SCIENZE BIOMEDICHE (FP000002)

1. language

Italian.

2. contenuti/course contents

Coordinator: Prof. GIAMPA' CARMELA

Year Course: 1

Semester: 1

UFC: 6
Modules and lecturers:
- APPLIED BIOLOGY (FP000034) - 1 cfu - ssd BIO/13
Prof. Carmela Giampa'
- CHEMISTRY AND BIOCHEMISTRY (FP000032) - 2 cfu - ssd BIO/10
Prof. Vito Pafundi
- APPLIED PHYSICS (FP000035) - 2 cfu - ssd FIS/07
Prof. Rocchina Caivano
- APPLIED GENETICS (FP000033) - 1 cfu - ssd MED/03
Prof. Marilena Carmela Di Giacomo

3. BIBLIOGRAPHY

Biochemistry module

David L. Nelson and Michael M. Cox. Introduction to Lehninger's Biochemistry. Zanichelli.
Massimi Stefani and Niccolo Taddei. Chemistry, biochemistry and applied biology. Zanichelli.
John W. Baynes and marek H. dominiczak: Biochemistry for disciplines biochemicals. Elsevier.
MV Catani, I. Savini, P. warriors, L. Avigliano. Biochemistry notes for graduation triennial. Piccin ed.

Biology module

Eldra P. Solomon, Linda R. Berg., Diana W. Martin) Fondamenti di Biologia, Edises
Hillis D. et al Elementi di Biologia e Genetica, Zanichelli.

Applied physics module

Applied physics module

G. Neri, M. Genuardi – Genetica umana e Medica – Elsevier Masson
G. Chieffi e altri – Biologia e genetica – Edises
B. Dallapiccola, G. Novelli – Genetica Medica – Edizioni scientifiche Falco 2022

It is necessary for the student to have a text, either one of the recommended ones or another text after teacher's approval.

4. LEARNING OBJECTIVES

The whole course is aimed at providing the student the necessary skills to know and understand the molecular basis of life and the biochemical processes underlying the functioning of the human organism.
At the end of the integrated course the student must demonstrate that he/she has reached the following objectives:

Knowledge and understanding - (Dublin 1) demonstrate knowledge and understanding of the basics principles of chemistry (chemical elements and reactions), biology, physics and genetics.

Applied knowledge and understanding - (Dublin 2) demonstrate to be able to apply the acquired knowledge of biology and chemistry to interpret and explain biological phenomena; he must demonstrate that he is able to use what he has learned for the understanding of other disciplines and for practical application in analytical and research laboratories, being aware that this knowledge is fundamental for understanding the application of specific techniques in the field of biomedical diagnostics and research.

Autonomy of judgement - (Dublin 3) At the end of the course the student should be able to independently discuss and critically analyse the cellular and molecular mechanisms underlying life processes. Autonomy of judgement will be stimulated during lectures through discussion of relevant issues.

Communication skills - (Dublin 4) be able to communicate scientific and applicative content in a clear and unambiguously way, using an appropriate scientific terminology and explaining their personal conclusions.

Ability to learn - (Dublin 5) At the end of the course the student must be able to evaluate their knowledge and skills and, consequently, to implement and/or update them by independently drawing on texts, scientific articles and online platforms.

5. prerequisites

In order to better understand the topics of the course, students must have basic (high school level) knowledge of physics, chemistry and mathematics

6. TEACHING METHODS

The teaching of the course is organized into lectures covering the topics of each modules to provide the basic elements of applied biology, physics, genetics, chemistry and biochemistry. The lectures will be supported by power point presentation (Dublin 1).

During the lessons the teaching methods implement active learning activities, such as problem-based learning, self-learning, case studies. The students are involved in active participation through exercises and discussions to learn the applicative potential oft he treated topics (Dublin 2).

Students thus begin to acquire autonomy in interpreting the importance of the mechanisms underlying biology and the chemistry of life (Dublin 3);

they also acquire discipline-specific terminology and the ability to communicate to others (Dublin 4).

Finally, students are invited to test the subject matter by studying the recommended texts and to express their doubts and curiosity in the following lesson. The disciplines will be taught in order to create the basis and interest for subsequent studies (Dublin 5).

7. OTHER INFORMATIONS

The teachers are available for information on the course and for clarification on the lessons by appointment via e-mail or, if for short questions, at the end of the lessons.

8. METHODS FOR VERIFYING LEARNING AND FOR EVALUATION

A written examination with multiple-choice questions, possibly supplemented by an oral examination, on the course topics is planned. The student's preparation will be assessed on the basis of the ability to describe biological and chemical processes in a clear and scientifically rigorous manner and to be able to connect the various topics, demonstrating an understanding of biochemical logic. The student achieves a mark of 30/30 by answering exactly all the questions asked and possibly the praise if the judgement of the Committee is unanimous. Should the health situation require it, it may be necessary to carry out the learning tests by on-line mode, via Teams and/or Blackboard platforms.

9. program

BIOLOGY

Discovery of the cells, basic properties and the two fundamentally different classes of cells. The structure and functions of biological molecules (carbohydrates, lipids, protein and nucleic acid). Differences between prokaryotic, eukaryotic cells and viruses. Cellular membrane (function and chemical composition, the movement of substances across cell membrane, diffusion and facilitated diffusion, active transport, exocytosis, endocytosis). Cellular organelles: nucleus, endoplasmic reticulum, lysosomes, golgi complex, mitochondrion and aerobic respiration).The cytoskeleton. The extracellular matrix and cell interactions. Cell division: cell cycle and its regulation. Mitosis and meiosis. Cell signaling pathways. Duplication and transcription of DNA. Translation of mRNA in prokaryotic and eukaryotic cells. Controlling gene expression.

APPLIED PHYSICS

Kinematics of the material point. Units, standards and the International System; elements

of mathematics an elements of mathematics and trigonometry, elements of functions, one-dimensional kinematics, position, speed and acceleration, rectilinear motion, uniformly accelerated rectilinear motion, dynamics principles–Stenght – Gravity force- law of universal gravitation – binding reaction force – friction – elastic deformation –electric charge- electrostatic interaction forces- Work - kinetic energy theorem definition –conservative force – Potential energy– Law of Conservation of Mechanical Energy– Mechanics of exednded bodies -Rotation theroy- Moment of a force- Equilibrium of extended bodies-Levers classification- human body's levers. Ideal fluid mechanics: fluidostatics – pressure – Pascal's law – Stevino's law – Torricelli's experience–Archimede's principle – fluid dinamics– laminar and turbulent flow regime – flow costancy – Bernoulli equation –aneurysm – stenosis– Hydrodynamics of blood circulation. Thermology e thermodynamics: temperature – thermal expansion– heat – thermal balance and balance temperature – Thermal capacity and specific heats – digital and analog thermometer – Laws of perfect gases – internal energy – principles of thermodynamics – thermodinamic transformation. Waves in elastic media with elements of acoustics and optics: wave propagation - transverse and longitudinal waves - waves in elastic media - frequency - wavelength - wave speed - wave intensity – acoustics– timbre, pitch and intensity of sound- overlapping principle – Fourier spectrum - interference - beats - electromagnetic waves - propagation of electromagnetic waves - the structure of the nucleus - radioactivity - ionizing radiation and not in medicine.

CHEMISTRY AND BIOCHEMISTRY PROGRAM

Basics of general chemistry, introductory notes. Periodic table, chemical periodicity and element classification. Description of the atom: elementary particles: proton, neutron, electron. isotopes. Electronic configuration of atoms. Numbers quantum and orbital. The various hybridizations of the type sp. The chemical bond. Solutions: concentration of the solutions. Concept of acids and bases, pH and buffer solutions.
Fundamentals of thermodynamics and chemical kinetics.
Basics of organic chemistry. The chemistry of carbon. Nomenclature and characteristics physicochemical properties of hydrocarbons, alcohols, aldehydes and ketones, carboxylic acids, compounds nitrogenous, aromatic compounds. Isomerism.

Biochemistry. Composition of living matter and role of biochemistry.
Amino acids. Peptides and proteins. Structure and properties of amino acids. Levels protein structure and denaturation. Protein function. Hemoglobin and myoglobin. Glucids: classification. Reserve carbohydrates and structural carbohydrates. Isomerism of sugars Lipids: classification of lipids. Phospholipid fatty acids, sphingolipids, triglycerides, steroids. Enzymes and coenzymes: role and classification. Enzyme kinetics. Inhibition concept. Allosteric enzymes. Role of coenzymes. Introduction to metabolism. Anabolism and catabolism. Bioenergetics (free energy, enthalpy, entropy) ATP and Coenzyme A. glucose metabolism: aerobic and anaerobic glycolysis. Difference between hexokinase and glucokinase. gluconeogenesis. Krebs cycle and reactions anaplerotic. Regulation of glucose metabolism. Lipid metabolism. Digestion and absorption. Role of lipoproteins. Beta oxidation. Bodies ketones. Biosynthesis of fatty acids. Cholesterol biosynthesis. Regulation of lipid metabolism. Protein metabolism: digestion and absorption. Transamination and deamination. urea cycle. Electron carriers e respiratory chain. Oxidative phosphorylation and ATP synthesis.