

Course Unit	Biochemistry	Field of study	Chemistry and Biology
Bachelor in	Biomedical Technology	School	School of Technology and Management
Academic Year	2022/2023	Year of study	2
Type	Semestral	Semester	1
Level	1-2	ECTS credits	6.0
Code	9600-752-2102-00-22		
Workload (hours)	162	Contact hours	T 30 TP 30 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) Joana Andrea Soares Amaral, Ricardo Frederico Pereira Dias

Learning outcomes and competences

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

1. Know the structure and functions of the cells major groups of chemical constituents (water and buffers, sugars, fat, proteins and vitamins).
2. Know the general characteristics of enzymes, enzyme kinetics, mechanisms of enzymatic reactions and metabolic regulation.
3. Know the role of hormones in metabolism regulation.
4. Know the biochemical processes of energy: energy couplings; central role of ATP.
5. Know the metabolism of sugars, lipids and the mechanisms of nucleotides biosynthesis.

Prerequisites

Before the course unit the learner is expected to be able to:
Use the concepts taught in Organic Chemistry.

Course contents

Major molecular components of cells (water, sugars, proteins, lipids). Enzyme kinetics. Metabolism of sugars (glycolysis, the Krebs cycle, electron transport and oxidative phosphorylation, gluconeogenesis, the glycogen metabolism, pentose-phosphate pathway). Metabolism of fat. Synthesis of nucleotides. Hormones and their role in regulating metabolism.

Course contents (extended version)

1. Molecular components: structure and functions of the major chemical constituents groups of the cell.
 - Water and tampons.
 - Carbohydrates: structure and function. Main groups and examples of their functions.
 - Carbohydrates: mono-, di-, oligo- and polysaccharides. Glycosidic bond. Reducing sugars.
 - Lipids: major groups and structural variety. Membrane structure.
 - Proteins: structure, properties and biological function of amino acids, peptides and proteins.
 - Proteins: three-dimensional structure of proteins (primary, secondary, tertiary and quaternary).
 - Proteins: quantification methods and sequenciation of amino acids in a protein.
2. Enzymes and enzyme kinetics.
 - General characteristics of enzymes, enzyme kinetics, mechanisms of enzymatic reactions.
 - Michaelis-Menton equation and linear representation of Lineweaver-Burk.
 - Catalytic power of enzymes. Catalytic activity and the factors involved in enzymes regulation.
 - Enzyme inhibition. Regulation of enzyme activity. Identification of coenzymes and cofactors.
3. Energetic biochemistry: energy couplings.
 - Central role of ATP.
 - Obtaining ATP during glycolysis and formation of reducing equivalents in the Krebs cycle.
 - Coupling between oxidation-reduction reactions and synthesis of ATP. Oxidative phosphorylation.
4. Carbohydrates metabolism .
 - Glycolysis, oxidative decarboxylation of Pyruvic acid, the Krebs cycle.
 - Electron transport and oxidative phosphorylation. Pentose-phosphate pathway.
 - Biosynthesis and degradation of glycogen, glycolysis and gluconeogenesis.
5. Lipids Metabolism.
 - Biosynthesis of fatty acids, beta-oxidation of fatty acids; formation of ketone bodies.
 - Metabolism of cholesterol and other lipid compounds.
6. Hormones and their role in regulating metabolism.
 - General concepts of hormone production, release, transport, metabolic fate and mechanisms of action.
 - Concentration of plasma glucose and hormonal regulation of its metabolism (insulin and glucagon).
7. Biochemical tests used for diagnosis, monitoring and screening for some diseases.

Recommended reading

1. Garrett and Grisham, Biochemistry, 6th edition, Saunders College Publishing, 2016.
2. A. Quintas, A. P. Freire, M. J. Halpern, Bioquímica, Lidel, 2008.
3. D. L. Nelson, M. M. Cox, Lehninger Principles of Biochemistry, W. H. Freeman and Company, 4ª edição, New York, 2005.
4. Luís S. Campos, Entender a Bioquímica. O metabolismo fundamental em animais e plantas, Escolar Editora, 1998.
5. J. M. Berg, J. L. Tymoczko, J. L. Stryer, Biochemistry. WH Freeman and Company. 5ª edição, New York, 2002.

Teaching and learning methods

Explanation of theoretical concepts. Analysis and discussion of application examples. Resolution of practical exercises. Oral presentation of bibliographic research work. Individual and group study of the course contents.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
 - Intermediate Written Test - 50% (Mini-test carried out between the 10th-12th week of classes with a minimum score of 7 points.)
 - Final Written Exam - 30%
 - Presentations - 20% (Powerpoint presentation of a group work.)
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
 - Presentations - 20% (Powerpoint presentation.)
 - Final Written Exam - 80% (Includes all the theoretical concepts.)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

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18-10-2022	22-10-2022	24-10-2022