INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Celular and Molecular Biology			Field of study	Health Sciences		
Bachelor in	Biomedical Technology			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9600-752-1201-00-23		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			30	-	30	-	-	-	-	-

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): Joana Andrea Soares Amaral, Pedro Jorge Louro Crugeira

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Recognize the organizations of living eukariotic systems; identify the ultra-structure of the eukariotic cell and the specific functions of each cell component.
2. Know different methodologies used in cell studies.
3. Understand the role of biomembranes in transmembranar transportation.
4. Characterize the main steps and mechanisms of cellular division.
5. Recognize the DNA molecular bases, structure and organization of genetic material; know the processes of DNA replication and of gene expression (transcription and translation).
6. Understand different techniques for DNA study: UV absorption, electrophoresis, Southern Blot and DNA sequence analysis.
7. Know the polimerase chain reaction (PCR), RFLPs and respective applications. Know possible applications of genetic engineering.
8. Participate in laboratory experiments. Analyze and interpret data obtained in laboratory work

Prerequisites

Before the course unit the learner is expected to be able to:
Not applicable.

Course contents

Ultrastructure of eukaryotic cells. Membranes structure and functions. Membrane transport. Major steps and mechanisms of cell division cycle. Molecular basis of heredity. Plasmidic DNA and chromosomes. Organizational structure of the genome and the flow of genetic information. Regulation mechanisms of gene expression, enzyme activity and metabolism. Basic genetic mechanisms: replication of DNA, transcription and mRNA processing, translation. Techniques used in biotechnology.

Course contents (extended version)

1. Organization of eukaryotic living systems.
   - Ultra- structure of the eukaryotic cell.
   - Internal organization of the cell: structure and function of organelles, membranes and cytosol.
   - Constitution of biomembranes and its role in the transmembrane transport.
   - Channels, carriers and pumps, simple diffusion, facilitated diffusion and active transport.
2. Antioxidant activity in biological systems
   - Reactive oxygen species and reactive nitrogen species.
   - Antioxidant defenses.
3. The nucleus and cell division cycle.
   - Major steps and mechanisms of cell division cycle: interphase, mitosis and meiosis.
   - Mechanisms of cell signaling: reception and signal transduction.
   - Molecular mechanisms of cancer induction; relationship with the regulation of cell cycle.
4. Molecular basis of heredity.
   - Genome organization and the flow of genetic information.
   - Basic mechanisms for genetic information transmission: transcription, translation and replication.
   - Regulation mechanisms of gene expression, enzyme activity and metabolism.
5. Biotechnology and its practical applications.
   - Techniques used for the isolation and analysis of DNA.
   - Amplification of specific fragments by the technique of polymerase chain reaction (PCR).
   - Real-time PCR.
   - Restriction fragment length polymorphism and PCR-RFLP.
   - Techniques for DNA study: Feulgen reaction, electrophoresis, hybridization, blotting, DNA sequencing
   - Applications of gene cloning in biotechnology.

Recommended reading

1. Carlos Azevedo, Biologia Celular e molecular, 4a edição, Lidel, edições técnicas, 2005.
2. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter, Molecular Biology of the Cell, 4th edition, Garland Science, 2002.
3. H. Lodish, A. Berk, P. Matsudaira, C. A. Kaiser, M. Krieger, M. P. Scott, L. Zipursky, J. Darnell, Molecular Cell Biology, 5th edition, W. H. Freeman, 2004.
4. G. Karp, P. Geer, Cell and Molecular Biology: Concepts and Experiments, John Wiley & Sons Inc, 2004.
5. Curso "DNA decoded", plataforma Coursera, 2022.

Teaching and learning methods

Explanation of theoretical concepts. Analysis and discussion of application examples. Execution and presentation of a bibliographic search work. Execution of the proposed laboratory experiments. Individual and group study of the course contents. Students will be asked to take the Coursera course "DNA decoded" during non-presencial hours, and discuss it in theoretical classes.

Assessment methods

1. Method 1 - (Regular, Student Worker) (Final, Supplementary)
   - Development Topics - 20% (Oral presentation of a work comprising literature research.)
   - Intermediate Written Test - 25% (Theoretical minitest. Minimum grade of 7 values.)
   - Intermediate Written Test - 20% (Theoretical test regarding laboratorial concepts.)
   - Final Written Exam - 25% (Theoretical test.)
   - Intermediate Written Test - 10% (Test on the contents covered in the Coursera course "DNA decoded".)
2. Method 2 - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 60% (Global theoretical test. Minimum grade of 7 values.)

Assessment methods

- Intermediate Written Test - 20% (Theoretical test regarding laboratorial concepts.)
- Development Topics - 20% (Oral presentation of a work comprising literature research.)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Joana Andrea Soares Amaral	Hélder Teixeira Gomes	José Carlos Rufino Amaro
08-03-2024	13-03-2024	16-03-2024