Course Unit	Metabolism and Proteomics			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	1	Code	9029-782-2104-00-23		

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): Rui Miguel Vaz de Abreu

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. To acquire fundamental knowledge in metabolic processes, and in corresponding regulation and integration.
2. To understand the basic biosynthetic pathways for the production of primary and secondary metabolites.
3. To identify and to know the techniques available for metabolites analysis.
4. Understand the dynamic nature of the proteome.
5. Know the methodologies used in proteome analysis including two-dimensional electrophoresis, mass spectrometry, chromatography, X-ray crystallography and bioinformatics methods.
6. Recognize the main clinical and biotechnological applications of proteomics

Prerequisites

Before the course unit the learner is expected to be able to:
The students will have to possess solids knowledge in organic chemistry, biochemistry and biology.

Course contents

Basic concepts of metabolism. Signal transduction mechanisms and chemical communication between cells. Revision and integration of primary metabolism. Secondary metabolism: acetate pathways, mevalonate and non-mevalonate pathways, xiquimate pathway and biosynthesis of alkaloids. Enzymology of the primary and secondary metabolism. Integration, regulation and adaptations of metabolism. Concepts in metabolomics: determination of metabolomes, techniques for metabolites analysis and applications.

Course contents (extended version)

1. General concepts of metabolism and regulation strategies.
2. Mechanisms of signal transduction and chemical communication between cells.
3. Review and integration of primary metabolism:
   - Carbohydrate metabolism pathways: glycolysis, TCA cycle and electron transport chain.
   - Metabolic routes of lipids, aminoácidos e ácidos nucleicos.
4. Main pathways of secondary metabolism:
   - Acetate-malonate pathway (polyketone compounds).
   - Mevalonate and non-mevalonate pathway (isoprenoids).
   - Shikimate pathway (amino acids and phenylalanine derivatives).
   - Alkaloid biosynthesis pathway.
5. General concepts of Proteomics and main strategies for studying the proteome.
6. Protein separation and detection methods:
   - Processing and preparation techniques for protein samples.
   - Polyacrylamide gel electrophoresis (mono and two-dimensional) under different conditions.
   - Liquid chromatography of molecular exclusion, ion exchange, affinity and reversed phase.
   - Identification of proteins using antibodies, mass spectrometry and nuclear magnetic resonance
7. Clinical and Biotechnological Applications of Proteomics:
   - Study of the variability of different biological matrices.
   - Discovery of biomarkers, proteins associated with a disease, development of new drugs.
   - Proteins involved in resistance processes to pathogens.

Recommended reading

1. Quintas, A. ; Freire, A. P. ; Halperm, M. J. (2008) "Bioquímica - Organização Molecular da Vida", Editora Lidel.
2. Kosmides AK et al. (2013) "Metabolomic fingerprinting: challenges and opportunities. " Crit Rev Biomed Eng. , 41(3): 205-21.
3. Lovric J. (2011) Introducing Proteomics: From Concepts to Sample Separation, Mass Spectrometry and Data Analysis. First Edition, Wiley-Blackwell Press, New Jersey, USA
4. Sallam R. M. (2015) Proteomics in cancer biomarkers discovery: challenges and applications. Disease Markers, Review, 1-12.
5. Al-Amrani S et al (2021) Proteomics: Concepts and applications in human medicine. World J Biol Chem Sep 27; 12(5): 57-69.

Teaching and learning methods

Lessons with resource the equipped classrooms with acetate projector or datashow; Practical works in the lab and resolution of some exercises; Bibliographical research, using the existing resources in the IPB.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 60% (Eliminatory theoretical component: exam)
   - Practical Work - 40% (Laboratory protocol reports.)
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 60% (Eliminatory theoretical component: exam.)
   - Final Written Exam - 40% (Eliminatory practical component: Exam (minimum grade 8,5))

Language of instruction

1. Portuguese
2. Portuguese, with additional English support for foreign students.

Electronic validation

Rui Miguel Vaz de Abreu	Paula Cristina Santos Baptista	Altino Branco Choupina	Paula Cristina Azevedo Rodrigues
24-01-2024	25-01-2024	25-01-2024	25-01-2024