

Course Unit	Metabolism and regulation		Field of study	Biology and biochemistry	
Bachelor in	Biology and Biotechnology		School	School of Agriculture	
Academic Year	2022/2023	Year of study	2	Level	1-2
Type	Semestral	Semester	1	ECTS credits	6.0
Workload (hours)			162	Contact hours	
			T	30	TP
			PL	30	TC
			S	-	E
			OT	4	O
			Code		
			9029-510-2104-00-22		

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 the principles of metabolism enzymology.
4. To know concepts of metabolomics and to exemplify its applications.
5. To identify and to know the techniques available for metabolites analysis.

### 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. Basic concepts of metabolism. Regulatoty strategies (metabolic control).
2. Signal transduction mechanisms and chemical communication between cells.
3. Revision and integration of primary metabolisms:
  - Metabolic routes of glucids: glycolysis, TCA cycle and electron transport chain.
  - Metabolic routes of lipids.
  - Metabolic routes of nucleic acids.
4. Secondary metabolism.
  - Acetate routes (policetonic compounds).
  - Mevalonate and non-mevalonate routes (isoprenoids).
  - Xiquimate metabolic route (amino acids and phenylalanine derivatives).
  - Alkaloid biosynthesis route.
5. Enzimology of primary and secondary metabolism. Integration, regulation and metabolic adaptations.
6. Basic concepts of metabolomics.
  - Phenotype and genotype relation of metabolites.
  - Metabolic fingerprinting and footprinting.
  - Obtaintion of metabolomes and it's application in metabolimic engeneiring.
7. Analysis technics of metabolites:
  - Mass spectroscopy, cromothography and nuclear magnetic resonance. Statistical methods.
8. Techniques for protein purification, separation and identification.
  - Protein electrophoresis.
  - FPLC protein chromatography.

### Recommended reading

1. Nelson D. L. , Cox M. M. (2014) "Princípios de Bioquímica de Lehninger", Artmed. Editora.
2. Quintas, A. ; Freire, A. P. ; Halperm, M. J. (2008) "Bioquímica - Organização Molecular da Vida", Editora Lidel.
3. Voet, D. (2014) "Fundamentos de Bioquímica Clínica", Artmed. Editora.
4. Kosmides AK et al. (2013) "Metabolomic fingerprinting: challenges and opportunities. " Crit Rev Biomed Eng. , 41(3): 205-21.
5. Lobo, A. M. , Lourenço, A. M. (2007) "Biossíntese de Produtos Naturais", IST Press.

### 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)
  - Development Topics - 15% (Research work with a theme supplied by the teacher.)
  - Presentations - 10% (Oral presentation of the research work.)
  - Reports and Guides - 15% (Laboratory protocol report.)
2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 60% (Eliminatory theoretical component: exam)
  - Final Written Exam - 40% (Eliminatory pratical component: exam)

### Language of instruction

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

## Electronic validation

Rui Miguel Vaz de Abreu	Maria João Almeida Coelho Sousa	Altino Branco Choupina	Paula Cristina Azevedo Rodrigues
23-12-2022	23-12-2022	25-12-2022	26-12-2022