UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biochemistry

2627-2-E3202Q010-E3202Q01001

Aims

Acquire the fundamentals of the biochemical processes that occur in living organisms with particular attention to enzymatic catalysis and the structure / function relationship of biomolecules.

Knowledge and understanding
At the end of the course the student knows:
- the methods by which living organisms extract the energy necessary to carry out all the manifestations of life;
- methods for studying the properties of macromolecules, especially proteins, enzymes and nucleic acids;
- the methods used to determine the speed of an enzymatic reaction;
- the catabolic and anabolic pathways and the methods used by living beings to coordinate metabolic pathways.

Applied knowledge and understanding
At the end of the course the student is able to:
- calculate the isoelectric point of an amino acid or other metabolite;
- calculate the kinetic constants that govern an enzymatic reaction;
- calculate the molecular weight of a protein.

Autonomy of judgment
Knowing how to identify the most appropriate methods for analyzing enzymatic inhibitors.

Communication skills
Knowing how to describe in a clear and concise way in written form and to present the objectives, the procedure and the results of the processing carried out orally with language properties.

Ability to learn
Be able to apply the knowledge acquired in areas other than those presented during the course and to deepen the topics covered in the scientific literature concerning the aspects of metabolism.

Contents

The teaching is:

1. of the structure and function of simple, polymeric and complex biomolecules;
2. of the ways in which the biochemical reactions occur in the living organisms;
3. the role of the environment in which biochemical reactions take place;
4. of the ways in which biochemical reactions can be controlled both physiologically and artificially.
5. of the description of biochemical reactions and how these develop within pathways called metabolic pathways.
6. of the main techniques for studying biomecules.

Detailed program

Detailed plan

1. Biomolecules: amino acids: structure and properties. The peptide bond and the primary structure of proteins. Secondary, tertiary and quaternary structure of proteins. Respiratory pigments and oxygen transport. Monosaccharides and polysaccharides. Nucleotides and nucleic acids. Lipids: structure and functions. Biological membranes: structure and transport of solutes.
2. Enzymes: classification and catalysis. Coenzymes and vitamins. Enzymatic kinetics: Henri-Michaelis-Menten equation. Enzymatic dosage. Equation of reciprocal doubles.
3. Water: hydrophilic and hydrophobic substances. pH and buffer systems.
4. Enzymatic inhibition: reversible and irreversible inhibition. Allosteric enzymes. Examples of herbicides and insecticides that act as enzyme inhibitors.
5. Principles of bioenergetics and metabolism. Role of ATP and electron transporters. Catabolism. Glycolysis: reactions, enzymes and intermediates. Via dei pentoso phosphates. Lactic and alcoholic fermentation. Krebs cycle and anaplerotic reactions. Glyoxylate cycle. Beta-oxidation of fatty acids. Degradation of amino acids and urea cycle. Mitochondrial electron flow and ATP biosynthesis. Rotational catalysis. Inhibitors and decouplers of oxidative phosphorylation. Oxidases with mixed function. Biotransformation of xenobiotics. Role of glutathione. Anabolism: gluconeogenesis, biosynthesis of fatty acids and biosynthesis of amino acids. Nitrogen cycle. Carbon organization: Calvin cycle and photosynthesis.
6. Basic biochemical techniques: sample preparation, centrifugation, electrophoresis, immunological and enzymatic techniques. Enzymes as environmental biomarkers.

Prerequisites

To follow the teaching conn profit it is necessary that the student has acquired, without however having to have passed the respective exams:

1. knowledge of general chemistry, in particular on the structure of chemical bonds and on the properties of the elements;
2. knowledge of carbon chemistry and chemical-physical properties of organic molecules in their diversity and complexity;
3. knowledge of thermodynamics.

Prerequisites are not required.

Teaching form

24 2-hour in-person lectures in delivery mode

Textbook and teaching resource

The teaching material includes:

Slides of the lectures, films and animations projected in the classroom are available on the e-learning website.

The recommended text is: Nelson and Cox, Introduzione alla biochimica di Lehninger Zanichelli ed., 2023. It is available for personal loan in a reduced number of copies at the science library; it can be purchased on paper with a discount on the cover price at all university bookstores or is available at a lower price as an e-book at the publishing house or even at the university library it is possible to download the e-book so that it can be consulted offline for a predetermined period of time. Previous editions of the textbook are accepted.

Some websites are provided on which to deepen useful knowledge to complete the basic preparation.

Semester

Second semester

Assessment method

Oral examination. The examination is considered passed if the student achieves a mark of between 18 and 30 thirtieths.
18-19: preparation on a small number of the topics present in the course programme, with limited ability to deal with and analyse them, which, in the case of the oral test, only emerges following help and questions from the lecturer; expository competence and vocabulary not always correct, with limited ability to critically elaborate;
20-23: preparation on part of the topics in the course syllabus, ability to analyse independently only on purely practical and executive issues, use of correct, though not entirely accurate and clear vocabulary and expository capacity at times uncertain;
24-27: preparation on a large number of topics covered in the course programme, ability to carry out autonomous independent argumentation and critical analysis, ability to apply knowledge to contexts and to link topics to concrete cases, use of
topics to concrete cases, use of correct vocabulary and competence in the use of disciplinary language;
28 - 30/30L: Complete and exhaustive preparation on the topics in the examination programme, personal ability to autonomous treatment and critical analysis of the topics, ability to reflect and self-reflect and to link the topics to concrete cases and different contexts, excellent critical and autonomous thinking skills, full command of the disciplinary vocabulary and a rigorous and articulate expository capacity, capacity for argumentation, reflection and self-reflection, ability to make connections to other disciplines. There are no numerical exercises or multiple-choice tests.
There are no intermediate assessments, group tests, workshops or project presentations.

Office hours

Receive by appointment writing to the address paolo.parenti@unimib.it

Sustainable Development Goals

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