Universitat Autònoma de Barcelona

2019/2020

Reproductive Techniques

Code: 105062
ECTS Credits: 3

Degree	Type	Year	Semester
2500890 Genetics	OT	4	0

Contact

Name: Francesca Vidal Domínguez
Email: Francesca.Vidal@uab.cat

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 "Genetics and Reproduction" subject.

Furthermore, for optimal follow-up of the subject, basic knowledge on cellular biology and techniques used in this discipline are 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 the reproduction of mammals, as well as on the applications of manipulation of pre-implantation gametes and embryos. 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 also 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

Theoretical classes

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, trophoectoderm, blastocoele.

Topic 2. Criopreservation 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. Criopreservation 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, establishment of cell lines, differentiation. Induced pluripotent cells (IPs): reprogramming, characterization, 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

Methodology

The subject consists of theoretical classes, practical classes and oral presentations of papers.

Theory classes

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 Virtual Campus. Videos, animations and links to websites will be also available.

Although it is not essential to extend the contents of the classes, 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 the classes, 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 theoretical training

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

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

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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.

Theoretical exam

It will count 50% of the final grade of the subject. The totality of the subject presented in the theoretical classes 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 its realization through the answers included in the corresponding questionnaires to determine if they have achieved the competences and 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 examination

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

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

To participate in the retake exam, the students must have been previously evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject. A student will obtain the "No Avaluable" qualification if the evaluation activities undertaken count less than 67% in the final mark of the subject. A student will obtain the "No Avaluable" qualification if the evaluation activities undertaken count less than 67% in the finalmark of the subject.

Exams revision

Revision of exams will be with by appointment and on the dates offered.

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

Genral information of the topics coould be found in the following texbooks

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 thecourse, 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.