![Instituto Politécnico de Bragança logo](ipb logo)

Course Unit	Genetic Biotechnology			Field of study	Animal Science		
Master in	Technology and Animal Science			School	School of Agriculture		
Academic Year	2023/2024	Year of study	1	Level	2-1	ECTS credits	6.0
Type	Semestral	Semester	1	Code	5026-810-1102-00-23		

Workload (hours)	162	Contact hours	T	-	TP	-	PL	-	TC	-	S	-	E	-	OT	-	O	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s)	Teresa Maria Montenegro Araújo A. Correia

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
The student should know the most recent techniques in genetic biotechnology and understand their applicability to Animal Science. Pay attention to the ethical part involved.

Prerequisites

Before the course unit the learner is expected to be able to:
Students must have knowledge of genetics

Course contents

Knowledge of cytogenetics with application in animal production and health.
Study of animal genomes and new genome editing technologies - CRISPR-cas9
Use of RNAi in functional genomics.
Microbial metagenomics, new challenges in animal production.
Practice
Development of basic molecular genetic protocols
Research of genomic databases and data interpretation.

Course contents (extended version)

1. Cytogenetics
   - Chromosome constitution
   - Different types of banding
   - "In situ" hybridization
   - Constitution and analysis of karyotypes of different animal species
2. RNAi for improvement of animal breeding
   - Mechanisms of RNAi
   - Pathways of RNA silencing
   Transcriptional
   Posttranscriptional
   - Transgenic expressing of RNAi-inducing molecules
3. From gene to genomic. Genomic selection: a molecular tool for genetic improvement in animals
   - Most used molecular markers in animal science
   - Real time-PCR
   - Next-generation sequencing
   - Use of microarrays in animal breeding and animal health
4. Gene terapy
   - Viral and non-viral vectors.Advantages and disadvantages
   - Target tissues and applications in monogenic and polygenic diseases
   - vaccines
5. Target genome editing
   - New tools for genome editing - CRISPR-Cas9
   - Origin and mechanisms of CRISPR-cas9.Scientific advantages and applications
   - Ethical aspects
6. Microbial metagenomics, new challenges in animal production
   - Microbiome: intestinal, mammary gland and vagina
   - Reconstructing the genomic content of microbial community from NGS data
7. Practical
   - Extraction of DNA from diferente animal tissues
   - PCR and electrophoresis
   - Culture of microorganisms
   - Interpretation and consultation of genomic databases

Recommended reading

1. Barrango, R.,Sontheimen, E.,J.; Marraffini,L.A.; 2022. CRISPER Biology and Aplications. Americaqn Society for Microbiology. London, United Kingdom
2. SuKanta Mondal and Ram LaKhan, 2021. Advances in Animal Genomics.ELSEVIER. London, United Kingdom
3. Chowdhury, B., Garai, G., 2017 A review on multiple sequence aligmment from the prespective of genetic algoritm. genomics 109, 419-431
4. Array,J., 2010. Sistemas de informação para sistemas de microarry.Tese de Doutoramento. Universidade de Aveiro, Portugal.
5. Iyle, Eid, J.,Fehr, A., Gray, j., luong, k.J., Otto, G., Peluso, P., rank, D., et all., 2009.Real-time DNA sequencing from single polymerase molecules. Science 323 (5910), 133-138

Teaching and learning methods

Theoretical classes accompanied by media and multimedia.
Students will be encouraged to research some newer topics, checking the status of ART.
At a practical level, laboratory classes will be held.
At the end, students will have to present an exhibition on a chosen topic.

Assessment methods

1. Continuous evaluation (60% P+40%) - (Regular, Student Worker) (Final, Supplementary)
   - Intermediate Written Test - 40% (Minimum score 8)
   - Presentations - 60% (Minimum score 9.5)
2. General exame 100% (T/P) minimum score of 9.5 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100% (Written exam (T/P). Minimum score of 9.5)

Language of instruction

1. Portuguese
2. Spanish

Electronic validation

Teresa Maria Montenegro Araújo A. Correia	Vasco Augusto Pilão Cadavez	Alfredo Jorge Costa Teixeira	Ramiro Corujeira Valentim
18-01-2024	07-02-2024	08-02-2024	08-02-2024