Universitat Autònoma de Barcelona

2020/2021

Genetic Improvement in Animals

Code: 100957
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Armand Sánchez Bonastre
Marcelo Amills Eras

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.

Competences

- Apply the principal techniques for the use of biological systems: recombinant DNA and cloning, cell cultures, manipulation of viruses, bacteria and animal and plant cells, immunological techniques, microscopy techniques, recombinant proteins and methods of separation and characterisation of biomolecules.
- Describe the molecular, cellular and physiological bases of the organisation, functioning and integration of living organisms in the framework of their application to biotechnological processes.
- Design continuation experiments for problem solving.
- Identify the strategies for producing and improving products in different sectors using biotechnological methods and display an integrated vision of the R&D&I process.
- Interpret experimental results and identify consistent and inconsistent elements.
- Learn new knowledge and techniques autonomously.
- Make decisions.
- Obtain information from databases and use the software necessary to establish correlations between the structure, function and evolution of macromolecules.
- Read specialised texts both in English and ones own language.
- Reason in a critical manner
- Search for and manage information from various sources.
- Search for, obtain and interpret information from the principal databases on biology, bibliography and patents and use basic bioinformatic tools.
- Think in an integrated manner and approach problems from different perspectives.
- Use ICT for communication, information searching, data processing and calculations.
- Work individually and in teams

Learning Outcomes

1. Apply biotechnological processes to lactic proteins.
2. Apply programmes for the comparative analysis of animal genomes.
3. Design continuation experiments for problem solving.
4. Explain embryo manipulation techniques as applied to animal improvement.
5. Explain the biological principles behind genetic improvement processes in animals.
6. Interpret experimental results and identify consistent and inconsistent elements.
7. Learn new knowledge and techniques autonomously.
8. Make decisions.
9. Read specialised texts both in English and ones own language.
10. Reason in a critical manner
11. Search for and manage information from various sources.
12. Think in an integrated manner and approach problems from different perspectives.
13. Use ICT for communication, information searching, data processing and calculations.
14. Use and interpret information from useful databases in the field of genetic improvement in animals.
15. Use the techniques for analysing genetic variability in domestic species.
16. Work individually and in teams

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/)

"*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

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.

**The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practicals	12	0.48	7, 2, 11, 6, 16, 14, 15

Lectures	40	1.6	2, 3, 5, 4, 12, 8, 10, 14, 1
Type: Supervised			
Problem solving	12	0.48	7, 13, 11, 9, 16, 14
Type: Autonomous			
Study	82	3.28	2, 5, 14, 15, 1

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 answers of double option (true / false). 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 CV 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 fulfillment 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 CV 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 amaximum 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 "

**Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evaluation of laboratory practicals	15%	0	0	13, 2, 6, 15
Partial exam 1	40%	2	0.08	13, 11, 3, 5, 9, 12, 8, 10, 14, 15
Partial exam 2	40%	2	0.08	13, 2, 11, 3, 4, 9, 12, 8, 10, 14, 1
Problems, questions and works	5%	0	0	7, 13, 11, 9, 16, 14

Bibliography

Books

-Brown, T. A. (2002). Genomes. 2nd ed. Oxford, UK: BIOS Scientific Publishers, Ltd; 2. Free online acces to 2nd edition https://www.ncbi.nlm.nih.gov/books/NBK21128/

-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

-Strachan, Tom and Read, Andrew P. (1999). Human Molecular Genetics 2. 2nd ed. Oxford, UK: BIOS Scientific Publishers Ltd

Research 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.

-Bidanel J.P. y Rothschild M. (2002). Current status of quantitative trait locus mapping in pigs. Pig News and Information, 23: 39N-54N.

-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.

-Georges M. (2007). Mapping, fine mapping, and molecular dissection of quantitative trait Loci in domestic animals. Annu Rev Genomics Hum Genet.; 8:131-62.

-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.

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

-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.

-International Chicken Genome Sequencing Consortium. 2004. Sequence and comparative analysis of the chicken genome provide unique perspectives on vertebrate evolution. Nature 432:695-716

-Lindblad-Toh et al., (2005). Genome sequence, comparative analysis and haplotype structure of the domestic dog. Nature. 2005 Dec 8;438(7069):803-19.

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/