

28418 - Quantitative and molecular genetics in animal breeding

Syllabus Information

Academic year: 2023/24

Subject: 28418 - Quantitative and molecular genetics in animal breeding

Faculty / School: 105 - Facultad de Veterinaria

Degree: 451 - Degree in Veterinary Science

ECTS: 6.0

Year: 2

Semester: Second semester

Subject type: Compulsory

Module:

1. General information

The objective of the subject is to know and use the strategies of animal genetic improvement and conservation of genetic resources, to be able to give genetic counselling in pathologies of hereditary origin and to know the possibilities of transgenesis and gene therapy in veterinary medicine.

This objective and the contents of the subject make it possible to increase the competitiveness of livestock populations and disposable income in rural areas (SDGs 1, 8 and 10), contribute to the maintenance of the environment and agro-livestock ecosystems (SDGs 12 and 15) and produce healthier food (SDGs 2 and 3) with a greater environmental respect (SDG13).

It is advisable that the student has acquired the competences related to the basic training subjects of the first year and the first four-month period of the second year. Those corresponding to Genetics and Statistics are considered especially necessary for the subject's correct follow-up

2. Learning results

- To understand the fundamentals of animal breeding developed from productive, genealogical and molecular information.
- To know the genetic analysis of the traits involved in selection objectives and criteria.
- To be able to construct and interpret results of genetic evaluation models of selection candidates using genealogical, phenotypic and molecular information.
- To discern between basic alternatives oriented to the design of improvement plans for cattle breeds and selection schemes for specialized genetic lines.
- To know the appropriate measures to estimate and control inbreeding levels.
- To be able to give genetic counselling in pathologies of hereditary origin.
- To know the methodological basis and applications of gene transfer in veterinary medicine.

3. Syllabus

BLOCK I. INTRODUCTION

Topic 1. Introduction to animal breeding.

BLOCK 2. GENETIC STRUCTURE OF A QUANTITATIVE CHARACTER.

Topic 2. Values, means and variances.

Topic 3. Kinship and consanguinity.

Topic 4. Relatedness, heritability and repeatability.

BLOCK 3. SELECTION.

Topic 5. Response to selection and correlated response.

Topic 6. Selection indexes

Topic 7. Best linear unbiased predictor (BLUP).

BLOCK 4. MOLECULAR GENETICS AND SELECTION

Topic 8. Linkage disequilibrium and quantitative expression gene (QTL) detection.

Topic 9. Gene- and marker-assisted selection.

Topic 10. Genomic selection

BLOCK 5. CROSSING.

Topic 11. Heterosis and complementarity.

Topic 12. Types of crossbreeding.

BLOCK 6. CONSERVATION

Topic 13. Endogamic depression and effective size.

Topic 14. Genetic management for conservation.

BLOCK 7. IMPROVEMENT PROGRAMS.

Topic 15. Organization of genetic improvement.

Topic 16. Introduction to improvement programs.

BLOCK 8. INHERITANCE OF DISEASES IN DOMESTIC ANIMALS.

Topic 17. Hereditary diseases associated with single copy genes and multigene inheritance.

Topic 18. Control and eradication of hereditary diseases.

BLOCK 9. GENOME MANIPULATION IN BREEDING.

Topic 19. Transgenesis as a tool in veterinary medicine.

Topic 20. Therapies based on genetic modification and their applications in breeding.

4. Academic activities

1. Theoretical classes. 30 sessions of 1 hour to develop key concepts.
2. Types of problems. 12 sessions of 1 hour to solve theoretical situations.
3. Practical classes. 8 face-to-face or telematic sessions of 2 hours supported by freely available simulation programs (<https://sites.google.com/a/unizar.es/pqgen/>), with free statistical analysis software (www.r-project.org) and through access to on-line databases
4. Problem solving. A face-to-face session of 2 hours, dedicated to the resolution of previously posed problems.
5. Individual study and solving of cases proposed in a non-face-to-face basis.

5. Assessment system

The student must demonstrate achievement of the intended learning results through the following assessment activities:

1. Theoretical exam: Development of multiple choice, true/false, short questions and developmental topics for a period of 1.5 hours (50% of the grade). Wrong answers in multiple-choice questions will subtract from the final grade the value of the question divided by the possible number of wrong answers.
2. Exam of problems and practical questions: Development of multiple choice questions and problems for a period of 1.5 hours (30% of the grade). Wrong answers in the multiple choice questions will subtract from the final grade the value of the question divided by the possible number of wrong answers. During the development of the exercise the student will have access to the bibliographic material.
3. Practices: Students will be asked to solve the questions individually (10% of the grade). The evaluation will be carried out throughout the semester, once the corresponding practical sessions have been completed.
4. Classroom problems: Students will perform pre-prepared problems in the problem solving session (10% of the grade).

Sections 1 (Theoretical Examination) and 2 (Examination of problems and practical questions) must be passed with at least 4 out of 10.

Tests for non-face-to-face students

1. Theoretical exam: Development of multiple choice, true/false, short questions and developmental topics for a period of 1.5 hours (60% of the grade). Wrong answers in multiple-choice questions will subtract from the final grade the value of the question divided by the possible number of wrong answers.
2. Exam of problems and practical questions: Development of multiple choice questions and problems for a period of 1.5 hours (40% of the grade). Wrong answers in the multiple choice questions will subtract from the final grade the value of the question divided by the possible number of wrong answers. During the development of the exercise the student will have access to the bibliographic material.