

Degree	Type	Year	Semester
4313782 Cytogenetics and Reproductive Biology	OT	0	2

## Contact

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## Teachers

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## Use of languages

Principal working language: catalan (cat)

## Prerequisites

This module needs no requirements.

## 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 chromosomal anomalies in a semen sample through the use of this technique.

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 its advantages and limitations and how to use it.

## Skills

- 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 (immunocytochemistry).

ESC differentiation.

Detection of differentiation (immunocytochemistry).

Cell cultures contamination control.

**Submodule 2:** Fluorescent in situ hybridization on sperm

Fluorescent in situ hybridization technique in a fixed semen sample

Evaluation of hybridization

Analysis of aneuploidy

**Submodule 3:** Mouse oocytes and embryos culture

Embryos collection and culture.

MII oocyte collection and activation.

GV oocytes collection and in vitro maturation.

Isolation of blastomeres.

**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.

**Submodule 5:** Confocal laser scanning microscopy

Basics of Fluorescence and Confocal Microscopy

Sample preparation for fluorescence

Capturing the image in Confocal Microscope

Processing series

## **Methodology**

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

In the block of embryonic stem cells cultures, students must acquire the ability to work in sterile conditions. An important part of this practice, the establishment of cell cultures, is done in the research laboratories of the Unit of Cell Biology, under the same working conditions that researchers work.

In the block of FISH, students will learn how to analyze aneuploidy.

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

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

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

## Activities

Title	Hours	ECTS	Learning outcomes
<b>Type: Directed</b>			
Confocal Laser Scanning Microscopy	10	0.4	15, 5, 10, 6, 13, 16, 17
Embryonic Stem Cell (ESC) culture	15	0.6	7, 4, 2, 8, 9, 18, 15, 5, 10, 6, 12, 16, 17
Oocyte and Embryo culture	15	0.6	7, 4, 3, 8, 9, 18, 15, 5, 10, 6, 16, 17
Update in histological and cytological techniques	20	0.8	4, 1, 2, 9, 18, 5, 10, 6, 16, 17
<b>Type: Supervised</b>			
How to prepare a laboratory report	10	0.4	14, 18, 15, 5, 10, 6, 16
How to prepare a Photographic composition	8	0.32	5, 6, 17
How to solve problems and case studies	10	0.4	4, 14, 9, 18, 15, 5, 10, 6, 16, 17
Personalized tutorials	30	1.2	15, 5, 10, 6
<b>Type: Autonomous</b>			
Laboratory reports	8	0.32	14, 9, 18, 5, 10, 12, 16
Photographic composition using Photoshop software	8	0.32	15, 5, 10
Solve problems and case studies	8	0.32	4, 14, 18, 15, 5, 10, 6, 16, 17
Study	73	2.92	18, 15, 5, 10, 6, 16, 17

## Evaluation

To pass the module the student must obtain a minimum score of 5 points and a maximum of 10 possible points. As has already been discussed this module consists of five submodules, each with a different dedication and therefore a specific percentage within the module. The table summarize the hours of each submodule and its percentage with respect to the final 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) skills acquired in the laboratory (25%) and 2) final laboratory report (75%)

Submodule 2. Oocytes and embryos culture. This submodule has a weight of 17% of the module. The evaluation will consider the final laboratory report (100%)

Submodule 3. Fluorescent in situ hybridization. This submodule has a weight of 8% of the module. The evaluation will consider the final report explaining the results and clinical assessment (statistical survey regarding population control) (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%), 2) resolution of a case study (40%) and 3) realization of a written exam (50%)

The final grade will be calculated taking into account the percentage of the different submodules. To pass the module, the student must have a grade of  $\geq 4$  in each submodule. Scores lower than  $\leq 3,99$  in one or more of the submodules will require students to pass a final exam of all submodules.

## Evaluation 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	7, 2, 8, 9
Acquiring skills in using a confocal microscope	2%	1	0.04	13
Delivery reports	67%	2	0.08	1, 14, 9, 18, 11, 15, 5, 10, 6, 12, 16, 17
individual tests	8%	4	0.16	1, 15, 5, 10, 6, 17
Solve problems and case studies	10%	1	0.04	4, 3, 9, 18, 15, 5, 10, 6, 16, 17

## Bibliography

\* Culture of animal cells. A manual of basic technique (7th ed.) R.I. 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. John Wiley & 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. Vintsten, 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