General Information	BACELOR DEGREE IN BIOTECHONOLOGIES
Title of the subject	Biochemistry and Enzymology
Degree Course (class)	Industrial and Agro-Food Biotechnologies
ECTS credits	8
Compulsory attendance	Yes
Language	Italian
Academic year	Second

Subject Teacher		
Name and Surname	Grazia Maria Liuzzi	
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Place and time of reception		
ECTS credits details	Discipline sector (SSD)	Area
	BIO10	---

Study plan schedule	Year of study plan	Semester
	Second	First

Time management	Lessons	Laboratory	Exercises	Total
CFU	6	2		8
Total hours	150	50		200
In-class study hours	48	24		72
Out-of-class study hours	102	26		128

Syllabus	
Prerequisites / Requirements	
Expected learning outcomes (according to Dublin descriptors)	
Knowledge and understanding	The teaching of Biochemistry and Elements of Enzymology aims at providing the knowledge for the understanding of the molecular mechanisms that underlie cellular metabolic activities. In particular, the chemical reactions that allow living organisms to obtain energy through the oxidation of organic molecules taken with the diet and to transform these molecules into their constituents will be analyzed. Furthermore, the mechanisms of regulation of these metabolic pathways will be discussed, in different physiopathological conditions.
Applying knowledge	To develop capacities for independent learning and generic competences that allow the new bachelor graduate to evaluate and interpret biochemical data.
Making informed judgments and choices	To develop the ability to collect and interpret biochemical data considered useful for determining independent judgments, including reflection on scientific topics related to them.
Communicating knowledge	To be able to display fundamental principles and concepts of the studied

	themes and to describe the theory with clarity and property of language.
Capacities to continue learning	To develop the learning skills that are necessary to undertake further studies with a high degree of autonomy.
Study Program	
Content	**Molecular components of cells**: Bioelements. Biomolecules: chemical composition, characteristics, specialization and differentiation. Water: Structure and properties. Definition of pH and pK. Buffer systems. **Amino acids**: structures and properties, stereoisomerism, acid-basic properties and isoelectric point. **Protein structure and function**: primary structure; secondary structure: peptide bond, alpha helix and ß sheet structure; tertiary structure; quaternary structure. Denaturation. Classification of proteins. Oxygen transport molecules: myoglobin and hemoglobin: structure - function relationship; allosteric properties and cooperativity. Collagen: structure and biosynthesis. **Enzymes**: Classification, coenzymes, enzyme activity regulation. Kinetics of enzymatic reactions. Constant of Michaelis-Menten. Factors that influence enzyme activity. Reversible and irreversible enzymatic inhibition. Competitive, non-competitive and uncompetitive inhibition. Graphic methods for the identification of the nature of the inhibition and for the determination of Km, Vmax. Regulatory and allosteric enzymes. **Lipids**: structure and function of fatty acids, triacylglycerols, membrane lipids and cholesterol. **Bioenergetics and metabolism**: Biological membranes and transport. Standard free energy changes and equilibrium constant. Phosphate group transfer potential. Free-energy and redox potential. Glycolysis, pentose phosphate pathway and gluconeogenesis. Glycogen metabolism. Pyruvate dehydrogenase complex and its regulation. Krebs cycle. Fatty acid oxidation. Ketone bodies. Transamination and oxidative deamination. Urea cycle. Amino acid degradation. Respiratory chain and oxidative phosphorylation. Biosynthesis of lipids: fatty acids, triacylglycerols, membrane lipids, cholesterol. Gluconeogenesis and its regulation. Tissue-specific metabolism. **Hormones**, receptors and general mechanisms of signal transduction. Integration of metabolism and hormonal regulation. <u>LABORATORY EXERCISES</u> Preparation of solutions. Buffer solutions. Dosage of proteins with the Bradford method. Determination of the molar extinction coefficient of proteins. Electrophoresis. General principles. Gel-electrophoresis of proteins: determination of molecular weight of proteins by polyacrylamide gel electrophoresis (PAGE) in SDS (SDS-PAGE).
Bibliography and textbooks	1) D.C. Nelson e M.M. Cox I principi di biochimica di Lehninger., Ed. Zanichelli, Bologna. 2) D.C. Nelson e M.M. Cox Introduzione alla biochimica di Lehninger. Ed. Zanichelli, Bologna. 3) P. Riccio La biochimica essenziale. Ed. Laterza, Bari.
Notes to textbooks	
Teaching methods	Front lessons with PowerPoint slides support For practical laboratory exercises, students are divided into groups (maximum 10 students per group).
Assessment methods	Oral

(oral, written, ongoing assessment)	
Evaluation criteria (describe criteria for each of the above expected outcomes)	• *Knowledge and understanding skills* At the end of the course the student will demonstrate the acquisition of a good knowledge on the structure and function of the main biological macromolecules and the understanding of the basic principles of bioenergetics for the study of metabolism. It will also demonstrate to know the strategies of regulation of the specific biochemical processes of the various tissues and organs and their integration and hormonal regulation, as well as the general processes through which genetic information is transmitted and expressed. • *Ability to apply knowledge and understanding* At the end of the course the student will demonstrate to understand the relationships between structure and function of the main biological molecules and the ability to make correlations between the various metabolic pathways through their regulation. The level of knowledge achieved and the mastery of the fundamental concepts will be verified through the discussion of the topics studied during the oral examination. • *Autonomy of judgment* The student will demonstrate to be able to critically analyze and argue the acquired information regarding the homeostatic mechanisms that regulate the functioning of cell and the integration between organs and tissues. The achievement of this goal will be verified by the discussion during the oral examination. • *Learning ability* The student must demonstrate the ability to communicate clearly the fundamental principles and concepts of the issues under study thanks to a good knowledge of the terminology related to the studied topics. The verification of these skills will be assessed during the oral examination. *Exercise Test*: The student will demonstrate the acquisition of competences for the use of equipment and laboratory material and skills in the preparation of buffers, spectrophotometric measurements and application of the Lambert Beer law and setting up of calibration curves.
Further information	