

## 27127 - Animal Biotechnology

### Syllabus Information

**Academic Year:** 2019/20

**Subject:** 27127 - Animal Biotechnology

**Faculty / School:** 100 -

**Degree:** 446 - Degree in Biotechnology

**ECTS:** 6.0

**Year:** 4

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:** ---

### 1.General information

#### 1.1.Aims of the course

#### 1.2.Context and importance of this course in the degree

#### 1.3.Recommendations to take this course

### 2.Learning goals

#### 2.1.Competences

#### 2.2.Learning goals

#### 2.3.Importance of learning goals

### 3.Assessment (1st and 2nd call)

#### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

### 4.Methodology, learning tasks, syllabus and resources

#### 4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It favors the understanding of the different animal biotechnologies. A wide range of teaching and learning tasks are implemented, such as theory sessions, laboratory sessions, and seminars.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class and the website of the Faculty of Sciences in the corresponding section of the Degree in Biotechnology: <https://ciencias.unizar.es/grado-en-biotecnologia>.

#### 4.2.Learning tasks

The course includes 6 ECTS organized according to:

- Lectures (4 ECTS): 40 hours.
- Laboratory sessions (1 ECTS): 10 hours.
- Seminars (1 ECTS): 10 hours.

Lectures, 40h.

Lecture notes will be available for the student (via Moodle) at least 1 week before their explanation in the classroom. At the beginning of each lecture, it is planned to spend 5 minutes reviewing the previous one 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 lecture.

Laboratory sessions, mandatory attendance. 10 h.

Session 1 will take place on the premises of Support Service of Experimentation (SAE) and the sperm evaluation laboratories of the Department of Biochemistry and Molecular and Cellular Biology, both in the Faculty of Veterinary Medicine. In this laboratory session, the students will work in small groups (4 people maximum, to be announced in advance), and they will handle the rams during the semen collection by artificial vagina, and they will analyze the sperm quality in the laboratory in a 3-hour session.

Sessions 2 and 3 will take place together in a 5-hour session, in the laboratory of the Department of Biochemistry and Molecular and Cellular Biology, Faculty of Veterinary Medicine. The students will freeze ram sperm, and they will evaluate the post-thaw quality using the techniques learned in session 1. They will also learn the zona pellucida binding assay.

Session 4 will take place in the computer room of the Faculty of Veterinary. In this session, the students will design gene therapy treatments

Seminars, 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 the schedule of the lectures.

### 4.3.Syllabus

The course will address the following topics:

#### **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*

11. DNA handling to gene overexpression in mammals
12. Generation of overexpressing transgenic animals.
13. DNA handling in gene targeting.
14. Gene targeting-mediated transgenic generation
15. Inducible transgenesis: recombinases and inducible elements (interferent RNA and knock-down)
16. Nucleases in gene targeting zinc fingers, TALEN's and CRISPR/cas.
17. Phenotyping and genetic background. Data bases and applications of genetically modified organisms.
18. Cloning animals and their uses.
19. Embryonic stem cells, germ cells and iPS cells.

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

20. Introduction to Gene Therapy. Strategies based on Gene Therapy.
21. Viral vectors: retrovirus, adenovirus, adenoassociated adenovirus and lentivirus.
22. Non viral vectors.
23. Candidate diseases for Gene Therapy.
24. Stem cells and Cell Therapy. Descellularization and printing.
25. Gene Therapy versus traditional therapies.

#### **PRACTICE 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.

#### **4.4.Course planning and calendar**

For further details concerning the timetable, classroom and further information regarding this course, please refer to the "Facultad de Ciencias" website (<https://ciencias.unizar.es/grado-en-biotecnologia>).

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, the 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 also be 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 generally be held 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-biotecnologia>.

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

#### **4.5.Bibliography and recommended resources**

[http://biblos.unizar.es/br/br\\_citas.php?codigo=27127&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=27127&year=2019)