INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Genetically Modified Organisms			Field of study	Biology and biochemistry		
Master in	Biotechnological Engineering			School	School of Agriculture		
Academic Year	2021/2022	Year of study	1	Level	2-1	ECTS credits	5.0
Type	Semestral	Semester	1	Code	5010-509-1105-00-21		

Workload (hours)	135	Contact hours	T	TP	PL	TC	S	E	OT	O
			25	-	25	-	-	-	4	-

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): Maria João Almeida Coelho Sousa

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
Acquire skills in molecular biology and to master GMO strategies and different detections methods adapted to different materials. To know about regulation and labeling of GMO

Prerequisites

Before the course unit the learner is expected to be able to:
have knowledge of biology, genetics and biochemistrye

Course contents

Definition of GMOs; Using transgenic animals, plants and microorganisms in various applications. Genetic manipulation of microorganisms: getting GMO producers compounds. Recombinant DNA techniques: a prokaryotic / eukaryotic DNA. Extraction of nucleic acids and production of plants / transgenic animals. Selection of GMO. Molecular analysis of GMO. Expression of the DNA of interest. Methods of detection / quantification of GMO. GMO Legislation: Labelling and traceability

Course contents (extended version)

1. GMO definition, short historical perspective
   - What are GMOs and how they came
   - Where we can find OGMs. Some examples
   - Canola, Maize, Rice, Tomato, Soybean; rats, mousse, and cellular lines; bacteria and yeast
2. Use of transgenic animals for the production of proteins of commercial interest
   - Ex: Industrial / Laboratory of Protein production of GMOs.
   - Advantages of prokaryotic vs eukaryotic cell in synthesis and posttranslational modification
3. Transgenic animals in human / veterinary medicine
   - Studies of diseases
   - Xenotransplantation
4. Transgenic plants producing a protein of pharmacological interest
   - Production of hormones, vaccines or other examples
   - Antibodies production structure and function: Polyclonal and monoclonal
   - Agronomic and commercial improvement
   - Production of compounds
   - Genetic manipulation of microorganisms: getting GMO producers compounds.
5. Molecular Biology - Basic Techniques. DNA Prokaryotic versus Eukaryotic.
   - Nucleic acids isolation and separation GMO by DNA detection
   - Nucleic acids manipulation: Techniques and basic tools
   - Recombinant DNA techniques: prokaryotic / eukaryotic DNA. obtaining transgenic plants and animals.
   - Selection of GMOs. Molecular analysis of GMOs. Stable / transient incorporation of DNA.
   - Detection and quantification GMOs strategies Expression of the DNA of interest.
   - DNA detection: polymerase chain reaction(PCR), PCR types (PCR screening, nested, RT-PCR, multiplex)
   - Electrophoresis; Hybridization probes
   - Quantification methods: quantitative competitive PCR (QC-PCR), real time PCR (PCR-RT)
   - Protein detection: Radioactive isotopes. Conjugates: enzyme activity and fluorochromes. immunoassays
   - Biotest, Immunological test(ELISA), Lateral flow(FL), Western blot
6. Alternative methods to detect and quantification of GMOs
   - Chromatography and Mass spectrometry
   - DNA Microarrays and microchips
   - Infrared spectroscopy
7. Regulation and legislation

Recommended reading

1. Albert C, Laurent M. S., Norin C. , Yonglong C. , Louis Du Pasquier, Jana L., Nicolas P, Michael R. , Daniel L. W. , Odile J. B. (2008). Transgenesis producers in Xenopus. Biol cell 100 (9): 503-521.
2. Brown T. (2010) Gene Cloning and DNA Analysis: An Introduction (Brown, Gene Cloning and DNA Analysis)
3. Rapley R. , & Harbron S. (2011). Molecular Analysis and Genome Discovery. 2th edn. John Wiley & Sons, Chichester
4. Erando k. , Harvey, Chistopher T. R. , Barry J. H. , Mikko A. (2011). Transgenic animal models of neurodegeneration based on human genetic studies. J Neural Trans. 118 (1): 27-45.
5. James D. Watson, Richard M. Meyers, Amy A. Caudy (2007)Recombinant DNA: Genes and Genomes - A Short Course, 3th Ed. (Watson, Recombinant DNA)ISBN-13: 978-0716728665

Teaching and learning methods

Theoretical lessons with expositive methods, utilization of audio-visual resources. Laboratorial practical lessons with final presentation of reports

Assessment methods

1. Attendance of 3/4 of practical lessons - (Regular) (Final, Supplementary, Special)
2. pratical exame - (Regular) (Final, Supplementary)
   - Final Written Exam - 30% (85% Assessment of practical work with a final written exam. Minimum successful result 10 marks)
   - Practical Work - 10% (lab. work and presentation)
3. evaluation of pratical part - (Student Worker) (Final, Supplementary, Special)

Assessment methods

- Final Written Exam - 40% (practical work with a final written exam. Minimum successful result 9, 5 marks)
4. evaluation of theorical part - (Regular) (Final, Supplementary, Special)
- Final Written Exam - 50% (practical work with a final written exam. Minimum successful result 9, 5 marks)
- Development Topics - 10% (work developed and presented by students in class)
5. final exame theorical - (Student Worker) (Final, Supplementary, Special)
- Final Written Exam - 60% (theorical work with a final written exam. Minimum successful result 9, 5 marks)

Language of instruction

1. English
2. Portuguese

Electronic validation

Maria João Almeida Coelho Sousa	Altino Branco Choupina	Paula Cristina Azevedo Rodrigues	Maria José Miranda Arabolaza
29-11-2021	30-11-2021	01-12-2021	02-12-2021