# Genetic Improvement in Animals

Code: 100957
ECTS Credits: 6

2024/2025

| Degree | Type | Year |
|---|---|---|
| 2500253 Biotechnology | OT | 4 |

## Contact

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## Teachers

Marcelo Amills Eras

## Teaching groups languages

You can view this information at the end of this document.

## Prerequisites

There are no specific prerequisites for students, but it is recommended:

- To know fundamental concepts of Mendelian genetics, molecular genetics and biostatistics

- Be able to read scientific works in English

- Be able to use basic bioinformatic tools

## Objectives and Contextualisation

Animal Breeding is an optional subject with 6 ECTS of the first semester, within the first course of the Degree in Biotechnology. The students will learn the theoretic and practical knowledge which will allow them to participate in the genetic management of domestic animals using molecular and genomic tools, both in conservation programs, control of diseases, selection and animal breeding and biotechnological production.

The specific goals of formation are:

- To know how to measure and quantify the genetic variability of populations.

- To understand the inheritance of quantitative and multifactorial traits.

- To know the methods of analysis of the genomes of domestic animals.

- To acquire the knowledge of how to identify and analyze genes related with complex traits and how to apply them to the genetic improvement of animals.

- To know the bioinformatic tools required for the analysis of the animal genome.

- To introduce the knowledge to apply reproductive methodologies in the animal breeding.

- To know the strategies of biotechnological production in domestic animals.

## Learning Outcomes

1. CM29 (Competence) Explain the biological bases on which animal genetic improvement processes are based.
2. CM29 (Competence) Explain the biological bases on which animal breeding processes are based.
3. CM30 (Competence) Assess sex/gender inequalities in animal breeding processes.
4. KM33 (Knowledge) Determine biological entities in the regulation of natural services essential for human and environmental health.
5. SM31 (Skill) Use techniques for analysing genetic variability in domestic species.

## Content

The general content of the subject, distributed in blocks, is the following:

Block 1. Study of the animal populations and the complex and quantitative traits.

Block 2. Characteristics of the genetic animal breeding.

Block 3. Analysis of the genetic variability in animals.

Block 4. Analysis of the animal genome.

Block 5. Detection of hereditary pathologies in domestic animals.

Block 6. Biotechnology applied to domestic animals.

In addition, the student will learn the use of molecular genetics techniques for animal identification and paternity tests, the molecular determination of hereditary pathologies and the application of bioinformatic tools for genetic animal breeding. The student will solve problems through a work in the laboratory and the analysis of the obtained data. This part of the subject is structured in 4 sessions of 3 hours in the laboratory and informatic data analysis.

It is required to see the general program of the course in the web page of the Biosciences Faculty ( http://www.uab.cat/biociencies/)

It is required to see the virtual space located at the Campus Virtual de la UAB (https://cv2008.uab.cat/home/)

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|

| | | |
|---|---|---|
| Type: Directed | | |
| Laboratory practicals | 12 | 0.48 |
| Lectures | 40 | 1.6 |
| Type: Supervised | | |
| Problem solving | 12 | 0.48 |
| Type: Autonomous | | |
| Study | 82 | 3.28 |

*The teaching methodology that will be used throughout the learning process is based essentially on the student's work. The teacher will be in charge of helping him both in the acquisition and interpretation of the information and in the direction of his work. In accordance with the objectives of the subject, the training activities that will be carried out are:*

*- Traditional lectures. With these classes the student acquires the fundamental knowledge of the subject, which must be complemented with the study of the concepts explained. These classes will include practical examples that will be solved in class and the interaction and participation of the student will be encouraged.*

*-Practice of laboratory and computer room. In these classes the student applies the knowledge acquired in the resolution of real practical cases. The student learns the laboratory techniques and bioinformatic tools necessary for the analysis of the data.*

*-Autonomous. Throughout the course, the student will be given several questionnaires, problems and works that must be resolved independently or with the help of a manual that will guide him during the learning process. This activity aims to promote the ability to use computer and bibliographic resources to solve questions related to the practical application of the acquired knowledge. A small number of these works will be evaluable and will be indicated in the CV of the subject. Most of this activity will be voluntary and will serve for the self-evaluation of the student and to evaluate his work and attitude positively.*

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

## Continous Assessment Activities

| Title | Weighting | Hours | ECTS | Learning Outcomes |
|---|---|---|---|---|
| Evaluation of laboratory practicals | 15% | 0 | 0 | SM31 |
| Partial exam 1 | 40% | 2 | 0.08 | CM29, SM31 |
| Partial exam 2 | 40% | 2 | 0.08 | CM29, CM30, KM33 |
| Problems, questions and works | 5% | 0 | 0 | CM29, CM30 |

Continuous assessment

The assessment will be individual and will be carried out continuously in the context of the different training activities that have been programmed. There will be two partial exams of the theoretical part of the subject with test type questions. The partial exams will be used to release matter and can be retrieved in a final exam. The minimum mark to pass the exams will be 5 points with a maximum of 10 points. The minimum mark to do the average of a partial exam will be 4 points with a maximum of 10, with lower grades the student must recover the part obligatory. Likewise, a test of the laboratory practices will be carried out on the last day of the sessions of scheduled practices. This exam will consist of short questions and problems. This exam will not be recoverable. The Moodle (Campus Virtual) of the subject will include questionnaires, problems and works that will be evaluable and not recoverable.

The student's attitude towards the subject, the voluntary fulfilment of problems, self-assessment work and questionnaires, the level of achievement of the student towards their classmates and the participation in class will also be valued. This assessment will allow to increase the final mark obtained up to a maximum of 1.5 points (out of 10).

The dates of the exams can be consulted on the Campus Virtual of the subject or on the Faculty website.

The marks obtained in the exams will be the following proportion of the final grade:

- Partial exam 1: 40%

- Partial exam 2: 40%

- Laboratory practices exam: 15%

- Problems, questionnaires and works: 5%

The minimum mark to pass the subject will be 5 points with a maximum of 10 points.

The examination of recovery will exclusively correspond to the theoretical part of the subject and will consist of answers of double option (true / false).

Attendance at practical sessions is mandatory. The students will obtain the "Non-Appraising" qualification when the absence exceeds 20% of the programmed sessions

To participate in the recovery, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the "Non-Valuable" qualification when the assessment activities carried out have a weighting of less than 67% in the final grade.

Single Assessment

The single evaluation consists of a single synthesis test in which the theoretical contents of the entire subject program will be evaluated. The test will consist of test type questions and will be held on the same day, time and place as the last continuous assessment test of the subject (second partial exam). The mark obtained in this test will account for 80% of the final grade of the subject.

Students who use the single evaluation must carry out laboratory practices (PLAB) in in-person sessions that will follow the same process of continuous evaluation (last day of the laboratory sessions). The laboratory practices exam weighs 15%. Assistance to laboratory practices is mandatory.

Delivery of quizzes, problems, and works will follow the same procedure as continued assessment, via Moodle of the subject (Campus Virtual) and account for 5% of the final mark.

The single assessment can be recovered on the day set by the assignment recovery.

## Bibliography

Most relevant bibliography

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-Galas DJ i Mc Cormack SJ. (Ed.) (2002). Genomic technologies. Present and Future. Caister Academic Press, Norfolk, UK

-Krebs J.E., Goldstein E.S., Kilpatrick S.T. (2017). Lewin's GENES XII. Jones & Bartlett Learning; Edición: 12.

-Mount DW. (2001) Bioinfomatics. Cold Spring Harbor Laboratory Press.

-Nicholas F.W. (2009). Introduction to Veterinary Genetics. Blackwell Publishing.

-Strachan, Tom and Read, Andrew P. (1999). Human Molecular Genetics 2. 2nd ed. Oxford, UK: BIOS Scientific Publishers Ltd. Acceso online: http://www.ncbi.nlm.nih.gov/books/NBK7580/?term=human%20molecular%20genetics%20strachan

Additional articles

-Abasht B, Dekkers JC, Lamont SJ. (2006). Review of quantitative trait loci identified in the chicken. Poult Sci. Dec;85(12):2079-96.

-Andersson L. (2001). Genetic dissection of phenotypic diversity in farm animals. Nat Rev Genet., 2: 130-138.

-Andersson L, Georges M. Domestic-animal genomics: deciphering the genetics of complex traits. Nat Rev Genet. 2004 Mar;5(3):202-12.

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-Dekkers JC y Hospital F. (2002). The use of molecular genetics in the improvement of agricultural populations. Nat Rev Genet., 3: 22-32.

-Fadiel A, Anidi I, Eichenbaum KD. (2005). Farm animal genomics and informatics: an update. Nucleic Acids Res. Nov 7;33(19):6308-18.

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-Goddard M.E. y Hayes B.J. (2009). Mapping genes for complex traits in domestic animals and their use in breeding programmes. Nature Reviews Genetics, 10:381-391.

- Kues WA1, Niemann H.(2011). Advances in farm animal transgenesis. Prev Vet Med. 2011 Nov 1;102(2):146-56.

-Haley C. y Vischer P. (1999) DNA markers and genetic testing in farm animal improvement: Current applications andfuture prospects. Roslin Institute, Edinburgh, Annual Report 98-99, 28-39. http://www.roslin.ac.uk/publications/9899annrep/abst-markers.html

- Ragoussis J. (2009).Genotyping Technologies for Genetic Research. Annu. Rev. Genomics Hum. Genet. 10:117-33

-Rockman MV,Kruglyak L. Genetics of global gene expression. Nat Rev Genet. 2006 Nov;7(11):862-72.

-Rothschild MF, Hu ZL, Jiang Z. (2007). Advances in QTL mapping in pigs. Int J Biol Sci. Feb 10;3(3):192-7.

-Sobrino,B, Briona M., Carracedo A. (2005). SNPs in forensic genetics a review on SNP typing methodologies. Forensic Science International, 154: 181-194.

-Vignal A., Milan D., Sancristobal M., EggenA. (2002) A review on SNP and other types of molecular markers and their use in animal genetics. Genet. Sel. Evol.: 34, 275305.

Webs

-Books-NCBI: http://www.ncbi.nlm.nih.gov/books

-U.S Pig Genome Mapping Site: www.animalgenome.org/pigs/

-OMIA - Online Mendelian Inheritance in Animals: http://omia.angis.org.au/home/

-The Bovine Genome Database: http://genomes.arc.georgetown.edu/drupal/bovine/

## Software

-AnimalQTLdb: http://www.animalgenome.org/QTLdb/

-BioMart: http://www.ensembl.org/biomart/martview

-Ensembl: http://www.ensembl.org/index.html

-PLINK: https://www.cog-genomics.org/plink/

-R (The R Project for Statistical Computing): https://www.r-project.org

## Language list

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (PLAB) Practical laboratories | 441 | Catalan | first semester | afternoon |
| (PLAB) Practical laboratories | 442 | Catalan | first semester | afternoon |
| (TE) Theory | 44 | Catalan | first semester | morning-mixed |