

COURSE: <b>General Biochemistry and Enzymology</b>			
ACADEMIC YEAR: <b>2019/2020</b>			
TYPE OF EDUCATIONAL ACTIVITY: <b>Basic</b>			
TEACHER: <b>Dr. Rocco Rossano Ph.D</b>			
e-mail: <b>rocco.rossano@unibas.it</b>		website:	
phone: <b>+390971 205507</b>		mobile (optional):	
Language: <b>Italian</b>			
ECTS: <b>9</b> (8 lessons and 1 tutorials/practice)	n. of hours: <b>80</b> (64 lessons and 16 tutorials/practice)	Campus: <b>Potenza</b> Dept./School: <b>School of agriculture, forestry, food and environmental sciences</b> Program: <b>Food Technology</b>	Semester: <b>I</b>

**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

The course aims to provide students with basic scientific knowledge about the molecular components of the cell, the molecular mechanisms related to the metabolism of proteins, carbohydrates and lipids, the biochemical processes associated with the production and utilization of metabolic energy, the enzymes kinetic (mechanism of action; studies of active sites; regulation of catalytic activity). In addition, great emphasis is given to the importance of diet on human health and the role of natural antioxidants and polyunsaturated fatty acids. Finally, students acquire knowledge about the purification and determination of proteins/enzymes from different food matrix.

**Knowledge and understanding:** Knowledge and understanding the regulation of the major metabolic pathways.

Knowledge and understanding of the interconnections between the different metabolic pathways. Ability to analyze and describe the factors underlying enzymatic regulation. Ability to plan and apply protocols for protein extraction from different matrices. Knowledge and understanding the basic principles of the enzymatic assay.

**Applying knowledge and understanding:** Ability to analyze the structure and functions of biomolecules. Ability to analyze the mechanisms underlying the regulation of the major metabolic pathways. Ability to analyze interconnections between different metabolic pathways. Ability to analyze the factors underlying enzymatic regulation. Ability to plan and apply protocols for the extraction and determination of protein from different matrix. Enzymatic assay.

**Making judgements:** Ability to evaluate independently the relationship between structure and functions of biomolecules. Ability to evaluate independently the molecular mechanisms of metabolism of the main biomolecules. Ability to evaluate the processes related to the production, storage and utilization of energy. Ability to evaluate independently the factors underlying the regulation of the activity of enzymes. Ability to evaluate the functional aspects of the diet.

**Communication skills:** Ability to communicate and illustrate, in scientific and / or dissemination contexts, the metabolic pathways of the main biomolecules, the correlations existing between the different metabolic pathways. Ability to communicate the impact of nutrition on human health and wellness.

**Learning skill:** Ability to access and understand the scientific literature, in order to be able to attend: specialization courses, specialist seminars, and master.

**PRE-REQUIREMENTS**

To the students are required a satisfactory knowledge of different concepts of general chemistry and organic chemistry already acquired.

**SYLLABUS**

The group is divided in 8 teaching blocks.

**Block 1 (6 h, lectures):** The biological material. Bioelements. Isotopes. The biomolecules. Electronegativity. The world of water. Hydrogen Bond. Water as a solvent. Hydrophilicity, hydrophobicity. The hydrophobic effect and hydrophobic interactions. Asymmetric molecules.

**Block 2 (8 h, lectures):** Amino acids and proteins: structure and function. Carbohydrates. Epimers. Isomers. Polysaccharides. Complex polysaccharides. Lipids. Structure and classification, nomenclature of fatty acids.  $\omega$  -3 and

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ω-6. Biomembranes, lipid rafts. General structure of nucleotides.

**Block 3 (5 h, lectures):** The chemical equilibrium. Free energy. Spontaneity and reversibility of reactions. ATP and other high-energy compounds. Transmembrane transport systems.

**Block 4 (10 h, lectures):** Glycolysis from glucose and other sugars. Conversion of glucose into pyruvate, lactate or ethanol. Cellular respiration. Oxidative decarboxylation of pyruvate to acetyl-CoA. Krebs cycle. Anaplerotic reactions. Redox reactions. Respiratory chain and oxidative phosphorylation. Respiratory control. Shuttles.

**Block 5 (12 h, lectures):** Glycogen metabolism. Pentose phosphate shunt. Gluconeogenesis. Oxidation and synthesis of fatty acids. Synthesis of ketone bodies. Cholesterol synthesis. Amino acids metabolism. Transamination reactions. Urea cycle. Role of mitochondria in synthesis. Metabolism regulation and metabolic correlations.

**Block 6 (13 h, lectures):** Nutrition and health. Functional aspect of diet. Natural diet antioxidants and polyunsaturated fatty acids (PUFAs), biochemical characteristics, functions and metabolism.

**Block 7 (10 h, lectures):** Enzyme kinetics. Active site. Formation of the enzyme-substrate complex. The model of Michaelis-Menten.  $K_m$  and  $V_{max}$ . Lineweaver-Burk plot. Specificity, saturation and inhibition. Catalytic perfection. Competitive, non-competitive and anti-competitive inhibition. Enzymes classification. Cofactors and coenzymes. Water-soluble vitamins. Modulation of enzymatic activity. Influence of chemical-physical parameters. Allosteric enzymes. Covalent modification. Zymogens. Isozymes. Housekeeper and induced enzymes. Enzyme assays. General principles for the extraction of proteins/enzymes from biological and food matrix. Purification of enzymes. Zymography. Catalysis mechanisms. Covalent catalysis and Schiff bases. Suicide inhibitors and affinity markers.

**Block 7 (16 h, laboratory):** Preparation of solutions and buffers for the extraction of proteins from food matrix. Protein determination. Enzymatic assays.

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#### TEACHING METHODS

**Lectures and laboratory activities**

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#### EVALUATION METHODS

**Oral examination. Evaluation: score on 30 points**

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

1. Nelson e Cox: I Principi di Biochimica di Lehninger, Ed. Zanichelli, Bologna.
2. Campbell e Farrell: Biochimica, Ed. EdiSES, Napoli.
3. Riccio: La Biochimica Essenziale, Ed. Laterza, Bari.
4. Material provided by the teacher.

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#### INTERACTION WITH STUDENTS

**Office hours (3<sup>rd</sup> floor-3ANord building):** Wednesday from 9:00 to 11:00 and Friday from 9:00 to 11:00. In addition, the teacher is available at all times for a contact with the students through e-mail.

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#### EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

February 17, 2020

March 13, 2020

May 8, 2020

June 19, 2020

July 16, 2020

September 7, 2020

October 9, 2020

December 18, 2020

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SEMINARS BY EXTERNAL EXPERTS    YES ☐    NO ☒

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#### FURTHER INFORMATION

**Examination panel:**

**Dr. Rocco Rossano (president)**

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<sup>1</sup>Subject to possible changes: check the web site of the Teacher or the Department/School for updates.

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**Prof. Faustino Bisaccia (component)**  
**Prof. Giuseppe Martelli (component)**  
**Prof. Giovanni Salzano (component)**

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