UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biomedical Sciences

2627-1-I0302D002

Aims

Knowledge and understanding
Upon completion of the course, the student will have acquired knowledge of the fundamental chemical and biochemical concepts necessary to understand biological phenomena and their associated energy variations, as well as the molecular bases of the complex processes that regulate the metabolism of living beings. Furthermore, the student will have acquired the principles of general and organic chemistry required to study the compounds present in biological systems and the main cellular metabolic pathways. The topics covered in the course will allow the student to gain knowledge on the structure and function of prokaryotic and eukaryotic cells, integrated with the most current concepts of molecular and cellular biology, and to understand the foundations of human genetics.
Applying knowledge and understanding
At the end of the course, the student will be able to describe, using appropriate biochemical and molecular language, the correlation between molecular structure and function. They will be able to analyze the complex phenomena of communication, interaction, and control of cellular and tissue functions, and to apply the concepts of genetics and molecular biology to interpret the results of the main diagnostic tests and genetic screenings.
Making judgements
Upon completion of the course, the student will be able to critically evaluate basic biochemical and biological data, distinguishing normal physiological parameters from altered or pathological ones. Furthermore, they will be able to interpret information derived from family trees (pedigrees) and basic genetic tests to identify the risk of transmitting hereditary diseases.
Communication skills
At the end of the course, the student will have acquired the ability to present the topics covered during the course clearly, using appropriate terminology and scientific rigor.
Learning skills
At the end of the course, the student will have acquired the tools necessary to independently pursue further learning, study, and continuous updates in the field of basic biomedical sciences.

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 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

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