Universitat de Lleida

DEGREE CURRICULUM

ANIMAL BREEDING AND REPRODUCTION

Coordination: PENA SUBIRÀ, RAMONA NATACHA

Academic year 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>ANIMAL BREEDING AND REPRODUCTION</td></tr>
<tr><td>Code</td><td>101632</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th colspan="2">PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><th>Number of credits</th><td>0.6</td><td>1.4</td><td>0.6</td><td>3.4</td></tr>
<tr><th>Number of groups</th><td>2</td><td>1</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>PENA SUBIRÀ, RAMONA NATACHA</td></tr>
<tr><td>Department</td><td>ANIMAL HUSBANDRY</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>on-site or tutor-guided hours: 60h
off-site hours (self-paced): 90h</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English</td></tr>
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Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
PENA SUBIRÀ, RAMONA NATACHA	romi.pena@udl.cat	4,6	
SERRANO PÉREZ, BEATRIZ	beatriz.serrano@udl.cat	2	

Subject's extra information

Currently, animal breeding must incorporate the many biotechnological tools to complement the selection methods used to increase the economic value of farm animals. Among these tools, molecular markers and novel reproductive techniques can effectively increase the response to selection within a few generations. The combination of both technologies requires a biological understanding of quantitative traits, and a profound knowledge of how biotechnology can be applied to livestock animals.

Requirements

- Prerequisites: 101610 Genetics

- Requirements: It is advisable to take "*Biotechnology in production and animal health*" (code 101631) as an elective subject during the second block of the 4th Year.

Recommendations

Medium level of English Language, B2 or higher.

Learning objectives

Students who pass the course should be able to:

- Critically interpret the scientific and technical data selectively using information from appropriate databases
- Write clear and comprehensible reports on the work performed using suitable scientific and technical vocabulary
- Work in the laboratory using criteria of quality and good practice
- Understand the application of biotechnology in animal breeding in the context of animal science
- Understand the basics and the methodology used to generate transgenic livestock animals

Competences

A graduate in Biotechnology should:

General skills

- GC1 Being able to selectively search for and use sources of information necessary to achieve the training objectives.
- GC2 Interpret scientific-technical information with a critical sense, and be able to make presentations based

on this information.
- GC4 Knowing and adequately using the scientific and technical vocabulary of the different areas of Biotechnology.
- GC5 Working in the laboratory applying criteria of quality and good practice.

Specific skills

- CE19 To know the singularities of genetic analysis and its biotechnological functions.
- CE21 To know the fundamentals and methodology used in the genetic modification of organisms and knowing how to apply it.

Soft skills

- CT1 Being able to produce comprehensible written and oral reports on the work carried out, with a justification based on the theoretical-practical knowledge obtained.

Subject contents

SECTION 1. BIOTECHNOLOGY OF ASSISTED REPRODUCTION IN DOMESTIC ANIMALS

Topic 1. Introduction to reproductive biotechnology. (2h)

Topic 2. Artificial insemination and associated technologies. Development of AI in domestic animals. Collection and processing of semen. Storage and cryopreservation. Insemination procedures. Semen sorting technologies. Artificial insemination and in vitro fertilization. (2h)

Topic 3. Embryo transfer. Development of embryo transfer in domestic animals. Superovulation technologies. Embryo recovery and evaluation. Donor-recipient synchrony. Embryo transfer technologies. (2h)

Topic 4. In vitro embryo production. Development of in domestic animals. Oocyte collection. Evaluation and maduration of the oocyte. Sperm preparation and in vitro fertilization. IVP in commerce and in research. (4h)

Topic 5. Preservation and cryopreservation of gametes and embryos. (2h)

SECTION 2. BIOTECHNOLOGY TOOLS IN ANIMAL BREEDING

Topic 6. Animal Breeding: The role of biotechnology in animal breeding. Selection schemes. Productive animals, Traits as selection goals. Prediction of genetic value in animals (2h)

Topic 7. Genomic tools in livestock species. Molecular markers (SNPs, microsatellites, CNVs). SNP genotyping methods (PCR-RFLP; allelic discrimination; primer extension, HRM). New uses for cDNA microarrays and DNA microchips. The role of next-generation sequencing (3h).

Topic 8. Use of markers in animal production. Application of markers in selection programs. The concepts of QTL and GWAS. The major genes in livestock production (3h)

Topic 9. Use of markers in the improvement of meat and milk. MAS, GAS and genomic selection (2h).

Topic 10. Biotechnology in clinical diagnosis in animals (2h)

SECTION 3. GENE TRANSFER AND EDITING IN LIVESTOCK ANIMALS

Topic 11. Manipulation of gene expression in transgenic animals. Generation of transgenic animals: basic concepts and general strategies. Methods: (i) pronuclear microinjection of DNA into fertilized oocytes;

(ii) viral vectors; (iii) stem cell (ES cells)-mediated gene transfer; (iv) nuclear transfer; (v) semen-mediated transgenesis; (vi) genome editing. Advantages and limitation of each method. (3h)

Topic 12. Transgenic animals in animal production and health. Added value of new characters of livestock interest. Modification of the composition of milk and other traits of productive interest. Genetic modification and genetic resistance to diseases

Topic 13. Animal Pharming. GMOs as bioreactors. Obtaining recombinant proteins in milk, eggs and other products (2h)

Topic 14. Transgenic animals in applied research. Animal models of human diseases: hereditary diseases (monogenic and multifactorial). Xenotransplants, key aspects (2h)

Topic 15. Labeling of genetically modified products. Legislation. Biological safety and risks of animal transgenesis (2h)

Practicals

- Practical 1. Artificial insemination in livestock species. (2h)
- Practical 2. Practical applications of the embryo transfer. (2h)
- Practical 3. Micromanipulation of oocytes. (2h)
- Practical 4. Cryopreservation of gametes and embryos. (2h)
- Practical 5. Genotyping of molecular markers (I): Analysis of polymorphisms affecting meat quality. (8h)
- Practical 6. Genotyping of molecular markers (II): High-throughput genomic tools and the use of microsatellites in pedigree and traceability tests. (2h)

Methodology

The teaching activity is structured in theory and practical sessions, according to the time schedule included in the course **Schedule of Activites** that will be available in the course space of the Virtual Campus in **PDF** format and in the **AGENDA** tool.

1. Lecturse. Lectures are based on theory sessions and aim to present the contents of each topic. Each 2-hour session corresponds to a topic. During the 2020-21 academic year, the theoretical lectures will be taught **FACE-TO-FACE** or **ONLINE** through the Virtual Campus videoconference tool, depending on the week. Please consult the activity plan on the virtual campus.
2. Practical lessons. The practices consist of case resolution sessions, laboratory sessions. Eventually there may be an invited conference. It is **MANDATORY** that students wear the following personal protective equipment (PPE) during the teaching practices: Mask (all face-to-face practical sessions) and white lab coat (laboratory sessions). Failure to wear the described PPE or failure to comply with the general safety regulations will mean that the student cannot access the laboratories or have to leave them. Reports of the work carried out in the practical sessions must be presented, or exams will be carried out through the Virtual Campus test tool.

    - Case solving sessions aim to discuss problems and exercises that the student will have previously worked on. During the 2020-21 academic year, these sessions will be **IN-CLASS** in the classroom with a single working group, or several working groups (practice 4, block 1).
    - The laboratory sessions will be used to visualize the concepts presented in the theory class in the dissection and genetics laboratory and will be used to introduce the student to the protocols of reproductive biotechnology and molecular genetics. During the 2020-21 academic year, the laboratory sessions will be **FACE-TO-FACE** in the laboratory, except for the last session of practice 5, which will be ONLINE and the results obtained will be discussed.

3. Complementary activities. The theoretical and practical sessions will be complemented with short individual or small group work activities that the student must complete before or after the theory session (depending on the topic). These activities will be indicated in the teaching space of the subject. The "**LESSONS**" tool of the virtual campus will be used to organize the theoretical, practical and complementary tasks corresponding to each block of the subject.

The students will have the teaching material of the course in the electronic dossier of the subject. Each stage of the practical case will be complemented by an explanatory script with the objectives and procedures to be used

Development plan

The course is structured in **three blocks** of contents that include theoretical and practical activities.

The schedule of the subject varies every week so it is necessary to consult the academic schedule of the degree. The activities have been broken down into an **Schedule of Activities** that is available as a **PDF** in the Resources section and in the **Agenda** of the online campus. This Schedule indicates the day, time, space and teacher responsible for each activity.

- Regular classroom: ETSEA, building 3, floor 1, classroom 6 (3.1.06)
- Dissection room and Histophysiology Laboratory: ETSEA, building 1, floor 0, laboratory 1 (1.0.01)
- Genetics Laboratory: ETSEA, building 1, plant 1, laboratory 4 (1.1.04)

N-B. - Please, be aware of changes regarding schedules or classrooms that may come out during this semester to accommodate any changes in the health situation in our area. This notice also applies to changes in the face-to-face or online teaching of activities to respond to health emergencies that may arise during this semester.

Evaluation

Each **block** will be assessed through a **written test** that will count 20% of the final grade. In addition, for each practice a **report** will be delivered with the tasks related to the course content. Each report will provide a percentage proportional to the final grade. Attendance at practices is mandatory to present reports. The day and time of each exam can be found in the **Schedule of Activities** of the subject (Virtual Campus - Resources and Agenda).

- **BLOCK 1**
  - Exam - 20% of the final grade
  - Practice report 1 - 5% of the final grade
  - Practice report 2 - 5% of the final grade
  - Practice report 3 - 5% of the final grade
  - Practice report 4 - 5% of the final grade
- **BLOCK 2**
  - Exam - 20% of the grade
  - Practice report 5 - 15% of the grade
- **BLOCK 3**
  - Exam - 20% of the grade
  - Practical report 6 - 5% of the grade

To pass the subject it is necessary that the weighted average of these evaluative activities is equal to or greater than 5 points out of 10.

In the event that a student does not pass the subject, they may take an extraordinary exam within the same semester. The date of this exam must be consulted in the academic schedule of the 4th year of the Degree in Biotechnology.

Bibliography

Core References

- CAMPBELL AM, HEYER LJ (2003). Discovering genomics, proteomics, and bioinformatics. Benjaming Cummings.
- FALCONER DS, MACKAY TFC (1996). Introduction to quantitative genetics. Longman Group Ltd.
- FIELDS MJ, SAND RS, YELICH JV. Factors affecting calf crop. Biotechnology of Reproduction. CRC Press, 2002.
- GORDON I. Reproductive Technologies in farm animals. Cabi publishing, 2004.
- KEARSEY MJ, POONI, HS (1996). The genetical analysis of quantitative traits. Chapman and Hall
- LYNCH M, WALSH, B (1998). Genetics and analysis of quantitative traits. Sinauer Associates Inc.
- SENGER PL. (2012).Pathways to Pregnancy and Parturition. Current Conceptions, Inc.
- WELLER, JI (2001). Quantitative trait loci analysis in animals. CABI Publ.
- PRESICCE, GA (2020). Reproductive Technologies in Animals. Academic Press (https://doi.org/10.1016/C2018-0-01374-2)

Complementary sources

Genetics of Livesctock animals:

- PIPER L. & RUVINSKY A. (1997). The Genetics of Sheep. CABI Publishing.
- ROTHSCHILD M. F. & RUVINSKY A. (2011). The Genetics of the Pig. CABI Publishing.
- FRIES R. & RUVINSKY A. (1999). The Genetics of Cattle. CABI Publishing.