

## Reproductive Techniques

Code: 105062  
ECTS Credits: 3

Degree	Type	Year	Semester
2500890 Genetics	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

### 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

### Teachers

Josep Santaló Pedro

### Prerequisites

In order to guarantee the achievement of the learning objectives, it is a prerequisite to have passed the subject "Genetics and Reproduction" of the third year of the degree.

Furthermore, for an optimal follow-up of the subject, basic knowledge of cellular biology and the techniques used in this discipline is recommended since many of them will appear throughout the development of the subject.

It is recommended that students have adequate knowledge of English.

### Objectives and Contextualisation

The subject Reproductive Techniques aims to provide the student with knowledge about the cellular and molecular mechanisms involved in mammal reproduction, as well as on the applications of manipulation of embryos and gametes. It also aims to provide students with knowledge about assisted reproduction procedures in the field of human and animal reproduction. The last sections of the syllabus will deal with interventions on gametes and embryos associated with emerging technologies. The new scenarios envisaged in this field, the repercussions, and the impact of new applications will be discussed.

### Competences

- Apply knowledge of theory to practice.
- Assume ethical commitment
- Define mutation and its types, and determine the levels of genic, chromosomal and genomic damage in the hereditary material of any species, both spontaneous and induced, and evaluate the consequences.
- Describe the genetic bases of the development and control of genic expression.
- Describe the organisation, evolution, inter-individual variation and expression of the human genome.

- Design experiments and interpret the results.
- Develop self-directed learning.
- Measure and interpret the genetic variation in and between populations from a clinical, conservational and evolutionary perspective, and from that of the genetic improvement of animals and plants.
- Perform genetic diagnoses and assessments and consider the ethical and legal dilemmas.

## Learning Outcomes

1. Apply knowledge of theory to practice.
2. Apply the basic principles of bioethics.
3. Assess the implication of genetic anomalies as a cause of infertility.
4. Assume ethical commitment
5. Describe the basic genetic techniques for the study and prevention of sterility and infertility.
6. Describe the genetic bases of the determination and differentiation of human gender.
7. Describe the genetic basis and control of human gametogenesis.
8. Describe the structure and variation of the human genome from a functional and evolutionary perspective.
9. Design experiments and interpret the results.
10. Develop self-directed learning.
11. Explain cancer as an error in the control mechanisms of genic expression.
12. Perform pre-conceptual genetic assessment taking into account its ethical and legal implications.
13. Recognise the genetic anomalies of spermatogenesis and ovogenesis related with a sterility phenotype.

## Content

### Theory lessons

Topic 1. Mechanisms of fertilization and pre-implantation embryo development (updating). Interaction between gametes. Penetration of the oocyte. Membrane fusion. Prevention of polyspermy. Pronuclei formation. Morphokinetic preimplantation embryo development. Cell differentiation: Morulae formation, compaction, polarity. Totipotency and cell differentiation. Blastocyst formation: inner cell mass, trophectoderm, blastocoele.

Topic 2. Cryopreservation of gametes and embryos. Consequences of the decrease of temperature. Characteristics of freezing and thawing protocols. Vitrification. Cryopreservation of embryos. Cryopreservation of sperm. Cryopreservation of oocytes. Cryopreservation of ovarian tissue and testicular tissue. Banks of gametes, embryos, and gonadal tissue.

Topic 3. Assisted reproduction techniques (ART) in humans. Assisted reproductive techniques as a reproductive option (update). New strategies: Oocyte maturation in vitro. In vitro fertilization in natural cycles. Embryo manipulation related to oocyte and embryo reconstruction: mitochondrial transfer, transfer of meiotic spindle, pronuclear transfer. Fertility preservation.

Topic 4. Assisted reproduction techniques (ART) in animals. Reproductive cycles, reproductive efficiency. Basic procedures of assisted reproduction in animals. Applications.

Topic 5. Cloning. Cloning procedures in animals: blastomere isolation, embryo splitting, somatic cell nuclei transfer. Applications, efficiency.

Topic 6. Genetic modification. Methods of transference of genetic constructions. Genetic modification of gametes and embryos.

Topic 7. Pluripotent cells and reproduction. Embryonic stem cells (ESC): obtaining, characterization, the establishment of cell lines, differentiation. Induced pluripotent cells (IPs): reprogramming, characterization, the establishment of cell lines, differentiation. In vitro production of gametes: fiction or reality?

### Laboratory sessions

- In vitro culture and preimplantation embryo development

- Induction of oocyte maturation in vitro
- Embryo freezing
- Embryo manipulation: cloning by blastomere isolation
- Analysis of a semen sample
- Projection of audio-visual tutorials

Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents

## Methodology

The subject will be delivered through theory lessons, practical classes, and oral presentations given by the students.

### Theory lessons

The content of the theory program will be explained by the teacher as lectures, with audio-visual support and encouraging the active participation of students. Tables, figures, and graphics used during the lectures will be available in \*pdf format on the Moodle classroom. Videos, animations, and links to websites will be also available.

Although it is not essential to extend the contents of the lessons, unless specifically requested, students are advised to consult regularly the books and texts recommended in the bibliography section of this guide to consolidate and clarify, if necessary, the topics of the program.

In addition to the attendance to class, the follow-up of the topics will also imply an active role of the student, who will have to develop individually or in team parts of the theory program.

### Laboratory practice

The practical sessions are designed to learn the basic methodologies used in reproductive biology laboratories and to complement the theory lessons.

The students will work in groups of 2 students and, during the sessions, they will have to answer a test.

Attendance at the practical classes is mandatory to pass the subject.

### Oral presentations of papers

The students will have to present an article published in an international scientific journal in the field of reproductive technologies. In these sessions, updated topics of special interest for the students will be approached and discussed.

The papers will be distributed at the beginning of the teaching period. Each team will prepare a presentation of a paper during 5-8 minutes (according to the number of students enrolled in the subject). The aim of this presentation is to summarize the results of the research, draw conclusions and achieve a critical discussion.

### Tutorship

At the student's request, tutorials will be programmed to solve doubts about the contents of theory and practices.

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities

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			
Oral presentation of papers	2	0.08	1, 4, 5, 10, 12, 13, 3
Practice sessions	13	0.52	1, 5, 7, 10, 9, 13
Theoretical clases	15	0.6	1, 2, 4, 5, 8, 6, 7, 9, 11, 12, 13, 3
Type: Supervised			
Tutorship	2	0.08	4, 5, 6, 7, 9, 12, 13, 3
Type: Autonomous			
Preparation oral presentations	4	0.16	10
Study and self learning	32	1.28	1, 2, 4, 5, 6, 7, 10, 9, 12, 13, 3

## Assessment

To pass the subject it will be essential to obtain a final mark equal to or greater than 5 points (out of 10). Attendance to the practical sessions is mandatory.

### Theory exam

It will count 50% of the final grade of the subject. The totality of the subject presented in the theory lessons will be evaluated and it will consist of a multiple-choice test.

To use the mark obtained for the final mark of the subject, it will be necessary to obtain a minimum of 4 out of 10 in this exam.

### Evaluation of practical sessions

It will count 40% of the final mark of the subject.

The laboratory practices will be evaluated during their realization through corresponding questionnaires to determine if they have achieved the learning objectives. Attendance to the practical sessions is mandatory.

### Assessment of oral presentations

It will count 10% of the final mark of the subject.

The report prepared and the oral presentation of the paper will be evaluated.

Short-term evaluation exercises related to the paper's presentations could be also programmed.

### Retake exam

There will be a retake exam for those students who have not passed the theory exam. The examination methodology may be different from the one used previously.

A minimum score of 4 out of 10 in this examination is required to pass the course.

To participate in the retake exam, students must have been previously evaluated in a set of activities whose weight equals a minimum of two-thirds of the total grade of the subject. A student will obtain the qualification of "Not Evaluable" if the weight of the activities performed during the course does not reach the 67% of the subject.

Exam review (contesting exam results)

Students will have the choice to review the exams on the specific dates scheduled by the teacher.

Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of laboratory sessions	40	3	0.12	1, 10, 9, 13, 3
Examination of theoretical sessions	50	2	0.08	2, 4, 5, 8, 6, 7, 10, 11, 12, 13, 3
Oral presentation of papers	10	2	0.08	2, 4, 12, 13, 3

## Bibliography

General information of the topics could be found in the following textbooks

Bajo JM, B. Coroleu B. (Eds.) Fundamentos de Reproducción. Editorial Panamericana. Madrid. 2009.

Elder K., Dale B. *In vitro* fertilization. (3rd edition). Cambridge University Press. New York. 2011.

Fauser B.C.J.M. (Ed.). Molecular Biology in Reproductive Medicine. The Parthenon Publishing Group. New York. 1999

Gardner D.K. et al. (Eds.). Textbook of assisted Reproductive Techniques. Martin Dunitz Pub. Hampshire. 2001.

Gupta S.K. et al. (Eds.) Gamete Biology. Emerging frontiers in Fertility and Contraceptive Development. Nottingham University Press. Nottingham. 2007.

Hafez B. and Hafez E.S.E. (Eds.). Reproduction in farm animals. 7th edition. Lippincott Williams and Wilkins. USA. 2000.

Harper J. (Ed.) Preimplantation Genetic Diagnosis. (2nd Edition). Cambridge University Press. New York (USA). 2009.

Johnson M.H. and Everitt B.J. (Eds.) Essential Reproduction. 5th Edition. Blackwell Science. Oxford. 2005.

Lanza R. Et al. (Eds.) Handbook of Stem Cells. Vol 1 i 2. Elsevier Academic Press. Amsterdam. 2004.

Matorras R, Hernández J. (Eds.). Estudio y tratamiento de la pareja estéril. Adalia. Madrid. 2007.

Nadal J. (Ed.). Donación de ovocitos. Momento Médico Iberoamericana. Madrid. 2010.

Remohí J., Pellicer A., Simón C., Navarro J. (Eds.). Reproducción Humana. 2ª Edición. McGraw

Hill-Interamericana. Madrid. 2002.

Wolf D.P. and Zelinski-Wooten M. (Eds.). Assisted fertilization and nuclear transfer in mammals. Humana Press. New Jersey. USA. 2001.

During the course, specific bibliography will be recommended for the preparation of sections of the syllabus by the students.

Reviews and updated papers will be also recommended.

Web links containing rigorous and up-to-date information will be suggested.

## **Software**

For the correct follow-up of the subject, students should regularly consult documents in pdf format.