BASI MOLECOLARI DELLA VITA (INC112)

1. language

Italian.

2. course contents

Coordinator: Prof. MARCELLA ZOLLINO
Year Course: 1st
Semester: 1st
UFC: 5
Modules and lecturers:
- BIOCHIMICA (INC05A) - 2 CFU - SSD BIO/10 - Prof. Alessandro Lupi
- BIOLOGIA (INC06A) - 1 CFU - SSD BIO/13 - Prof. Anna D'Altocolle
- FISICA APPLICATA (INC08A) - 1 CFU - SSD FIS/07 - Prof. Andrea Fidanzio
- GENETICA APPLICATA (INC07A) - 1 CFU - SSD MED/03 - Prof. Marcella Zollino

3. bibliography

Elementi di Biologia e Genetica (Hillis D. et al. Zanichelli).
Elementi di Fisica" V. Monaco, R. Sacchi. A. Solano
Ricciotti, Fondamenti di Biochimica, Ed. Bovolenta.
Alternatively, other free choice books on Medical Genetics, Biology, Physics and Biochemistry, with the topics of the course covered in an exhaustive manner.

4. learning objectives

The training objectives are to promote understanding of the topics expressed in the educational program, through lectures based on direct examples of pathology, so that the notions can be applied in clinical practice.
Through questions posed during lectures, autonomy of judgment will be favoured in characterizing the nature of the problem at the patient's bed or in ambulatory and day hospital regimes, and in coordinating the interventions of appropriate specialists. Through simulations of clinical situations in the classroom, the ability to communicate both with the patient and with other specialists will be assessed, according to a multidisciplinary model of care. Learning skills will be assessed with ongoing tests, outside the official exam sessions.

5. PREREQUISITES

Basic school training and knowledge of basic scientific elements in the fields of genetics, biology, chemistry and physics/mathematics are required: logarithms, graphs, basic knowledge of mathematics, cell constitution, general notions on DNA.

6. teaching methods

Teaching methods are lectures in which the scientific/theoretical bases of the program topics are accompanied by simulations of real situations in clinical practice: students are asked about the framing of the problem, especially if in the context of an urgent situation, and the possible approaches for its solution, with particular regard to multidisciplinary specialist interventions. During these simulations, the ability to communicate with the patient and with colleagues will be assessed and whether the concepts have been assimilated will be verified, creating critical awareness

Exercise exercises on the topics covered during the lectures will be provided *in itinere.*

7. other informationS

The teachers will be available to receive students, on the days and in the manner that will be indicated during the course.

8. methods for verifying learning and for evaluation

The final examination will be the tool for voting, expressed out of thirty.

It will consist of a written test including 12 multiple choice questions and 3 open, compilation questions for each of the 4 disciplines of the course. Each question will have a value of 2. There is no penalty for incorrect answers.

A minimum of 18 for each discipline is required to pass the written exam. The questions will be presented in a manner that can favour students to demonstrate both knowledge of the scientific topics, ability of problem solving and the achievement of autonomous judgment. The open questions have the purpose of verifying also the communication skills.

The oral exam is not mandatory, but can be requested by the student, in addition to the written test, if a minimum of 18 is reached in individual disciplines, or suggested by the teacher.

The final grade will largely be the result of a weighted average of the results obtained in the various disciplines of the integrated course, therefore in accordance with the UCFs of the individual teaching.

The possibility of reaching the highest final grade depends on the result of the written test: the written test alone can allow for the achievement of the highest grade if the weighted average is at least 27, and if the result of the individual teaching tends to be homogeneous towards high values. If the written test has a grade equal to or lower than 26, the highest final grade can only be achieved with the oral test. The oral test can modify the result of the written test up to a maximum of 6 points, which can be used both in a positive and in a negative sense.

The partial results of one discipline can only be kept valid until the next date of the same session, in summer or in autumn.

9. program

Biochemistry

- Atomic theory.
- Chemical bonds.

- Waterfall. Solutions and concentrations.
- Strong and weak acids. Equilibria in aqueous solution.
- Buffer systems of biological interest.
- Quantities and principles of Thermodynamics.
- Endo-ergonic and exo-ergonic reactions.
- The main classes of biomolecules. Monosaccharides and polysaccharides. Simple and complex lipids. Saponification. Amino acids. Proteins and their structure.
- Enzymes: functioning and inhibition.
- Enzyme deficiency pathologies.
- Vitamins and coenzymes.
- Nucleic acids.
- Metabolic pathways and cycles. Glycolysis. Krebs cycle. Beta-oxidation of fatty acids. Chetonic bodies. Respiratory chain and oxidative phosphorylation.

Biology

- The scientific procedure and introduction to biology. The cell theory.
- The characteristics of living organisms. Macromolecules of biological interest and their role in cell biology: organic compounds (carbohydrates, lipids, proteins and nucleic acids).
- Cell organization: prokaryote-eukaryotic differences. Cell membranes: structure, function and types of transport (diffusion, active transport, endocytosis, exocytosis, osmosis).
- Cytoplasmic organelles: structure and function (nucleus, nucleolus, smooth and rough endoplasmic reticulum, lysosome, Golgi apparatus, mitochondrion and cellular respiration, ribosomes).
- Extracellular matrix and cell adhesion. Cytoskeleton and cellular movements. DNA: structure and replication in prokaryotes and eukaryotes.
- Genetic code: Expression and translation of the genetic message: transcription and translation of the RNA. Post-transcriptional RNA and post-translational maturation of proteins. Cell cycle, mitotic division, meiotic division and its role in the evolution of the species and in genetic transmission.

Physics

- Physical quantities; scalar and vector quantities; kinematics of the point; dynamics of the point.
- Static: moment of force, static balance, levers, mechanical advantage, levers in the human body, work and energy.
- Ideal fluids: fluids at rest, hydrostatic pressure, pressure measurement, Archimedes' principle; moving fluids: laminar and turbulent motion, flow rate, continuity equation, hydrodynamic blood circuit, Bernulli equation.
- Aneurysm and stenosis, TIA; viscous fluids: friction, Poiseuille's law, blood viscosity and hematocrit.
- Work of the heart, resistance of the vessels and pressure drop.
- Thermology: temperature, internal energy, heat, mechanical equivalent of the calorie, specific heat, heat transmission, first law of thermodynamics and considerations on metabolism.

- Electrical phenomena: charge, Coulomb's force, electric field, electric potential, current, Ohm's law, resistances in series and in parallel, capacitance, defibrillator. Magnetic field, Lorentz force.

Genetics

- Hereditary transmission models of genetic diseases: autosomal-recessive, autosomal-dominant, X-linked inheritance.
- Genomic imprinting.
- Human chromosomes: anomalies of number and structure. Conventional cytogenetic analysis and cytogenetic-molecular analysis (array-CGH, FISH).
- Molecular analysis of DNA: mechanisms of gene mutation.
- Multifactorial genetic diseases.
- Genetics of tumors.
- Prenatal diagnosis