BIOCHIMICA E BIOCHIMICA CLINICA (CSU008)

1. language

Italian.

2. course contents

Coordinator: Prof. GIUSEPPINA NOCCA
Year Course: 1st
Semester: 2nd
UFC: 10
Modules and lecturers:
- BIOCHIMICA E BIOLOGIA MOLECOLARE APPLICATA (CSU057) - 3 CFU - SSD BIO/10 - Prof. Concetta Santonocito
- BIOCHIMICA E BIOLOGIA MOLECOLARE CLINICA (CSU056) - 3 CFU - SSD BIO/12 - Prof. Luigi Colacicco, Victor Corasolla Carregari
- BIOCHIMICA GENERALE (CSU055) - 4 CFU - SSD BIO/10 - Prof. Giuseppina Nocca

3. BIBLIOGRAPHY

Nelson DL, Fox MM. Introduzione alla Biochimica di Lehninger, Zanichelli 2018
Brown T.A. Genomi 4- Edises
Ciaccio, Lippi. Biochimica clinica e medicina di laboratorio. EdiSES 2018
Supplementary teaching materials, in the form of scientific articles and appropriate online sources, will also be provided to complete, deepen, and update the topics covered in class.

4. LEARNING OBJECTIVES

The integrated course aims to deepen the knowledge of topics related to the **Biochemistry of the human organism**, through a detailed description of the main metabolic pathways, with particular reference to areas of interest for the relevant degree program. These topics will be integrated with issues pertaining to **Clinical Biochemistry** and **Molecular Biology**.

At the end of the integrated course, students must demonstrate that they have achieved the following objectives:

Knowledge and understanding – to know and understand the issues related to biological macromolecules, with particular reference to anabolic and catabolic processes within the human organism.

Applied knowledge and understanding – to be able to adequately interpret and comprehend the practical applications of general Biochemistry, both in the clinical field and in the context of modern technologies in genetic engineering and the synthesis of recombinant proteins for clinical, dermatological, and cosmetic use.

Autonomy of judgment – to be able to integrate the acquired knowledge and skills in order to identify the types of biological macromolecules used in the cosmetic and dermatological fields.

Communication skills – to be able to communicate clearly and unambiguously, using appropriate technical terminology, in order to effectively disseminate scientific content related to the biochemical characteristics of the human organism, with particular reference to the metabolic processes that take place within it.

Learning skills – the student must be able to independently update and broaden their knowledge by consulting textbooks, scientific articles, and online platforms (such as NCBI, ATCC, Human Cell Atlas, etc.).

5. prerequisites

Students are required to have attended and successfully passed the General Chemistry and Biology examination.

6. TEACHING METHODS

The teaching methodology is based on **lectures** that provide both the fundamental elements of the various disciplines and their application perspectives. The lessons are conducted through **interactive methods**, integrating standard teaching with activities aimed at promoting **active learning**, such as problem-based learning, self-learning, and case studies.
The teaching methods adopted in this course are designed to enable students to achieve the intended learning outcomes, according to the following characteristics:

Knowledge and understanding – frontal lectures will systematically cover all the topics listed in the detailed syllabus, focusing on the most relevant and essential aspects, in order to provide students with a comprehensive framework of the integrated subjects and the appropriate study methodology to strengthen their theoretical knowledge.

Applied knowledge and understanding – the use of practical examples, particularly relevant to the cosmetic and dermatological fields, enables students to learn the potential applications of the topics covered.

Autonomy of judgment – the active learning methods implemented in this course are designed to allow students to develop the ability to formulate concepts and ideas independently.

Communication skills – active learning methods and constant interaction with the lecturer during the lessons are structured to progressively enable students to acquire communication skills aimed at presenting topics in biochemistry and molecular biology using appropriate scientific terminology.

Learning skills – the use of supplementary teaching materials, including articles from international scientific literature, will enable students to continue their studies primarily through **self-directed and autonomous learning**.

7. OTHER INFORMATION

Experimental thesis projects are available at the Departments and respective Sections to which

the course instructors belong, to be carried out in the research laboratories of the **Università Cattolica del Sacro Cuore** and the **Fondazione Policlinico Universitario A. Gemelli – IRCCS**.
Instructors are available for meetings by appointment, which can be arranged via e-mail.
Prof. Giuseppina Nocca: giuseppina.nocca@unicatt.it
Prof. Concetta Santonocito: concetta.santonocito@unicatt.it
Prof. Victor Corasolla Carregari: victor.corasollacarregari@policlinicogemelli.it
Prof. Luigi Colacicco: luigi.colacicco@unicatt.it

8. METHODS FOR VERIFYING LEARNING AND FOR EVALUATION

The examination consists of a **written test** comprising **20 multiple-choice questions** covering the contents of all the course modules. A minimum of **12 correct answers out of 20** are required to gain access to the **oral examination**. The oral examination will be conducted jointly by the three course instructors, and the final grade will be determined by a **weighted average of the written and oral assessments**.
To achieve a final mark of **30/30 with honors (cum laude)**, students must obtain at least **16 correct answers out of 20** in the written test.
The objective of this examination structure is to assess the student's acquisition of the following skills and knowledge:

- **Knowledge and understanding** – appropriate knowledge of the topics included in the syllabus and comprehension of the role of the studied molecular biochemical processes.
- **Applied knowledge and understanding** – the ability to connect theoretical concepts of general, applied, and clinical biochemistry with the pharmaceutical and cosmetic fields, with particular reference to the mechanisms of action and possible applications of natural and synthetic compounds for cosmetic or nutraceutical purposes.
- **Autonomy of judgment** – the capacity to establish cross-disciplinary connections between the topics covered.
- **Communication skills** – appropriate command of language and the correct use of technical and scientific terminology.
- **Learning skills** – the ability to independently explore topics of biological interest and to apply critical reasoning.

9. program

General Biochemistry:
Structure and function of proteins: amino acids and their chemical-physical properties, the hierarchical structure of proteins. Globular proteins. Fibrous proteins. Enzymes: general aspects. Michaelis-Menten equation. Regulation mechanisms. Bioenergetics and oxidative phosphorylation. Introduction to carbohydrates. Introduction to metabolism. Glycolysis. Tricarboxylic acid (TCA) cycle. Gluconeogenesis. Glycogen metabolism. Metabolism of monosaccharides and disaccharides. Pentose phosphate pathway and NADPH. Glycosaminoglycans, proteoglycans, and glycoproteins. Dietary lipid metabolism. Metabolism of fatty acids, ketone bodies, and triacylglycerols. Phospholipid metabolism. Overview of glycerophospholipids and eicosanoids. Cholesterol, lipoprotein, and steroid metabolism. Nitrogen metabolism. Amino acid degradation

and synthesis. Conversion of amino acids into specialized compounds: synthesis and degradation of heme. Catecholamines. Integration of metabolism, metabolic effects of insulin/glucagon. The fed-fast cycle. Overview of hormonal regulation mechanisms in metabolism.

Applied Biochemistry and Molecular Biology:
Nucleic acids: structure and function. Replication. Transcription. Protein synthesis. Eukaryotic and prokaryotic genomes. DNA mutation and repair. Techniques for nucleic acid manipulation: DNA and RNA extraction, PCR, restriction endonucleases and their applications, Real-Time PCR, sequencing, recombination and an introduction to cloning.

Clinical Biochemistry and Molecular Biology:
Laboratory medicine and clinical biochemistry: biochemical tests and laboratory organization. Pre-analytical, analytical, and post-analytical variability. Internal quality control and External Quality Assessment (EQA). Main analytical techniques. Immunoassays and interferences. Laboratory medicine and cardiovascular diseases: dyslipidemias, diabetes mellitus, cardiac damage markers. Laboratory and liver function. Laboratory and kidney function; chemical and microscopic urinalysis. Laboratory and endocrine system: water- and fat-soluble vitamins.