DEGREE CURRICULUM

ANIMAL BREEDING AND REPRODUCTION

Coordination: PENA SUBIRÀ, RAMONA NATACHA

Academic year 2019-20

ANIMAL BREEDING AND REPRODUCTION 2019-20

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>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>2</td><td>0.6</td><td>3.4</td></tr>
<tr><td>Number of groups</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>60 presential hours
90 non presentials hours</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>
<tr><td>Office and hour of attention</td><td>Romi PENA i SUBIRÀ (coordinator)
Centre: ETSEA
Department: Producció Animal (Animal Science)
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Phone: 973-70.29.18

Beatriz SERRANO PÉREZ
Centre: ETSEA
Department: Producció Animal (Animal Science)
Office: 5.01.08 Office hours: on request
Phone: 973-70.64.95</td></tr>
</table>

ANIMAL BREEDING AND REPRODUCTION 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
MARTÍNEZ ROYO, ALBERTO	alberto.martinez@udl.cat	2,4	
PENA SUBIRÀ, RAMONA NATACHA	romi.pena@udl.cat	2,4	
SERRANO PÉREZ, BEATRIZ	beatriz.serrano@udl.cat	2,4	

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, 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

Core Competencies

A graduate in Biotechnology should:

- Be able to find and use information selectively from different sources to achieve his/her goals
- Understand the scientific and technical information with a critical mind, and be able to prepare presentations based on this information
- Write clear and comprehensible reports on the work performed, based on the theoretical and practical knowledge acquired

Specific Competencies

A graduate in Biotechnology should:

- Understand and use appropriate scientific and technical vocabulary from different ambits of Biotechnology
- Work in the laboratory using quality and good practice criteria
- Understand the particularities of the genetic analysis and their biotechnological applications
- Understand the basics, the methodology and the applications of genetically modified organisms

Subject contents

SECTION 1. BIOTECHNOLOGY OF ASSISTED REPRODUCTION IN DOMESTIC ANIMALS

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

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. (3h)

Topic 3. Embryo transfer. Development of embryo transfer in domestic animals. Superovulation technologies. Embryo recovery and evaluation. Donor-recipient synchrony. Embryo transfer technologies. (4h)

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. (3h)

Topic 5. Preservation and cryopreservation of gametes and embryos. (1h)

SECTION 2. BIOTECHNOLOGY TOOLS IN ANIMAL BREEDING

Topic 6. Animal Breeding (I): production animals and traits. The role of biotechnology in animal breeding. Selection schemes. Productive animals, traits and selection objectives. Qualitative and quantitative traits. Major genes and polygenes. (2h).

Topic 7. Animal Breeding (II): E stimation of the breeding value. Data collection. Genetic parameters: heritability, repeatability correlations. The prediction of the genetic value of animals. (2h)

Topic 8. Animal Breeding (III): Selection and crossing. Directional selection: design and applications. The use of heterosis and complementarity. Introgression strategies. The response to selection. Genetic lag. (2h)

Topic 9. Genomic tools for livestock species. Molecular markers (SNPs, microsatellites, CNVs). Methods for genotyping SNPs (PCR-RFLP; allelic discrimination; primer extension; HRM). New tools: cDNA microarray and DNA microchips. Current state of the markers in livestock (2h)

SECTION 3. APPLICATIONS IN ANIMAL PRODUCTION AND HEALTH AND BIOMEDICAL FIELD

Topic 10. Using markers in animal production. Implementation of markers in selection programs. The concepts of QTL and eQTL. Major genes in livestock production. MAS, GAS and genomic selection. (2h)

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 traits of interest in livestock. Modification of milk composition and other production traits. Transgenic animals as bioreactors. Synthesis of recombinant proteins in milk, eggs and other products. Transgenic and genetic resistance to diseases. (3h)

Topic 13. Transgenic animals in applied research. Animal models of human hereditary disease: monogenic and multifactorial. Xenotransplantation, key aspects. Biological safety and risks of animal transgenesis. (1h)

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

Main concepts will be delivered in three blocks of lectures. For some activities, students will be asked to revise the teaching material before the lecture, to contribute to the global debate of the topic. Lecture and Practical's handouts will be available in the RESOURCE section at the beginning of the course.

Activity type	On-site activities		Off-site activities		Evaluation	Total time
	Aim	**H**	**Student activity**	**H**	**H**	**H**
Lectures	Explanation of main concepts	**34**	Study concepts	**60**	6	
Debate/discussion	Ethical concerns related to animal breeding and/or genetic manipulation.	**2**	Read on a particular topic and prepare debate	**5**		
Lab	Practical activities to expose students to methodologies related to the course content.	**18**	Study and write reports	**25**		
Totals		**54**		**90**	**6**	**150**

Development plan

Room: **ETSEA 03.01.06** (Building 1, 1st floor, room 6)

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Timetable : Monday and Thursday from 10-12am. Labs follow a different schedule. Please, check the development plan (uploaded in Resources - SAKAI).

Evaluation

Activity type	Grading System		Grading weight
	Procedure	**Number**	**(%)**
Tests	Written tests on lecture information	3	**20*3=60%**
Lab	Reports	2	**40%**
Total			**100%**

Observations

Each block of information covered in lectures will be evaluated through a written test that will each count towards 20% of the final mark. In addition, students must submit 2 lab reports with the topic chosen from out of the 6 practical labs (excluding the debate). Instructions as to how to prepare these reports will be given the first day of class. Each report will count towards 20% of the final mark. Attendance to all lab sessons is compulsory and can only be excused for proven medical or family emergencies. Unexcused absences will result in 0.2 points each being substracted from the final grade.

Bibliography

Basic 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. Pathways to Pregnancy and Parturition. Current Conceptions, I nc., 2006.

· WELLER, JI (2001). Quantitative trait loci analysis in animals. CABI Publ.

Complementary references

Livestock genetic series:

- 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.

Adaptations to the contents due to COVID-19

Practices 5 and 6 (laboratory) will be replaced by sessions of design of genotyping protocols and interpretation of results. These sessions will be arranged by videoconference with all participants and will be complemented by virtual tours and laboratory manuals adapted to this new content. Polymorphisms related to meat quality will continue to be used as driving examples.

Adaptations to the methodology due to COVID-19

Blocks 2 and 3 will be organized into modules. Each module will correspond to a topic of the syllabus and will specify the activities that the student must complete to learn that content. These activities include: 1) Notes and written digital material of each subject; 2) Live sessions (video conferences) where the most important points of each topic will be summarized; 3) recordings of the sessions in case a student cannot attend live sessions; 4) "Dummy tests", or self-evaluation tests, for each subject, in the virtual campus TESTS tool; 5) PDF with complementary text (usually scientific or informative article) related to each topic; 6) for some topics, watching short videos (<4 minutes) available online; 7) for some topics, short questionnaire (PDF with questions and solutions).

Adaptations to the evaluation due to COVID-19

Blocks 2 and 3 will be evaluated as follows: For each block, students will complete: 1) an online test consisting of 20 questions (T / F) chosen from those available in the "dummy tests". This test will be done individually at the agreed time; 2) Answer 4 content questions, individually or in pairs. The deadline for delivery is 05/15/2020, through the Virtual Campus ACTIVITIES tool. Each activity will count 10% in the final grade of the subject. Practices 5 and 6 will be evaluated through a report available in the Virtual Campus ACTIVITIES tool that can be answered individually or in pairs, with a deadline of 15/05/2020. This report will count for 20% of the final grade of the subject.