

## 27127 - Animal Biotechnology

### Información del Plan Docente

|                        |                               |
|------------------------|-------------------------------|
| <b>Academic Year</b>   | 2016/17                       |
| <b>Academic center</b> | 100 - Facultad de Ciencias    |
| <b>Degree</b>          | 446 - Degree in Biotechnology |
| <b>ECTS</b>            | 6.0                           |
| <b>Course</b>          | 4                             |
| <b>Period</b>          | Second semester               |
| <b>Subject Type</b>    | Compulsory                    |
| <b>Module</b>          | ---                           |

### 1. Basic info

#### 1.1. Recommendations to take this course

#### 1.2. Activities and key dates for the course

The course consists of participatory lectures, labs and seminars, and will take place during the second semester of the academic calendar. For students enrolled in the subject, places, times and dates of lectures and practical sessions will be public via Bulletin Board advertisements of the grade on the platform Moodle at the University of Zaragoza, <https://moodle2.unizar.es/add/>, and in the moodle page for the course. These routes will be also used to communicate enrolled students their distribution by groups of practical sessions, which will be organized by the coordination of degree, and the teachers of the course. The seminars will be held generally on schedule for the lectures.

Provisional dates will be available on the website of the Faculty of Sciences in the corresponding section of the Degree in Biotechnology: <https://ciencias.unizar.es/grado-en-biotechnologia>.

In this web there will be also available the dates of exams.

### 2. Initiation

#### 2.1. Learning outcomes that define the subject

#### 2.2. Introduction

#### 3. Context and competences

##### 3.1. Goals

##### 3.2. Context and meaning of the subject in the degree

##### 3.3. Competences

##### 3.4. Importance of learning outcomes

### 4. Evaluation

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### 5. Activities and resources

#### 5.1. General methodological presentation

The learning process that is designed for this subject is based on the following:

This subject is assigned 6 ECTS, which correspond to 150 hours of work by the student. Of these hours, 60 are teaching hours (40%) and 90 hours (60%) of student work. Thus, this matter is structured as follows:

1) Teaching hours: 60 hours

- 40 hours of lectures.
- 10 hours of practical lessons.
- 10 hours of seminars.

2) Student work: 90 horas

- Seminars preparation.
- Study hours.

#### 5.2. Learning activities

##### LECTURES

Classroom teaching, 40h.

The documentation for each lecture will be available (via Moodle) at least 1 week before its explanation in the classroom, so that the student can review it in detail before the corresponding class. In each theoretical session, it is planned to spend 5 minutes reviewing the previous class in order to place students in the later explanation, and a 45 minutes exposure of the most important and/or difficult aspects. It will emphasize the need to interrupt the teacher when they see fit to solve problems as they arise during the lesson.

##### PRACTICAL CLASSES

Laboratory teaching, mandatory attendance. 10 h.

Practice 1 will be held on the premises of Support Service Animal Experimentation (SAEA) and the sperm evaluation laboratories of the Department of Biochemistry and Molecular and Cellular Biology. In this practice, the students will work in small groups (4 people maximum, to be announced in advance), and they will be handling the rams, observing the process of semen collection by artificial vagina, and then they will analyze the sperm quality in the laboratory. This practice is conducted in a 3-hour session.

Practices 2 and 3 will be held together in a 5 hour session, in the labs of the Department of Biochemistry and Molecular and Cellular Biology, Faculty of Veterinary Medicine, and will consist of the freezing of sperm and the evaluation of post-thaw quality using the techniques learned in practice 1, together with a zona pellucida binding assay.

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Practice 4 will consist of the designs of gene therapy treatments and will take place in the computer room of the Faculty of Veterinary.

### SEMINARS

Classroom teaching, mandatory attendance. 10 hrs.

The seminars will be organized in sessions of 1 hour and will consist of the selection of a genetically modified animal and its presentation. They will be held on schedule of the lectures.

### 5.3.Program

#### LECTURES

##### *SECTION 1: REPRODUCTIVE BIOTECHNOLOGY*

1. Introduction to Reproductive Biotechnology
2. Physiology of reproduction. Female and male reproductive system. Hormonal regulation and gametogenesis.
3. Regulation of female reproduction: Reproductive cyclicity. Measurement of hormone levels. Induction and synchronization of oestrus. Superovulation.
4. Sperm capacitation, acrosome reaction and binding to oocyte
5. Semen collection methods. Sperm quality assessment: motility, viability, morphological alterations, capacitation status, apoptotic markers and subpopulation heterogeneity. Sperm sexing methods.
6. Gamete preservation: refrigeration and freezing. Cold-shock effects on gametes viability. Cryodiluents and cryopreservation protocols.
7. Artificial insemination: procedure and methods.
8. Oocyte recovery methods. In vitro maturation and in vitro fertilization (IVF). Intracytoplasmic sperm injection (ICSI). In vitro embryo culture. Early embryo development and maternal recognition of pregnancy. Pregnancy diagnosis.
9. Embryo transfer. Embryo preservation.
10. Reproductive biotechnology applied to animal endangered species.

##### *SECTION 2: TRANSGENESIS*

1. DNA handling to gene overexpression in mammals.
2. Generation of overexpressing transgenic animals.
3. DNA handling in gene targeting.
4. Gene targeting-mediated transgenic generation
5. Inducible transgenesis: recombinases and inducible elements (interferent RNA and knock-down)
6. Nucleases in gene targeting zinc fingers, TALEN's and CRISP/cas.
7. Phenotyping and genetic background. Data bases and applications of genetically modified organisms.
8. Cloning animals and their uses.
9. Embryonic stem cells, germ cells and iPS cells.

##### *SECTION 3: GENE THERAPY*

1. Introduction to Gene Therapy. Strategies based on Gene Therapy.
2. Viral vectors: retrovirus, adenovirus, adenoassociated adenovirus and lentivirus.
3. Non viral vectors.
4. Candidate diseases for Gene Therapy.
5. Stem cells and Cell Therapy. Descellularization and printing.
6. Gene Therapy versus traditional therapies.

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### PRACTICAL SESSIONS

1. Sperm collection from rams using artificial vagina. Evaluation of semen samples.
2. Cryopreservation of gametes (spermatozoa).
3. Oocytes collection. Evaluation of cryopreserved sperm. Zona Binding Assay.
4. Approach to Strategies based on Gene Therapy.

### SEMINARS

In this activity the students will gather information on a relevant aspect related to animal biotechnology and this information will be presented and discussed in class.

#### 5.4.Planning and scheduling

Schedules of lectures will coincide with the officially established and will be available at:  
<https://ciencias.unizar.es/grado-en-biotecnologia>. The seminars will be held generally on schedule for the lectures.

The places, calendar and groups for training and practical sessions will be established in coordination with the rest of matters at beginning of course. The Coordinator will produce the groups of students for these activities at beginning of course to avoid overlaps with other subjects.

#### 5.5.Bibliography and recommended resources