

Course Unit	Biochemistry and Biophysics			Field of study			
Bachelor in	Pharmacy			School	School of Health		
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits 5.0	
Туре	Semestral	Semester	2	Code	9549-803-1202-00-23		
Workload (hours)	135	Contact hours	T - Lectures; TP - Lectures a	30 PL 30 T nd problem-solving; PL - Problem-	C - S - solving, project or laboratory; TC -	E - OT 7,5 O - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other	

Name(s) of lecturer(s)

Amilcar Manuel Lopes António

Learning outcomes and competences

- At the end of the course unit the learner is expected to be able to:
- To identify the distinct types of macromolecules and understand their biological functions To have knowledge about the different levels of structure in proteins

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 To identify the importance of enzymes as biological catalysts
 To distinguish the main lipids and carbohydrates
 To understand and to delineate the main processes involved in the transformation of the energy of carbohydrates, lipids and nitrogen compounds into chemical energy and reducing power.
 To compare the metabolic profile of organs such as liver, muscle and adipose tissue, integrating the metabolic pathways used by each one
 To establish the connection between physical laws and health sciences, in connection with simple technological applications

Prerequisites

Not applicable

Course contents

1. Review on structural and functional properties of biological molecules 2. Proteins 3. Enzymes 4. Carbohydrates 5. Lipids 6. Metabolic pathways involved in the degradation and synthesis of carbohydrates, lipids and nitrogen compounds. 7. Integration of metabolism: key-points, metabolic profiles of the most important organs and hormonal regulation. 8. Fluids: fundamental properties; Hydrostatics; Hydrodinamics.

Course contents (extended version)

- 1. I. Biochemistry overview
- The chemical features of the living organisms; Functions of the essencial chemical elements 2. II. Proteins

 - Aminoacids: Structure, nomenclature, classification, chemical properties. Structure and function of proteins. The peptidic bond. Structural levels. Fibrous proteins (silk, keratins, collagen). Globular proteins (hemoglobin).
- 3. III. Enzvmes
- 3. III. Enzymes

 Classification, function, specificities and cofactors.
 Importance of vitamins in the synthesis of enzymatic cofactors.
 Enzyme Kinetics: the Michaelis-Menten and Lineweaver Burk models.
 Ways to regulate the enzymatic activity: pH and temperature.
 Reversible and irreversible inhibitors (competitive inhibition, uncompetitive and non-competitive).
 Regulatory enzymes: allosteric interactions and covalent modifications.
 Proteolytic cleavage of enzyme precursors; Isoenzymes and examples of their biological importance.

 4. IV. Hydrocarbons

- Arydrocarbons
 Classification. Major classes of sugars and of non-sugars.
 Monosaccharides (chemical composition, nomenclature, stereochemistry and occurrence).
 Cyclization of monosaccharides. Glycosidic linkage and disaccharides (maltose, lactose and sucrose).
 Homopolysaccharides. The relationship between their structure and function.
 Specific examples of storage (starch, glycogen) and structural (chitin, cellulose) polysaccharides .
 Aplications of of some homopolysaccharides and heteropolysaccharides.

- 5. V. Lipids
 Classification Fatty acids: structure and properties.
 - Simple lipids (terpenes and steroids) and complex (triacylglycerides and phosphoglycerides).
- Lipoproteins.
- Clabolism, anabolism and relation-sheep. Transference of energy in the biological systems.
 ATP and NADP cycles. Phases and main objectives of metabolism.
 VII. Metabolism of carbohydrates
- - Reactions, regulation and energetic balance of Glycolysis. Gluconeogenesis., Glycogen metabolism.
 Cycle of Cori. Shuttle systems for cytosolic NADH. Pathway of phosphate-pentoses.
 Oxidative decarboxylation of piruvate to acetyl-CoA: Cycle of citric acid: Individual reactions.
 Energetic balance; Regulation; Amphibolic character.
- Electron transport chain and oxidative phosphorylation. Respiration 8. VIII. Metabolism of lipids

- All. Metabolism of lipids
 Biological sources of lipids: diet, adipocytes and biosynthesis. Catabolism of fatty acids.
 Degradation of saturated, unsaturated and ramificated fatty acids.
 Energetic balance. Biosynthesis of saturated and unsaturated fatty acids. Sources of Acetyl-CoA.
 Regulation. Ketone bodies: synthesis and energetic function.

- 9. IX. Metabolism of nitrogen compounds

 Metabolism of amino acids: Hydrolysis of proteins; Glycogenic and ketogenic amino acids.
 Reactions of transamination, decarboxylation, desamination and desamisation.
 Metabolism of ammonia: sources, transport in the circulation and elimination pathways.
- X. Integration of metabolisms
 Main metabolic pathways and regulation centres. Key-connections: glucose-6-P, piruvate, acetyl-CoA.
 Metabolic profiles of the most important organs. Hormonal regulation of the energetic metabolism.
 X.I. Importance of Biophysics in Health Sciences.
 XI. Inportance of Biophysics in Health Sciences.

- Fundamental properties: density, viscosity, superficial tension, capilarity.
 Experimental measurement of different liquid densities. Pressure.
 Aplications in health sciences.

- 13. XIII. Fluid Dynamics Velocity. Flow Rate. Bernoulli's Principle

This

Recommended reading

- Lehninger, A. L., Nelson, D. L., Cox, M. M. (2014). Principles of Biochemistry (6th ed.). New York, NY: W. H. Freeman.
 Quintas, A., Ponces, A., Halpern, M. J. (2008). Bioquímica, Organização Molecular da Vida. Lidel.
 Weill, J. H. (2000). Bioquímica Geral. Lisboa: Fundação Calouste Gulbenkian.
 Durán, J. E. R. (2003). Biofísica: fundamentos e aplicações. São Paulo: Prentice Hall
 Hademenos, G. J. (1998). Physics for Pre-Med, Biology and Allied Health Students. New York, N. Y.; Schaum-McGrawHill.

Teaching and learning methods

Theoretical Classes: Lectures of theoretical contents. Theorico-Practical Classes: Resolution of exercises in the Strucutral and Metabolic Biochemistry and Biophysics areas.

Assessment methods

Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)

 Intermediate Written Test - 33% (- Structural Biochemistry)
 Final Written Exam - 67% (- Metabolic Biochemistry - Biophysics)

 Final Examination - (Regular, Student Worker) (Final, Supplementary, Special)

 Final Written Exam - 100% (- Structural Biochemistry - Metabolic Biochemistry - Biophysics)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation							
Amilcar Manuel Lopes António	Isabel Cristina Jornalo Freire Pinto	Ana Maria Nunes Português Galvão	Adília Maria Pires da Silva Fernandes				
02-04-2024	17-04-2024	17-04-2024	17-04-2024				