Code: 1691 **Genetics**
Degree: 1st cycle – Animal Production Engineering
Curricular Year: 2nd **Semester Course: 2nd**
Credits: 6 ECTS **Compulsory**
Language: Portuguese/English
Prerequisites: Cell Biology and Microbiology
Responsible: João Manuel Neves Martins
Other lecturer(s): Maria Wanda Sarujine Viegas, Maria Margarida Cabrita Xavier Delgado, Helena Sofia de Henriques Lebre de Campos Pereira and Victor Alves (FMV)
Web Site: http://www.isa.utl.pt/home/node/3967

1. Contact hours:
Lecture/Practicals 70 **Others** 14 **Total** 84

2. Objectives:

On completion of this subject, students should be able to (i) express the meaning and specific application of a range of genetic tools, (ii) estimate breeding values and use genetic tools to determine the impact of selection and crossbreeding, (iii) identify the impact of inbreeding depression, (iv) evaluate a range of genetic tools (including molecular and reproductive technologies) for genetic or breeding programmes.

3. Programme:

INTRODUCTION:
- The genetic approach to animal Biology.
- Single-gene inheritance;
- Independent assortment of genes;
- Mapping eukaryote chromosomes by recombination.
- The genetics of bacteria and their viruses

FROM DNA TO PHENOTYPE:
- Gene interaction: penetrance and expressivity;
- DNA: structure and replication;
- RNA: transcription and processing;
- Proteins and their synthesis;
- Regulation of gene expression in bacteria and their viruses;
- Regulation of gene expression in eukaryotes;
- The genetic control of development;
- Genomes and genomics.

MUTATION, VARIATION, AND EVOLUTION:
- The dynamic genome;
- Mutation, repair, and recombination;
- Large-scale chromosomal changes.

POPULATION GENETICS:
- Variation and its modulation;
- Effect of sexual reproduction on variation;
- Sources of variation: mutation; migration: selection and random drift;
- Selection;
- Balanced polymorphism: Overdominance and underdominance;
- Random Events.

QUANTITATIVE GENETICS:
- Genes and Quantitative Traits;
- Some Basic Statistical Notions: Statistical distributions, Statistical measures;
- Genotypes and Phenotypic Distribution;
- Norm of Reaction and Phenotypic Distribution;
- Determining Norms of Reaction: Domesticated animals, Studies of natural populations;
- The Heritability of a Quantitative Character: Familiarity and heritability, Phenotypic similarity between relatives;
- Quantifying Heritability: Methods of estimating H^2, The meaning of H^2 and h^2, Narrow heritability,
- Estimating the components of genetic variance, Artificial selection, The use of h^2 in breeding;
- Locating Genes: Marker-gene segregation, Quantitative linkage analysis.

4. Bibliography:

Main Bibliography

Griffiths A.J.F., Wessler S.R., Lewontin R.C., Carroll S.B. (2009) Introdução à Análise Genética. (9ª Edição) Ed. Guanabara Koogan. [ISBN: 13: 978-85-277-1497-6]
Falconer D.S. (1985) Introdução à Genética Quantitativa. (2ª Edição traduzida). [Policopiado]
Martins A. (1980) – *Apontamentos de Genética de Populações*. ISA, Lisboa.
Martins A. (1986) - *Apontamentos de Genética Quantitativa*. ISA, Lisboa.
Neves Martins J. (2008) – *Exercícios de Genética*. ISA, Lisboa.

Other Bibliography

Griffiths A.J.F., Wessler S.R., Lewontin R.C., Carroll S.B. (2008) Introduction to Genetic Analysis (9thEd.) W.H.Freeman & Cª. London & NY [ISBN: 978-0-716-76887-6]
Klug W.S., Cummings M.R., Spencer C., Palladino M.A. (2009) Concepts of Genetics (9th Ed.). Pearson Ed. Inc.
Falconer D.S., Mackay T.F.C. (1996) Introduction to Quantitative Genetics. 4th Ed. Longman [ISBN: 9780582243026]
Kinghorn J., Werf Van der, & Ryan M. (2001) *Animal Breeding. Use of New Technologies*. Twynam Press.
Martins A. (1993) *Heritabilidade e ganho de selecção em populações de propagação vegetativa e de reprodução sexuada*. ISA, Lisboa.

5. Assessment:

Obligations: Presence in 75% of all lectures time (normal accepted attendance).
Continuous evaluation during all theoretical-practical lectures the student will have a 15 min. questionnaire (4-5 questions), with exercises (30%), 3 tests, with a global (50%) and a final oral and written summary presentation of a scientific paper (20%). If Continuous evaluation ≥ 9,5 the final exam will be not needed. The averages of these three parts must be bigger than 8 values.
Final Exam, requested for the students with a continuous evaluation under 9,5 values.
Final Score: The student final evaluation score will be the continuous evaluation (≥ 9,5) or its mean with the final exam.

6. Estimated Workload: 168 Hours

7. Last Update: 9/3/2011