INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Recombinant DNA Technologies			Field of study	Biology and biochemistry		
Master in	Biotechnological Engineering			School	School of Agriculture		
Academic Year	2023/2024	Year of study	1	Level	2-1	ECTS credits	5.0
Type	Semestral	Semester	2	Code	5010-784-1205-00-23		

Workload (hours)	135	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): Maria João Almeida Coelho Sousa

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
Identify recombinant DNA techniques. Know genetic concepts and biological models/applications. Recognize requirements for manipulation/characteristics/potentialities/limitations of techniques/models

Prerequisites

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

Course contents

Genetic manipulation: Animals, plants, microorganisms' models. Expression vectors, heterologous DNA, biological models' selection/determination. Application in different areas. Metabolic engineering: homologous recombination, gene insertion/deletion, Genome editing: Synthetic biology: Principles/techniques: Red/ET recombination, Linear-Linear Homologous Recombination, Transformation Associated Recombination, in vitro Sequence Ligation Independent Cloning and bioblocks

Course contents (extended version)

1. Genetic manipulation of organisms to obtain bioproducts
   - What are DNA recombination techniques and is historical perspective
   - Where we can find genetic manipulation. Some examples
2. Transgenic animals in human / veterinary medicine
   - Studies of diseases
   - Xenotransplantation
3. Transgenic plants producing a protein of pharmacological interest
   - Production of hormones, vaccines or other examples
   - Agronomic and commercial improvement
   - Production of compounds
   - Genetic manipulation of microorganisms: getting GMO producers compounds.
4. Molecular Biology
   - Selection of expression vectors,
   - techniques of heterologous DNA insertion
   - selection and determination of different biological models
   - Application and examples in: agronomic, human/veterinary health, pharmacological and environmental.
5. Metabolic Engineering Techniques used to improve metabolism production and diversification
   - homologous recombination
   - gene insertion / deletion
   - Genome editing.
   - Application and examples in different areas
6. Synthetic biology. Principles and techniques
   - Red / ET (exonuclease / polymerase) recombination
   - Linear-Linear Homologous Recombination, LLHR
   - Transformation Associated Recombination (TAR)
   - in vitro Sequence Ligation Independent Cloning (SLIC) and bioblocks.
   - Application and examples in different areas.

Recommended reading

1. Genome Editing and Engineering: From TALENs, ZFNs and CRISPRs to Molecular Surgery (2018) by Krishnarao Appasani (Editor), George M. Church (Foreword), Cambridge University Press; 1 edition
2. Kurnaz I. A. (2015). Techniques in Genetic Engineering. Taylor & Francis Group
3. Mitra S. (2015). Genetic Engineering principles and practice. McGraw Hill Education
4. Vogel P. and Stafforst T. (2019) Critical review on engineering deaminases for site-directed RNA editing. Current Opinion in Biotechnology, 55: 74 -80

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% (practical work with a final written exam. Minimum successful result 9, 5 marks)
   - Practical Work - 10% (lab. work and presentation)
3. evaluation of pratical part - (Student Worker) (Final, Supplementary, Special)
   - 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

English

Electronic validation

Maria João Almeida Coelho Sousa	Altino Branco Choupina	Rui Miguel Vaz de Abreu	Paula Cristina Azevedo Rodrigues
16-01-2024	16-01-2024	23-01-2024	25-01-2024