UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biomedical Sciences

2122-1-I0302D002

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;
- to describe calcium 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.
- Calcium 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.

It is required 70% course attendance.

Textbook and teaching resource

BIOCHEMISTRY

Siliprandi & Tettamanti: Biochimica medica" PICCIN

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

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

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.

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

MEDICAL GENETICS

Peter J. Russel Genetica Fondamenti

Supplementary material will be provided by teacher

Semester

First semester

Assessment method

Being an integrated course, the evaluation will cover all four modules.

The evaluation will consist of a written test that will be used to ascertain the level of knowledge and ability to understand the topics covered during the course and to be able to solve problems. Therefore the student will have to answer:

Multiple choice test (10 quizzes concerning the topics of **Biochemistry**, 15 of **Biology**, 10 of **Chemistry** and 10 of **Medical Genetics**).

Oral examination will be required at professor's discretion (discussion of the written test). The oral test will serve to clarify critical issues emerged from the written test and to verify the communication skills of the student and will focus on the topics covered by the written test.

Office hours

By appointment required by mail