UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biochemistry I

2425-1-H4102D001-H4102D002M

Aims

The Biochemistry I Module aims : i) to provide the concepts necessary to understand the biological phenomena and the energetic changes connected to them, illustrating the complex chemical reactions that give rise to life. Object of study is the structure and transformation of cell components, such as proteins, carbohydrates, lipids, nucleic acids and other biomolecules. The description of the metabolism will take place both qualitatively and quantitatively. ii) to explain how organ functions can be regulated according to their particular biochemical processes, focusing on metabolic integration. iii) to explain how the regulation of metabolism occurs. iv) to illustrate the role of nutrients and balanced nutrition for maintaining the state of health.

Contents

The Biochemistry I module will illustrate the importance of life-sustaining chemical reactions. The objects of study are the structure and the metabolic pathways involved in the transformations of cell components, such as proteins, carbohydrates, lipids, nucleic acids, and other biomolecules. Moreover, the main hormones and their role in the regulation of metabolism will be described. Finally, the main components of the foods will be described in relation to a healthy diet. Clinical pearls will be provided.

Detailed program

General Biochemistry and Enzymology: Catalysis and enzyme kinetics. Vmax and Km. Factors influencing enzymatic activity. Inhibitors. Allosteric enzymes. Isozymes. Diagnostic use of enzymes and Bioenergetic isoenzymes: Respiratory chain and oxidative phosphorylation. Molecules with high energy content. The production of ATP. Inhibitors and decoupling of oxidative phosphorylation. Glucidic metabolism: Digestion, absorption and transport of carbohydrates. Glycolysis (aerobic and anaerobic). Regulation of glycolysis. Synthesis of glycogen and

glycogenolysis. Metabolism of galactose. Lipid metabolism: Digestion and absorption of lipids. Catabolism of lipids. beta-oxidation of fatty acids. Role of carnitine. Citric acid cycle. Lipogenesis: biosynthesis of fatty acids; biosynthesis of triglycerides. Regulation of lipolysis and lipogenesis. Metabolism of cholesterol and its derivatives. Cholesterol conversion into steroid hormones and bile salts. Metabolism of ketone bodies. Plasma lipoproteins. Protein metabolism: Digestion of proteins, absorption, and transport of amino acids. General metabolism of amino acids. Gluconeogenesis. Regulation of gluconeogenesis. Metabolism of purine and pyrimidine nucleotides: Purine and pyrimidine pathways. One carbon metabolism pathway. Vitamin B9. Vitamin B12. The feeding-fasting cycle. Clinical pearls associated with metabolisms malfunction. Biochemistry of nutrition: Biochemical aspects of digestive processes and nutrient absorption. Basal metabolism. Homeostasis of the carbohydrates, lipids, and proteins. Diet.
Nanomedicine concepts (seminar modality).
Proteomics concepts and imaging based spatial proteomics (seminar modality).

Prerequisites

Basic knowledge of biology and chemistry.

Teaching form

In-presence Frontal lectures
27 hr (9 classes - duration: 3 hr)

Online lectures
12 hr (4 classes -duration 3 h)

In-presence Practice
4h (1 class)
Final assessment of the student's learning goals via a practical activity for the examination

Students will also be involved in actively participating in lectures: questions are welcolmed during the course of the lessons; moreover last part of lessons will be specifically dedicated to concerns' clarifications. Clinical cases and scientific publications inherent to the program will be discussed in the classroom: students will be divided into groups to discuss some biochemistry questions on the topics covered in class.

Textbook and teaching resource

Slides will be provided.
Scientific publications published on international journals will be suggested along the course.
Suggested books:
Biochemistry with clinical aspects , Thomas Devlin
Biochemistry, Berg et al

Semester

1st year - II semester

Assessment method

**Written exam. **

25 questions multiple choice (A-B-C-D one answer is correct) and/or true-false questions: **value 1**
1 open question: short assay up to 20 lines **value up to 4**
1 open question: short answer (one or two words) **value up to 2**
The exam is positively evaluated with a mark of 18/30 or higher.
The questions proposed in the written exam will be constructed in such a way as to induce the student to biochemical-clinical reasoning, to understand the units of measurement, and to be able to evaluate the skills and competencies acquired according to the objectives of the course.

**Group activity **

The jounal club activity held by students will be also taken into account in the final score of the exam.
Specifically: **+1 **on the final score to very good presentations
**+2 **on the final score to excellent presentations

Office hours

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Sustainable Development Goals

GOOD HEALTH AND WELL-BEING