DEGREE CURRICULUM

ANIMAL BREEDING AND REPRODUCTION

Coordination: PENA SUBIRÀ, RAMONA NATACHA

Academic year 2017-18

ANIMAL BREEDING AND REPRODUCTION 2017-18

Subject's general information

Subject name	ANIMAL BREEDING AND REPRODUCTION
Code	101632
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	<table><tr><th>Degree</th><th>Course</th><th>Typology</th><th>Modality</th></tr><tr><td>Bachelor's Degree in Biotechnology</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr></table>
ECTS credits	6
Groups	1GG
Theoretical credits	0
Practical credits	0
Coordination	PENA SUBIRÀ, RAMONA NATACHA
Department	CIÈNCIA ANIMAL
Teaching load distribution between lectures and independent student work	60 presential hours 90 non presentials hours
Important information on data processing	Consult this link for more information.
Language	English
Office and hour of attention	Romi PENA i SUBIRÀ (coordinator) Centre: ETSEA Department: Producció Animal (Animal Science) Office: 1.01.12 Office hours: on request 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

ANIMAL BREEDING AND REPRODUCTION 2017-18

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
PENA SUBIRÀ, RAMONA NATACHA	romi.pena@ca.udl.cat	2,4	
SERRANO PÉREZ, BEATRIZ	bserrano@ca.udl.cat	2,4	
SOLÉ MÒDOL, EMMA	emmasolemodol@gmail.com	2,4	

Subject's extra information

Animal Breeding is nowadays incorporating 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 an 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 above.

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 sense, 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 ofBiotechnology
- 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): Estimation 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

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 of concepts	**60**	6	**100**
Problems and case situations	Solving problems and case situations.	**4**	Learn to solve problems and case situations.	**5**		
Lab	Practical activities: understanding principles, taking measurements...	**16**	Study and write reports	**25**		
Totals		**54**		**90**	6	**150**

Development plan

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

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

Evaluation

Tests	Practicals	Other activities
60%	40%	

Activity type	Grading System		Grading weight
	Procedure	**Number**	**(%)**
Lectures	Written tests on theory syllabus	3	**20*3=60%**
Lab	Reports	4	**40**
Total			**100**

Observations

Each block will be evaluated through a written test that will count for 20% of the final mark. In addition, for each practical a report shall be delivered with tasks related to course contents. Each report will count for 10% of the final mark. Attendance to practicals is compulsory in order to submit reports.

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.