



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Basic Sciences

1718-1-H4102D001

Aims

PHYSICS:

The student must know:

- The fundamental concepts of thermodynamics with particular reference to chemical reactions
- The fundamental concepts of mechanics with particular reference to the balance of the human body
- The basic concepts of radiation physics, with particular emphasis on biomedical applications
- The basic concepts of fluid dynamics, with particular reference to the human circulatory system
- The basic concepts of electrodynamics with particular reference to the transport of the electrical signal in the nervous system

CHEMISTRY AND PROPEDEUTIC BIOCHEMISTRY:

In the first part of the course will be illustrated: the principles of chemical kinetics, chemical equilibrium, redox reactions and energy related to them in the general framework of thermodynamics and electrochemistry, and finally the self-ionization of water will be treated, acid / base properties and buffer solutions.

In the second part will be described: the reactivity of the main classes of organic compounds, including the isomerism and the stereoisomerism of organic molecules containing carbon atoms. The properties of the main classes of macromolecules of biological interest (proteins, lipids, carbohydrates and nucleic acids) will be illustrated. In addition, the basic knowledge of proteomics and imaging with MS used for clinical applications will be provided.

BIOCHEMISTRY

Provide the concepts necessary to understand biological phenomena and energy changes connected to them

Explain the correlation between function and molecular structure, complex communication phenomena, interaction and control of cell and tissue functions;

Explain how organ functions can be regulated according to their particular biochemical processes, focusing on metabolic integration

Contents

The Physics module aims to provide the student with the tools necessary for understanding life processes at the molecular level and the basis for identifying the links due to the effect of chemical and physical processes most relevant to the curriculum of studies and the profession of the physician. This knowledge will form the basic basis for the interpretation of the complex reactions that represent life and will be aimed at introducing the student to the scientific method, of an inductive type

The Biochemical Chemistry and Propedeutic module is oriented to provide the fundamentals of general and bioorganic chemistry, meeting the requirements of the medical sciences. It is proposed to offer useful knowledge for better understanding of other chemistry-related disciplines, such as biology and biochemistry.

The Biochemistry module will illustrate the importance of life-sustaining chemical reactions. It will deal with aspects of general biochemistry, sensory and metabolic biochemistry in humans. It will also describe in detail the integrated biochemistry of organs and tissues. It will provide useful knowledge for the best understanding of other medical disciplines and clinics

Detailed program

RADIATION PHYSICS:

Overview of the physics of the nucleus.

Alpha, beta, gamma and nuclear reactions decay.

X-ray.

Radiation-matter interaction.

Biological effects of radiation

Biomechanics

Moment of a force.

Balance of a body with exemplifications of the balance of the limbs of the human body.

Levers.

Static of the rigid body.

Young's modulus and elasticity.

THERMODYNAMICS:

Thermodynamic systems and states
Phase transitions
Transformations of perfect gases
1st principle of thermodynamics
2nd principle of thermodynamics and entropy
Enthalpy and free energy.

ELECTRODYNAMICS:

Interaction between electrical charges.
Electrical field and electrostatic potential.
Dielectric constant.
The capacity of a capacitor.
Electric circuits in series and in parallel.
Laws of Ohm.
Stationary current and transient current.
Charge and discharge a condenser

FLUID MECHANICS:

Law of Stevino, Archimede, Bernoulli, Poiseuille
Properties of real liquids and viscosity
Hydraulic resistance of a conduit.
Surface tension in liquids.
Laplace's law

OPTICS:

Spectrum of electromagnetic radiation.
Absorption of radiation
Lenses and geometric optics
Construction of images according to geometric optics
Eye as an optical system
Optical defects of the eye
Theory of color perception

CHEMISTRY AND PROPEDEUTIC BIOCHEMISTRY:

General chemistry
Reactions and chemical balance; redox reactions; kinetics and thermodynamics (ΔH and G) and spontaneity of a reaction
Acids, bases and buffer solutions; Henderson-Hasselback equation; pH of a buffer solution
Principles of electrochemistry
Bio-organic chemistry
Classification of organic compounds: Definition of functional groups; Structure, nomenclature and chemical-physical properties of organic compounds.
Alkanes and halogen derivatives: reactivity and nucleophilic substitution;
Alcohols, thio alcohols and amines: chemical properties and reactivity;
Alkenes and aromatic hydrocarbons: the double bond and its reactivity;
Carbonyl compounds: chemical reactions of aldehydes and ketones;
Carboxylic acids: acidity and reactivity of carboxylic acids; carboxylic acid derivatives: esters, thioesters, amides, anhydrides.
Main classes of molecules of biological interest
Lipids: structure and reactivity
Carbohydrates: structure, stereochemistry and the reactivity of monosaccharides / disaccharides; the loop closure mechanism of a non-cyclic carbohydrate; polysaccharides.
Nucleosides, nucleotides and nucleic acids: structure and properties of nucleosides and nucleotides
Amino acids and proteins: classification and nomenclature of amino acids; the amide bond and its chemical properties; protein structure.

Basic knowledge of clinical proteomics and imaging with MS.

BIOCHEMISTRY

Module 1: General Biochemistry

Themes

- Macromolecules: structure and function.
- Enzymes. Control of the metabolic pathways. Diagnostic use of enzymes and isoenzymes.
- energy and metabolism: the reactions of life
- Energy needs and expenses under different conditions. Bioenergetics and metabolism in physiological conditions
- carbohydrate metabolism: digestion, absorption. aerobic and anaerobic glycolysis. The metabolism of galactose and fructose. Glycogen, glycogenolysis.
- Lipids and steroids
lipid metabolism: digestion and absorption. Catabolism of lipids. Synthesis.
Metabolism of cholesterol and its derivatives. The metabolism of ketone bodies.
Plasma lipoproteins and their metabolism
- Amino acids and nucleotides: digestion of proteins, absorption and transport of amino acids. The metabolism of amino acids. nucleic acid urea cycle: The metabolism of purine and pyrimidine nucleotides.

Module 2) Aspects of human and metabolic sensory biochemistry

Themes

- Hormones: classification, biosynthetic mechanisms and their control. Hormonal regulation of metabolism. Hypothalamic and pituitary hormones. Thyroid hormones. The adrenal cortex. Hormones
- Systematic biochemistry. Integration of metabolism

Prerequisites

Basic knowledge of mathematics

Basic knowledge of chemistry

Basic knowledge of biology

Teaching form

Conventional

Textbook and teaching resource

MEDICAL PHYSICS:

F. Borsa, A. Lascialfari Fisica Medica Ed. Edises

CHEMISTRY AND PROPEDEUTIC BIOCHEMISTRY

Physical Chemistry, Adkins & Paula;

Organic Chemistry, Clayden et al,

BIOCHEMISTRY

Biochemistry, Berg et al.

Biochemistry with clinical aspects , Thomas Devlin

Semester

1st and 2nd semester

Assessment method

Written test

Final vote

Office hours

On appointment
