Universitat Autònoma de Barcelona

2020/2021

Animal Development and Embryonic Manipulation Techniques

Code: 100861
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	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

Maria Plana Coll

Prerequisites

There are no prerequisites for taking the course. However, in order to achieve the learning aims, a basic knowled

It is also recommended to be familiar with the techniques used in these disciplines.

Sources of information are usually in English and it is recommended that students have knowledge of this language.

Objectives and Contextualisation

The aim of the course is to provide the student with knowledge about the cellular and molecular mechanisms invo

Throughout the course, practical applications of the manipulation of gametes and embryos, fertility control and as

Competences

- Apply the principal techniques used in biological systems: methods of separation and characterisation of biomolecules, cell cultures, DNA and recombinant protein techniques, immunological techniques, microscopy techniques, etc.
- Collaborate with other work colleagues.

- Describe intercellular and intracellular communication systems that regulate the proliferation, differentiation, development and function of animal and plant tissues and organs.
- Design experiments and understand the limitations of experimental approaches.
- Interpret experimental results and identify consistent and inconsistent elements.
- Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English and understand the language and proposals of other specialists.
- Manage information and the organisation and planning of work.
- Read specialised texts both in English and ones own language.
- Take responsibility for one's own learning after receiving general instructions.
- Think in an integrated manner and approach problems from different perspectives.
- Understand the language and proposals of other specialists.
- Use ICT for communication, information searching, data processing and calculations.

Learning Outcomes

1. Analyse the molecular mechanisms that regulate the size and differentiation stage of cells in tissues.
2. Apply the technologies deriving from intervention on gametes and embryos.
3. Apply the technologies used in the control of human and animal fertility.
4. Collaborate with other work colleagues.
5. Describe the molecular mechanisms that regulate postimplantation embryo development.
6. Describe the processes involved in gamete formation, fertilisation and preimplantation embryo development.
7. Design experiments and understand the limitations of experimental approaches.
8. Explain disorders in postimplantation embryo development.
9. Explain the pathogenesis associated with reproductive processes.
10. Interpret experimental results and identify consistent and inconsistent elements.
11. Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English and understand the language and proposals of other specialists.
12. Manage information and the organisation and planning of work.
13. Obtain, manipulate and culture preimplantation mammal embryos
14. Read specialised texts both in English and ones own language.
15. Relate the processes of gametogenesis and fertilisation to the normal functioning of the reproductive system.
16. Take responsibility for one's own learning after receiving general instructions.
17. Think in an integrated manner and approach problems from different perspectives.
18. Understand the language and proposals of other specialists.
19. Use ICT for communication, information searching, data processing and calculations.

Content

Theoretical classes program

I. Gametogenesis, fertilization, pre-implantation embryo development

Topic 1. Female gametogenesis. Male gametogenesis: General aspects of the male reproductive system. Spermatogenesis. Maduration of sperm: Epididimal functions. Ejaculation:characteristics and seminal parameters.

Topic 2. Fertilization.

Topic 3. Pre-implantation embryo development. Cell differentiation. Hatching

II. Assisted Reproduction Techniques (ARTs)

Topic 4. Assisted reproduction techniques (ARTs). Introduction to human sterility and infertility. Induction of ovulation. Artificial insemination. "In vitro" fertilization (IVF). Intracytoplasmic Sperm Injection (ICSI). "In vitro" embryo culture . Embryo transfer. Gamete donation. Epididimal and testicular sperm recovery. Sperm selection. Preconceptional and preimplantation genetic diagnosis.

Topic 5. Cryopreservation of gametes and embryos. General characteristics of cryopreservation. Vitrification. Cryopreservation of embryos. Cryopreservation of sperm. Criopreservation of oocytes and ovarian tissue. Gamete and embryo banks

Topic 6. Genetic risk related to ARTs.

Topic 7. Assisted reproduction in animals.

III. Technologies emerging from embryo manipulation

Topic 8. Cloning. Cell reprogramming and stem cells (ESC and IPS) in the field of reproduction.

IV. Post-implantation embryo development. Gastrulation and formation of axes.

Topic 9. Primary development in sea urchin. Embryonic division patterns. Formation of the blastula. Specification of the embryonic axes. Gastrulation

Topic 10. Primary development in Drosophila. Formation of primary axes during oogenesis. Antero-posterior polarity of the oocyte. Generation of the antero-posterior pattern. Generation of the dorso-ventral pattern. Segmentation.

Topic 11. Primary development in amphibians. Gastrulation. Progressive determination of the axes. Molecular mechanisms of the formation of axes in amphibians. Regional specificity of neural induction.

Topic 12. Primary development in birds. Gastrulation and specification of axes. Organization in birds. Antero-posterior pattern. Left-right axis

Topic 13. Primary development in mammals. Gastrulation Antero-posterior axis. Dorsal-ventral axis. Left-right axis

V. Organogenesis

Topic 14. Formation of the central nervous system. Formation of the neural tube. Differentiation. Differentiation of neurons in the brain. Cell differentiation into the vertebrate eye.

Topic 15. Miogenesis: Generation of muscle.

VI. Post-embryonic development

Topic 16. Maintenance of cell and tissue differentiation. Tissues with permanent cells. Compensatory regeneration in the mammalian liver. Renewal from stem cells: epidermis. Renewal from pluripotent stem cells: hematopoiesis

Topic 17. Aging. Cellular senescence and apoptosis. Metabolic alterations related to aging. Possible molecular bases of aging.

Laboratory sessions program

Male and female gametogenesis.

In vitro embryo manipulation and embryo culture.

In vitro oocyte maturation

Freezing of gametes and embryos.

Embryo splitting

Analysis of a semen sample

Audio-visual tutorials.

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

Methodology

Theory classes

The content of the theory program will be taught mainly by the teacher as lectures with audio-visual support. The presentations used in class by the teacher will be available in the Virtual Campus. It is recommended to the students to obtain this material and to use it as support when taking notes. 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 practices:

The practical sessions are designed to learn the basic methodologies used in reproductive biology laboratories and to complement the theoretical training. The students will take a total of 4 sessions of 3 hours each, working in groups of 2 and, during the sessions, they will have to answer a questionnaire.

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

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	40	1.6	1, 5, 6, 18, 8, 9, 14, 17, 15, 11
Practical sessions	12	0.48	19, 2, 3, 4, 7, 12, 10, 13, 11
Type: Autonomous			
Study and self learning concepts	95	3.8	

Assessment

To pass the subject it will be necessary to obtain a final grade equal to or greater than 5 points (out of 10) and have attended to the practical sessions.

The scheduled evaluation activities are:

- First term exam: It will count on 40% of the final grade. The topics taught in the firts term of the theoretical sessions will be evaluated.
- Second term exam: It will count on 40% of the final mark. The topics taught in the second term of the theoretical sessions will be evaluated.

In order to pass the subjects evaluated in these two theoretical exams and to use the mark obtained for the final mark, it will be necessary to obtain a mínimum mark of 3.5 out of 10 in the two examinations.

- Retake exam: adressed to students who have not obtained a final matk to pass the subject and those who wants to improve their mark . The matk obtained in this examination will prevail. The methodology of the exam may be different from that used in previous assessments.

To participate in the retake exam, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject. Therefore, students will obtain the "No-evaluable" qualification when the assessed activities correspond to less than the 67% of the activities.

- Evaluation of practical sessions

It will count on 20% of the final mark. The laboratory practices will be evaluated during its realization by a questionnaire. Attendance to the practical sessions is mandatory. The students will obtain the "No-evaluable" qualification

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	20	1	0.04	19, 2, 3, 4, 7, 18, 10, 13, 17, 11
First term examination	40	1	0.04	19, 2, 3, 6, 18, 9, 12, 10, 14, 17, 15, 11, 16
Second term examination	40	1	0.04	1, 19, 5, 18, 8, 12, 10, 14, 17, 11, 16

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

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

Wolpert Lewis, Rosa Beddington, Thomas Jessell, PeterLawrence, ElliotMeyerowitz, Jim Smith. Principles of Development, Second Edition . (2002) Oxford University Press

Specific bibliography will be recommended for the preparation of sections of the syllabus by the students.

Reviews and updated papers will be recommended during the course.

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