



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Biomedical Sciences

2425-1-I0302D002

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#### Aims

##### BIOCHEMISTRY

Students must be able:

- to explain structural characteristic of protein and the structure-function ratio;
- to describe the role of enzyme in the biochemical reactions, with particular attention to enzymatic kinetic and regulation;
- to define bioenergetics concepts, explaining respiratory chain function;
- to describe sugars, lipids and proteins mechanisms of digestion and absorption;
- to describe the metabolism of glucose, amino acid and fatty acid;
- to describe cholesterol, ketone bodies, purines and pyrimidines, hormones metabolism and hormonal regulation of metabolism.

##### BIOLOGY

The student will learn:

- the function of the main macromolecules of the cell;
- the structure of the cell membrane and its role in transport and communication;
- structure and function of the cytoskeleton;
- the molecular and cellular basis of gene expression and regulation;
- the cellular and molecular mechanisms that control cell division, differentiation, proliferation and cell-cell interaction;
- the basis and laws of the transmission of hereditary characteristics;
- the mechanisms determining the onset of human phenotypic variants.

##### CHEMISTRY

The student should be able to:

- describe the fundamentals of atomic structure, types and significance of chemical bonds; indicate possible interactions between molecules;
- explain the types of possible solutions and their concentration; define the concepts of osmolality and osmotic pressure the significance of osmotic phenomena in biological processes;
- describe the different types of reactions that can occur between the compounds;
- define the concept of acid, base and salt, pH and its meaning; describe the properties of the buffer systems;
- identify structural and chemical properties of the major classes of organic compounds and characteristics of the main reactions occurring in organic compounds;
- describe chemical characteristics of biological compounds: lipids, sugars, amino acids and nucleotides; describe composition and structure of nucleic acids and proteins.

## **MEDICAL GENETICS**

The student must be able:

- to recognize the mode of inheritance of Mendelian characters;
- to know the structure of human chromosomes;
- to know the sources of genetic variation;
- to know the mechanisms of epigenetic regulation of gene expression;
- to know basic concepts of quantitative genetics and population genetics.

## **Contents**

The course aims to provide the student with: the knowledge of general and organic chemistry for the study of compounds in biological systems; the knowledge of the main metabolic pathways and biochemical cellular mechanisms; the knowledge of the structure and function of pro/eukaryotic cells, thanks to the tools provided by the integration of the most current and advanced concepts of molecular and cellular biology; the basis of formal human genetics, introducing the student to the most basic laboratory techniques used for the diagnostic approach and research of hereditary disease.

## **Detailed program**

### **BIOCHEMISTRY**

- Living matter in general.
- Proteins: structure-function ratio, plasmatic protein.
- Biochemical reactions, enzymes, enzymatic kinetic and regulation.
- Bioenergetics, respiratory chain, oxidative phosphorylation.
- Digestion, absorption of sugars, lipids and proteins.
- Glucose, amino acid and fatty acid metabolism.
- Cholesterol, ketone bodies, purines and pyrimidines, hormones metabolism, and hormonal regulation of metabolism.

### **BIOLOGY**

- Structure and organization of the eukaryotic and prokaryotic cells.
- Structure and function of proteins and nucleic acids.

- DNA replication and mechanisms of DNA repair.
- Chromatin structure and the organization of the human genome.
- Organization of the eukaryotic genes.
- RNA transcription.
- Genetic code and protein synthesis.
- Regulation of gene expression.
- Signal transduction.
- Cell cycle and cell cycle regulation.
- Mitosis and Meiosis.
- Mendel's laws.
- DNA mutations and polymorphisms.

## **CHEMISTRY**

- The structure of matter. Chemical bonds.
- Solutions. Chemical reactions.
- Acids, bases and buffers.
- Classification of organic compounds; functional groups which characterize the organic compounds.
- General properties of organic compounds and their reactivity.
- Organic compounds of biological interest: carbohydrates, amino acids, nucleotides, lipids. Polysaccharides. Proteins. Nucleic acids.

## **MEDICAL GENETICS**

- Mitosis and meiosis in relation to conventional cytogenetics.
- Mendelian genetics, extensions, recombination and linkage, genetic and physical maps.
- Mendelian Inheritance in man, pedigree reconstruction.
- Sex determination and X chromosome inactivation.
- Fundamentals of epigenetics.
- Polymorphisms and mutations in the context of genetic variability.
- Basic principles of population and quantitative genetics.

## **Prerequisites**

## **Teaching form**

Lectures, exercises.

## **Textbook and teaching resource**

### **BIOCHEMISTRY**

M. Stefani, N. Taddei: Chimica Biochimica e Biologia Applicata Zanichelli.

R. Roberti, G. Alunni Bistocchi: Elementi di Chimica e Biochimica McGrawHill

### **BIOLOGY**

Solomon, Berg, Martin. Elementi di Biologia. EdiSES

Bonaldo, Duga, Pierantoni, Riva, Romanelli. EdiSES

## **CHEMISTRY**

M. Stefani, N. Taddei: Chimica Biochimica e Biologia Applicata Zanichelli.

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## **MEDICAL GENETICS**

Peter J. Russel Genetica Fondamenti

Supplementary material will be provided by teacher

## **Semester**

First semester

## **Assessment method**

Written test. The written test will consist of a CLOSED ANSWERS TEST for the Biochemistry module, a CLOSED ANSWERS TEST for the Biology module, a CLOSED ANSWERS TEST plus open questions for the Chemistry module and for the Medical Genetics module from a CLOSED ANSWER TEST.

The final evaluation will take into account the results obtained in the different tests.

## **Office hours**

By appointment required by mail

## **Sustainable Development Goals**

GOOD HEALTH AND WELL-BEING

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