

Course Unit	Chemistry of natural products			Field of study	Life Sciences	
Master in	Natural Products and Bioprospecting			School	School of Agriculture	
Academic Year	2023/2024	Year of study	1	Level	2-1	ECTS credits 6.0
Туре	Semestral	Semester	1	Code	5012-740-1104-00-23	
Workload (hours)	162	Contact hours	T - TP T - Lectures; TP - Lectures a	60 PL - T nd problem-solving; PL - Problem-	C - S -	E - OT 4 O - Fieldwork; S - Seminar, E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s)

Clementina Maria Moreira dos Santos

Learning outcomes and competences

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

- Recognize and distinguish the difference between primary and secondary metabolites. Identify the different pathways for synthesis of secondary metabolites and recognize and link the main families of natural products.
- 3. Understand and outline some common reactions in the biosynthesis of natural products.

Prerequisites

Before the course unit the learner is expected to be able to: Understand the general principles of chemistry and recognize the particularities of carbon chemistry

Course contents

Summary of organic chemistry: nomenclature, hybridization, electronic and resonance effects, stereochemistry and reaction mechanisms. Primary and secondary metabolism. The evolution of secondary metabolites and their importance in the interconnection of living things. The metabolic pathways of natural products: acetate, mevalonate and the shikimate pathway. Structural characteristics of secondary metabolites. Common reactions in the biosynthesis mechanisms. Biosynthesis mechanisms.

Course contents (extended version)

1. Introduction to the chemistry of natural products

- rimary and secondary metabolism

- Primary and secondary metabolism
 The importance of secondary metabolites in the evolution of living beings
 Functionality of secondary metabolites: the interaction between living beings
 The metabolic pathways of natural products; acetate, shikimate and mevalonate
 Origin and precursors for the different metabolic pathways
 The acetate pathway. Structural characteristics and properties of its metabolites
 Fatty acids
 Polyketides and acetogenins
 Prostanlandins

 - Prostaglandins Antibiotics: macrolides and tetracyclines
- Biosynthesis mechanisms.
 The mevalonate pathway. Structural characteristics and properties of its metabolites
 - Terpenes
 - Steroids (triterpenoids) and vitamin D
- Carotenoids (tetraterpenoids) and vitamin D
 Carotenoids (tetraterpenoids) and vitamin A
 The shikimate pathway. Structural characteristics and properties of its metabolites
 Benzoic and cinnamic acids
 Coumarins
- - Lignans and lignins
 Flavonoids and isoflavonoids
- Tanins
 Characteristics and properties of alkaloids. Classification
 Derivatives of ornithine and lysine
 Derivatives of aromatic aminoacids
- Derivatives of tryptophan6. Common reaction in biosynthesis
- Claisen and aldolic condensation.
 Elimination reactions and keto-enol equilibrium

- Einfination reactions and keto-enoi equilibrium
 Decarboxylation and transamination
 Oxidative coupling of phenols
 Aromatic electrophilic substitutions and nucleophilic substitutions
 7. Summary revision or organic chemistry concepts

 - Nomenclature
 Structure, hybridization and geometry
 Electronic effects: inductive and resonance effects
 Stereochemistry

Recommended reading

- Chemistry of Natural Products, Phytochemistry and Pharmacognosy of Medicinal Plants (2022) Ed. M. Napagoda, L. Jayasinghe, De Gruyter STEM
 Medicinal Natural Products (2009) P. M. Dewick, John Wiley & Son Ed., 3rd Edition
 Introduction to Natural Products Chemistry (2011) CRC Press

Teaching and learning methods

Interactive approach, using audiovisual materials. Study materials available via e-learning.

Assessment methods

Standard evaluation - (Regular, Student Worker) (Final)

 Intermediate Written Test - 25% (Written exam - basic organic chemistry, nomenclature, coenzymes.)
 Final Written Exam - 60% (Written exame: structural characterization, properties and biosynthesis of natural compounds.)

Assessment methods	
 Reports and Guides - 15% (Continuous evaluation: reports 2. 2nd Call - (Regular, Student Worker) (Supplementary, Speci- Final Written Exam - 100% (Written exam - all contents of 	s, work in the class.) al) theoretical and practical lessons.)
Language of instruction	
Portuguese	

Electronic validation			
Clementina Maria Moreira dos Santos	Vitor Manuel Ramalheira Martins	Maria João Almeida Coelho Sousa	José Carlos Batista Couto Barbosa
18-01-2024	19-01-2024	19-01-2024	20-01-2024