

Academic Year/course: 2021/22

## 27127 - Animal Biotechnology

### Syllabus Information

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**Academic Year:** 2021/22

**Subject:** 27127 - Biotecnología animal

**Faculty / School:** 100 - Facultad de Ciencias

**Degree:** 446 - Degree in Biotechnology

**ECTS:** 6.0

**Year:** 4

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:**

### 1. General information

### 2. Learning goals

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

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

The student must demonstrate that he has achieved the expected learning results through the following evaluation activities:

1. The assimilation and mastery of the specific competencies will be verified with a written exam, although depending on the needs, it may be oral. The written exam will consist of a series of test questions. Each of them will be valued, if the answer is correct, with 1 point. To pass the exam, it is necessary to reach 60% of the total content. The result of the assessment of the acquisition of knowledge will be 75% of the final grade.
2. 25% of the final grade will be provided by the attendance to the laboratory practices and the assessment of the presentations of the seminars related to the subject, as long as the student has obtained a grade higher than 4.5 in the exam end the course.
3. Those students who in the previous calls have exceeded 50% of the corresponding score in any of the training activities will not have an obligation to do these activities again.

**Fraud or total or partial plagiarism in any of the evaluation tests will lead to the suspension of the subject with the minimum grade, in addition to the disciplinary sanctions that the guarantee commission adopts for these cases.**

### 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 teaching and evaluation activities will be carried out in person unless, due to the health situation, the competent authorities and the University of Zaragoza require them to be carried out electronically or semi-electronically with reduced rotating capacity

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 (6 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, select spermatozoa by the swim-up technique, and they will evaluate the post-thaw and post-selection quality using the techniques learned in session 1.

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. Male reproductive system and spermatogenesis
2. Capacitation, acrosomic reaction and fertilization.
3. Semen collection and evaluation of seminal quality.
4. Conservation of gametes.
5. Female reproductive system. Reproductive cyclicity and estrous cycle.
6. Manipulation of the estrous cycle.
7. In vitro production of embryos.
8. MOET technology (multiple ovulation and embryo transfer) and embryo freezing.
9. Reproductive biotechnology applied to animal endangered species.

##### *SECTION 2: TRANSGENESIS*

10. Foundations of transgenesis. In pronucleus injection. Mouse ES cells and homologous recombination
11. Constructions for tissue-directed overexpression
12. Constructions for transient overexpression
13. Nuclear transfer in domestic animals. Human IS cells. IPS cells
14. Constructions for punctual alteration of the genome. Suppression GMOs
15. Conditional, inducible transgenics and recombinases.
16. Nucleases: ZFN, TALEN and CRISPR
17. Characterization of phenotypes and role of the genetic substrate. Databases and applications

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

18. Introduction to Gene Therapy. Strategies based on Gene Therapy.
19. Viral vectors: retrovirus, adenovirus, adenoassociated adenovirus and lentivirus.
20. Non viral vectors.
21. Candidate diseases for Gene Therapy.

22. Stem cells and Cell Therapy. Descellularization and printing.
23. 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. Evaluation of cryopreserved sperm. Swim-up
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://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=27127>

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