# General and Sports Biochemistry

## Prof. Alvaro Mordente

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Biochemistry is a discipline that belongs to the life sciences and studies the structure of biological molecules and the organisation of chemical reactions that take place in cells and tissues.

The aim of the course is to provide the student with the basics for:

1. Knowing and understanding the chemical-physical properties, structural organisation and functions of biological molecules (nucleic acids, carbohydrates, lipids, proteins and vitamins);

2. Knowing and understanding the main metabolic pathways (catabolic and anabolic) as well as the biochemical mechanisms that regulate cell metabolism;

3. Knowing and understanding the molecular mechanisms of muscle contraction and the bioenergetics of skeletal muscle.

At the end of the course, students will be able to:

- know and understand the biochemical bases of biological systems and processes;

- understand and describe the structure-function relationship in biological macromolecules (nucleic acids, carbohydrates, lipids and proteins);

- know and describe the main pathways of carbohydrate, lipid and amino acid metabolism, and understand the main mechanisms of metabolic integration and regulation;

- know and understand the biochemistry and bioenergetics of skeletal muscle;

- apply their acquired knowledge to interpret and explain in biochemical terms the main adaptations induced by physical exercise;

- apply their acquired knowledge to interpret and explain in biochemical terms the functioning of organs and tissues, and the molecular bases of the main human diseases;

- describe/communicate their biochemical knowledge, including to non-expert interlocutors, with a command of the language and the correct scientific terminology;

- implement and update their knowledge drawing independently from texts, scientific articles and online platforms.

***COURSE CONTENT***

*Fundamentals of Biochemistry*

- Molecular logic of life.

- Composition of the human body.

- Water: chemical-physical properties and biological role.

*Elements of Cytology*

- Structure of the eukaryotic cell.

- Cell cycle and division. Mitosis and Meiosis

*Biomolecules*

- Carbohydrates: structure and function of monosaccharides, oligosaccharides and polysaccharides.

- Lipids: structure and function of fatty acids, triacylglycerols, phospholipids and sterols.

- Nucleotides, nucleic acids and genetic information.

- Amino acids, peptides and proteins.

- Proteins: three-dimensional structure.

- Proteins: biological role.

- Haemoglobin, myoglobin and oxygen transport.

- Enzymes: general properties and mechanisms for regulating enzymatic activity.

- Water-soluble and fat-soluble vitamins.

*Bioenergetics and Metabolism*

- Thermodynamics of biological systems.

- Biological redox reactions.

- Introduction to metabolism: catabolism and anabolism.

- ATP and energy metabolism.

- Krebs cycle.

- Mitochondrial oxidative phosphorylation.

*Carbohydrate metabolism*

- Glycolysis.

- Pentose phosphate cycle.

- Gluconeogenesis.

- Glycogenolysis and glycogen synthesis.

*Lipid metabolism*

- Digestion, absorption and transport of lipids.

- β-oxidation of fatty acids.

- Biosynthesis of fatty acids and triglycerides.

- Biosynthesis of cholesterol.

- Formation of ketone bodies.

*Amino acid metabolism*

- Metabolic fate of amino groups: transamination, oxidative deamination.

- Urea cycle.

- Metabolic fate of the carbon skeleton of amino acids.

*Biochemical Role of Hormones*

- Signal transduction.

- Protein hormones.

- Steroid hormones.

*Biochemistry and bioenergetics of physical exercise*

- Molecular mechanisms of muscle contraction.

- Metabolism and bioenergetics of skeletal muscle.

***READING LIST***

D.L. Nelson-M.M. Cox, *Introduzione alla Biochimica di Lehninger*, Zanichelli, Bologna, 2018.

T.A. Brown, *Conoscere la Biochimica*, Zanichelli, Bologna, 2018.

D.R. Ferrier, *Le basi della Biochimica*, Zanichelli, Bologna, 2015.

The material available to students will be optimised through use of the Blackboard platform on the University website.

***TEACHING METHOD***

The course is annual (10 ECTS) and is structured around theoretical lectures and classroom tutorials. Lectures take place weekly and involve the use of PowerPoint slides.

***ASSESSMENT METHOD AND CRITERIA***

There is a final written exam with 30 (thirty) questions. One mark is assigned for each correct answer and zero marks for each wrong or missing answer. The final exam mark is expressed out of thirty. A student will receive a distinction if he/she correctly answers all thirty exam questions.

***NOTES AND PREREQUISITES***

There are no prerequisites for attending the course.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out following procedures that will be promptly notified to students.

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.