Universitat Autònoma de Barcelona

Advanced Genetic Improvements 2016/2017

Code: 42928
ECTS Credits: 6

Degree	Type	Year	Semester
4313802 Advanced Genetics	OT	0	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

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Prerequisites

A basic understanding of molecular genetics, population genetics and quantitative genetics is advisable.

Objectives and Contextualisation

The agroindustry in Europe is represented by 310,000 companies with an approximate economic value of 1 billion euros. In Spain, it represents the 17% of the Gross Product, comprises 32,000 companies and exports for a value of 13 billion euros.

Animal breeding and genomics are the pillars of an efficient and sustainable animal production. Many companies, as Monsanto, Evogene, Hypor, ABS Global US and Du Pont have specialized in the production of high-valued genetic resources aimed to improve the economic imput of farmers.

Our main goal is to provide to students with a highly specialized formation on Animal Breeding and Genomics. This knowledge would be fundamental to develop a career in the agricultural and farming industry as geneticists and animal breeders.

The specific goals of the course are listed below:

- Learn the statistical methodology to understand the genetic evaluation of animals and plants both using the IBD and molecular coancestry approaches.

- Develop strategies to optimize genomic selection.

- Learn new methods for the analysis of the genetic diversity of populations.

- Learn the methods used in the genome analysis of domestic animals.

• Introduce the student to the methods used to identify and analyze genes that contribute to the variability of complex traits in animals.

• Acquire bioinformatics skills for the genome analysis of domestic animals.

• Infer the processes that contributed to the formation of domestic animal populations from molecular data.

Skills

- Demonstrate a mastery of genetic analysis as a transversal tool applicable to any field of genetics.
- Demonstrate responsibility in management of information and knowledge.
- Design and apply scientific methodology in resolving problems.
- Identify and propose scientific solution for problems related to genetic research at both molecular and organism levels and demonstrate an understanding of the complexity of living beings.
- Possess and understand knowledge that provides a basis or opportunity for originality in the development and/or application of ideas, often in a research context
- Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
- Students should know how to apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study
- Use and manage bibliographical information and other resources related to genetics and related fields.
- Use scientific terminology to argue the results of the research and show how to communicate in spoken and written English in an international setting.

Learning outcomes

1. Apply bibliographical information about rules and legislation in risk assessment.
2. Apply methodology and knowledge acquired in the solution of practical problems of genetic improvement.
3. Demonstrate advanced knowledge of quantitative genetics and its application in genetic improvement.
4. Demonstrate responsibility in the management of information and knowledge and in the direction of groups and/or projects in multidisciplinary teams.
5. Demonstrate up-to-date knowledge of biocomputing methodology in the interest of genetic improvements.
6. Demonstrate up-to-date knowledge of the methodologies of molecular analysis of genetic variability and animal genomics.
7. Preparation and presentation of seminars
8. Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent
9. Use scientific terminology to argue the results of the research and show how to communicate in spoken and written English in an international setting.
10. Write a report that considers the use of the methodology used in the module to resolve a specific problem
11. Write critical summaries about the taught seminars

Content

GENERAL PART

Tema 1. Introduction to Animal Breeding.

Tema 2. Domestication.

Tema 3. The foundations of Animal Breeding and Selection.

Tema 4. The foundations of Animal Genomics.

Tema 5. Breed conservation strategies.

SPECIFIC PART

Tema 6. Breeding and Genomics of ruminants.

Tema 7. Breeding and genomics of swine.

Tema 8. Breeding and genomics of rabbits.

Tema 9. Genomics of dogs and cats.

Tema 10. Breeding and genomics of chicken.

Methodology

The activities of the course will include:

-Theoretical dissertations. In theses lectures the student will learn the fundamental concepts of the course. The theoretical dissertations will be complemented with applied examples and problems to be solved in class.

-Self-study - presentation of scientific articles. A recent scientific article will be assigned to the student for its critical reading and presentation in class.

-Self-study - work in group. Quizzes and exercises will be assigned to the students to be solved in groups. This work will require the use of bibliographic searches and bioinformatics resources.

-Tutorial class: tutorial sessions will be programmed for the resolution of questions and to guide students in the presentation of scientific articles and the resolution of exercises.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Presentation of scientific articles	4	0.16	1, 3, 7, 9, 10
Theoretical dissertations	26	1.04	1, 2, 3, 5, 6, 8
Type: Supervised			
Self-study-Presentation of scientifc articles	25	1	1, 2, 3, 6, 7, 9, 11
Self-study-Work in group	15	0.6	4, 10
Type: Autonomous			
Self-study	59	2.36	8, 11

Evaluation

The evaluation of the students will involve a written test exam (50%) with true/false responses, the presentation of a scientific article (30%) and one assignment (20%).

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Exercises and problems	20%	4	0.16	3, 5, 6, 10, 11
Presentation of a scientific article	30%	15	0.6	1, 3, 4, 6, 7, 9, 10, 11
Test exam	50%	2	0.08	2, 3, 5, 6, 8

Bibliography

Books

Brown, T. A. (2002). Genomes. 2nd ed. Oxford, UK: BIOS Scientific Publishers, Ltd; 2

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

Lynch M., Walsh B. 1998. Genetics and analysis of quantitative traits. Sinnauer, Sunderland.

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Searle S.R., Casella G., McCulloch C.E. 1992. Variance components. Wiley, NewYork.

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

Articles

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

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Groeneveld LF, Lenstra JA, Eding H, Toro MA, Scherf B, Pilling D, Negrini R, Finlay EK, Jianlin H, GroeneveldE, Weigend S; GLOBALDIV Consortium. 2010. Genetic diversity in farm animals--a review. Anim Genet. 41 Suppl 1:6-31

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Henderson C.R. 1976. A simple method for computing the inverse of a numerator relationship matrix in prediction of breeding values. Biometrics 32, 69-83.

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Kennedy B.W., Sorensen D.A. 1989. Properties of mixed-model methods for prediction of genetic merit. En B.S. Weir, E.J. Eisen, M.M. Goodman, G. Namkoong (eds.) Proc. of the Second International Conference on Quantitative Genetics, pp 91-103. Sinauer, Sunderland.

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Toro M.A., García-Cortés L.A., Legarra A. 2011. A note on the rationale for estimating genealogical coancestry from molecular markers. Genet. Sel. Evol., 43, 27.

Wiener P, Wilkinson S. 2011. Deciphering the genetic basis of animal domestication. Proc Biol Sci. 278: 3161-70.

Internet resources

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/