Course Unit	Genetic and Genomics Engineering			Field of study	Biology and biochemistry		
Bachelor in	Biology and Biotechnology			School	School of Agriculture		
Academic Year	2023/2024	Year of study	2	Level	1-2	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9029-782-2204-00-23		

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): Altino Branco Choupina

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Understanding the genetic information in prokaryotes and eukaryotes.
2. Understand the importance of the tools of recombinant DNA and its application in different cloning systems (host-vector).
3. Learn about the different processes of construction, transformation and selection of mutants.
4. Relate directed mutagenesis and structure / function of the protein.
5. Understand the importance of the analysis of genomic sequences and genomes.
6. Establish the multiple applications of genetic engineering methods in different areas of biological knowledge.

Prerequisites

Before the course unit the learner is expected to be able to:
1. knowledge, in generally, the biology, biochemistry, genetics, molecular biology and microbiology.
2. knowledge of English

Course contents

The genetic information in prokaryotes and eukaryotes. Methodologies and tools of recombinant DNA and its application in different cloning systems (host-vector). Meet processes of construction, transformation and selection of mutants. Directed mutagenesis and structure / function of the protein. Applications of genetic engineering methods in different areas of biological knowledge

Course contents (extended version)

1. Introduction to new genetic information in prokaryotes and eukaryotes.
2. Recombinant DNA technology:
   - restriction enzymes, polimerases and ligases;
   - cloning vectors;
   - preparation of rDNA;
   - introduction into the cell, and selection of recombinants;
   - genomic libraries;
   - homologous and heterologous expression;
   - expression vectors / overproduction and purification of r-proteins.
3. Segregational and structural instability of the r-plasmids: kinetic control and
4. Other molecular approaches and applications:
   - molecular hybridization probes;
   - Southern hybridization and applications;
5. Genotyping: principles and applications.
6. Methods for analyzing the regulation of gene expression:
   - fusions with a reporter gene;
   - Northern hybridization and RT-PCR in real time;
   - DNA microarray and RNA seq (RNA sequencing).
7. Deletion or insertional mutation in gene function analysis; mutagenesis and applications.
8. RNA antisense technology and RNAi.
9. Subcellular localization of proteins: GFP fusions and immunodetection.
10. Biological databases, analysis of DNA sequences and genomes.

Recommended reading

1. Isil Aksan Kurnaz (2015). Techniques in Genetic Engineering. Taylor & Francis Group
2. Sandhya Mitra (2015). Genetic Engineering principles and practice. McGraw Hill Education
3. Philip Mark Meneely (2014). Genetic analysis : genes, genomes, and networks in eukaryotes. Second edition. Oxford : Oxford University Press
4. Shashikant Kulkarni, John Pfeifer (2015) Clinical Genomics: A guide to Clinical Nex Generation Sequencing, 1st Edition. Amazon. com
5. Röbbe Wünschiers (2022). Genetic Engineering: Reading, Writing and Editing Genes. Springer

Teaching and learning methods

Magistral classes using the classrooms equipped with datashow; laboratory manipulation of nucleic acids and genetic transformation in order to complement and consolidate the knowledge acquired in theoretical content, using laboratory rooms. Literature search, using the existing wireless network and libraries on the campus of Santa Apolonia.

Assessment methods

1. Ordinary Students - (Regular) (Final, Supplementary, Special)
   - Final Written Exam - 70% (Theoretical contents)
   - Final Written Exam - 30% (practical component.)
2. Student Workers - (Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 70% (Theoretical contents)
   - Final Written Exam - 30% (practical component.)

Language of instruction

Portuguese

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Electronic validation

Altino Branco Choupina	Maria Lurdes Antunes Jorge	Altino Branco Choupina	Paula Cristina Azevedo Rodrigues
23-01-2024	24-01-2024	25-01-2024	25-01-2024

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