, 9, 10, 14, 15, 16, 17, 18
Personalized tutorials	30	1.2	5, 6, 10, 15
Type: Autonomous			
Laboratory reports	8	0.32	5, 9, 10, 12, 14, 16, 18
Photographic composition using Photoshop software	8	0.32	5, 10, 15
Solve problems and case studies	8	0.32	4, 5, 6, 10, 14, 15, 16, 17, 18
Study	73	2.92	5, 6, 10, 15, 16, 17, 18

This course is essentially practical. In all submodules except confocal laser scanning microscopy students will work in pairs under the guidance of a teacher.

In the embryonic stem cells culture submodule, students must acquire the ability to work in sterile conditions.

In the FISH submodule, students will learn to process semen samples to apply FISH methodologies and to identify chromosomal abnormalities.

In the mouse embryo culture submodeule, the practical classes are designed to acquire the skills necessary to handle oocytes and embryos.

In the histology submodeule students will become familiar with the techniques used in histology.

Finally, in the scanning laser confocal microscopy submodeule, students must work in groups of approximately 6 people. This practice is carried out in Microscopy Service, using the laser scanning confocal microscopes available in the service.

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Acquiring skills in histology techniques	7%	1	0.04	2, 6
Acquiring skills in stem cell culture laboratory	6%	1	0.04	2, 7, 8, 9
Acquiring skills in using a confocal microscope	2%	1	0.04	13
Delivery reports	67%	2	0.08	1, 5, 6, 9, 10, 11, 12, 14, 15, 16, 17, 18
Individual tests	8%	4	0.16	1, 5, 6, 10, 15, 17
Solve problems and case studies	10%	1	0.04	3, 4, 5, 6, 9, 10, 15, 16, 17, 18

This module consists of five submodules, each with a different dedication and therefore a specific percentage within the module. In the following table you will find a summary of the hours of each submodule and its weight in the final mark of the module:

		hours	%
1	ESC cultures	15	25
2	FISH-in spermatozoa	5	8
3	Oocytes and embryos culture	10	17
4	Update in histological and cytological techniques	20	33
5	Confocal laser scanning microscopy	10	17
		60	100

Evaluation activities scheduled:

Submodule 1. Embryonic stem cells culture. This submodule has a weight of 25% of the module. The evaluation system is organized into two sections: 1) attitude and skills acquired in the laboratory (25%) and 2) final laboratory report exposition (75%)

Submodule 2. Spermatozoa fluorescent ***in situ*** hybridization. This submodule has a weight of 8% of the module. The evaluation will consider the final report explaining the results (100%)

Submodule 3. Oocytes and embryos culture. This submodule has a weight of 17% of the module. The evaluation will consider the final laboratory report (100%)

Submodule 4. Update on histological and cytological techniques. This submodule has a weight of 33% of the module. The evaluation system is organized into three sections: 1) skills acquired in practical sessions (20%), 2) delivery of an individual report and questionnaires (40%) and 3) delivery of a photographic composition using the program Photoshop (40%)

Submodule 5. Confocal laser scanning microscopy. This submodule has a weight of 17% of the module. The evaluation system is organized into three sections: 1) skills acquired in practical sessions (10%) and 2) resolution of a case study 90%)

The final grade will be calculated taking into account the percentage of the different submodules. To pass the module the student must obtain a minimum mark of 5 points and a maximum of 10 possible points. For the different submodules to be averaged, a minimum grade $\geq$4 must be obtained in each of the submodules. Scores lower than $\leq$3,99 in one or more of the submodules will require students to pass a retake an exam of all submodules.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

Bibliography

* Culture of animal cells. A manual of basic technique (7th ed.) RI Freshney. Wiley-Liss, 2016 (biblioteca 6e edició en paper i electrònic) ISBN:9781118873656

* Cell and Tissue Culture: Laboratory procedures in biotechnology.A. Doyle and J.B. Griffiths Eds. JohnWiley & Sons Ltd. 1999. ISBN: 9780471982555

* Animal Cell Culture Methods. Methods in Cell Biology.J.P. Mather and D. Barnes Eds. Academic Press. 1998 . en paper i electrònic) ISBN:9780124800403

* Manipulating the Mouse Embryo: A Laboratory Manual (4th Edition). R. Behringer, M. Gertsenstein, K. Vintesten, A. Nagy. CSH Press. 2014. ISBN: 978-1-936113-01-9

* Theory and Practice of Histological Techniques (7th edition). John D. Bancroft, Churchill Livingstone. Elsevier. 2013. ISBN: 978-0-7020-4226-3

Software

Free software of image analysis Image J - FIJI.

Language list

Name	Group	Language	Semester	Turn
(PLABm) Practical laboratories (master)	1	Catalan/Spanish	second semester	morning-mixed
(SEMm) Seminars (master)	1	Catalan	second semester	morning-mixed