

Course Unit	Molecular Biology	Field of study	Science Base
Bachelor in	Biomedical Laboratory Sciences	School	School of Health
Academic Year	2022/2023	Year of study	1
Type	Semestral	Semester	2
Level	1-1	ECTS credits	5.0
Code	9995-550-1203-00-22		
Workload (hours)	135	Contact hours	T - TP 22,5 PL 30 TC - S - E - OT 7,5 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, Maria Lurdes Antunes Jorge

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Knowing the genetic: DNA as the genetic material, its chemical nature and structural characteristics.
2. Identify the structure and organization of the genome of different organisms.
3. Knowing the genetic mechanisms of replication, transcription and translation in prokaryotes and eukaryotes and applying the genetic code to determine the protein amino acid sequence.
4. Justify as the amino acid sequence of a protein reflects its location and function explain the post-translational modifications that may suffer.
5. Understanding the genetic information in bacteria. Identify key recombinant DNA tools. Understand the importance of the methods of recombinant DNA and its application in different cloning systems.
6. Relating directed mutagenesis and structure / function of the protein. Establish the applications of molecular cloning to develop products of medical interest
7. Understand the importance of genomic sequences analysis and genomes. Understanding gene expression. Make the analysis of transcriptomes and deduct their applications.
8. Establish the multiple applications of the methodologies of Molecular Biology in Medical and Pharmaceutical Sciences.

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

Introduction to genetic bases. Eukaryotic and prokaryotes genomes. The replication and transcription of DNA in prokaryotes and eukaryotes. Translation. Genetic code. Modification post-translation and subcellular targeting of proteins. Basic Molecular Biology techniques used in medicine: PCR, hybridization analysis, DNA sequencing, RFLP, analysis of transcriptomes, among others. Recombinant DNA technology and site-directed mutagenesis. Genomes sequencing and Human Genome Project.

Course contents (extended version)

1. Introduction to genetic bases
 - Identification of DNA as the Genetic Material
 - Chemical composition of DNA and RNA
 - DNA structure: A, B and Z forms of DNA
 - Positive and negative supercoiling
2. Different types of genome: Eukaryotic, prokaryotes and virus genomes
 - Classification of viruses according to their genome
 - Bacterial genomes and plasmids
 - Organelle genomes. Mitochondrial and chloroplast genome
 - Nuclear Genome. Complexity of genomes
 - Repetitive and Non Repetitive DNA. Tandem and dispersed repetitive DNA
 - Mobile nucleotide sequences - IS elements, transposons and retrotransposon
3. DNA Replication
 - Origins of replication in prokaryotes and eukaryotes
 - DNA replication in prokaryotes
 - DNA replication in eukaryotes
4. Transcription
 - Structure of RNA: rRNA, tRNA and mRNA
 - Steps of the transcription: initiation, elongation and termination
 - Enzymatic system responsible for the transcription process
5. Translation and Genetic Code
 - Protein synthesis: stages, factors and enzymes
6. Basic Molecular Biology techniques used in medicine
 - DNA and RNA extraction
 - Manipulation of nucleic acids: basic tools and techniques (Electrophoresis, Hybridization, PCR, etc)
7. Recombinant DNA technology
 - Enzymes used in the production of recombinant DNA
 - Molecular Cloning: Vectors and strategy for cloning
 - Application of molecular cloning in the production of pharmaceutical compounds and disease diagnosis
 - Sequencing and analysis of genomic sequences.
 - Genomes sequencing and importance of Human Genome Project in health sciences.

Recommended reading

1. Allison L. A. (2012) Fundamentals of Molecular Biology, 2nd Edition, Wiley-Blackwell
2. Azevedo C. , Sunkel C. (2012) Biologia Celular e Molecular, Lidel.
3. Krebs J. E. , Goldstein E. S. , Kilpatrick S. T. (2012) Lewin's GENES XI, 11 ed. Jones & Bartlett Learning
4. Shashikant Kulkarni, John Pfeifer (2015) Clinical Genomics: A guide to Clinical Next Generation Sequencing, 1st Edition. Amazon. com
5. Geoffrey S. Ginsburg and Huntington F. Willard (2013) Genomic and Personalized Medicine (Second Edition). Elsevier

Teaching and learning methods

Lectures using power point presentations. Lectures notes deposited in the e-learning resources. Laboratory classes.

Assessment methods

- Alternative - (Regular, Student Worker) (Final, Supplementary, Special)
- Final Written Exam - 100% (Practical evaluation, 30%)

Language of instruction

Portuguese

Electronic validation

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08-03-2023	21-03-2023	22-03-2023	26-03-2023