Basic Life Sciences 1 [1205105]

Offerta didattica a.a. 2024/2025

Docenti: GIOVANNI DI PINO

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi
Students must achieve an adequate knowledge and understanding of the main aspects of cell biophysics, the importance of cell differentiation and specialization in the morpho-functional organization of tissues, in development of the organism and in the physiological interactions between cells. Moreover, they must know the precise anatomical terminology and understand the morphological and topographical organization of the main body regions and the morpho-functional organization of the musculoskeletal system, with a plain comprehension of the quantitative aspects of models and rules determining the functions.

Prerequisiti
The course is preparatory for Basic Life Sciences 2

Contenuti del corso
Anatomy:
Overview of the organization of the body. Nomenclature and Anatomical terminology. Superficial Anatomy. Reference planes. General classification of the organs.
Topographic and superficial Anatomy of the body regions: the head and the neck, the thorax, the abdomen and the pelvis. Clinical importance of superficial anatomy.
Locomotor Apparatus: classification of bones: long bones, short bones and flat bones. Classification of joints. Diarthrosis and enarthrosis. Classification of muscles. Nomenclature and classification of movements. The skull: splancnocranium and neurocranium. The jaw. Muscles of the head and the neck. Masticatory muscles. The spine: vertebrae. Joints of the spine. Intervertebral disks and ligaments of the spine. The thorax: ribs and sternum. Muscles of the spine, thorax and abdomen. The inguinal region and the inguinal canal. Bones, joints and muscles of the upper limb. Bones, joints and muscles of the lower limb. Principles of kinematic.

Histology:
Introduction to two-dimensional, three-dimensional and four-dimensional histological methods. Summary of the anatomy of the “theoretic eukaryotic cell”. Early stages of development and origin of the adult tissues. Epithelial tissues: classification of epithelia. Lining epithelia: mono-stratified and pluri-stratified lining epithelia, specialized lining epithelia. Squamous epithelia: the skin. Endothelia. Transitional Epithelia. Mesothelia. Glandular epithelia: exocrine and endocrine glands: secretion modalities, neuro-endocrine correlations. Connective tissues: classification. Specialized connective tissues: cartilaginous tissue: intracellular matrix, cartilaginous lacunae, chondrocytes and chondroblasts. Bone tissue: osteocytes and osteoblasts, mechanisms of osteogenesis and mineralization. Bone homeostasis and its clinical implications for aging. Blood: circulating blood cells, serum and plasma. Congenic and acquired anemia and introduction to blood transfusion as a form of cell therapy. Adipose tissues and mechanisms of thermogenesis. Muscular tissue. Skeletal muscle structure: endomysium, perimysium. Skeletal muscular cells: sarcomeres and myofibrils, actine/myosin interactions. Sarcolemma, sarcoplasmic reticulum. Extra-myofibrillar cytoskeletal proteins. Mechanism of muscular contraction. Neuromuscular junction. Cardiac muscular tissue: myocardial cells. Gap junctions and inter- cellular communications. Mechanisms of myocardial contraction. Smooth muscular tissue. Nervous tissue: white matter and grey matter. The Neuron: size, shape and morphology of different neuronal subtypes. The neuronal cytoskeleton: axons, dendrites and axonal transport. Neuronal membrane and its specializations. Principal classes of neurotransmitters ad their receptors. The synapses: morphological classification and ultrastructure. The glial cells: astrocytes, oligodendrocytes, Schwann cells. Formation and constitution of myelin sheets. Microglia and mesenchymal cells of the central nervous system. Ependymal cells. The peripheral nerve: axonal organization, histological classification of neuronal fibers. Myelin sheets, endonervic and perinervic sheets. Unmyelinated peripheral fibers. Embryology: Life cycle stages. Gametogenesis. Development of the gonads. Spermatogenesis. Oogenesis. Fertilization. Embryo implantation. Segmentation. Gastrulation. Cellular and molecular mechanisms of cells differentiation. Germ layers and derivatives. Endoderm and formation of primitive intestine. Mesoderm and mesenchima. Notochord formation. Ectoderm and neuro-ectoderm, neuronal crests. Somites. General development of the fetus. Embryonic appendages.
Stem cells: Pluripotent, multipotent, unipotent stem cells. Pluripotent stem cells: the cells in the gastrula. Multipotent stem cells: cells of the embryonic body, mesenchymal and hematopoietic stem cells. Lineage-specific stem cells: Neuronal and muscle stem cells. The hematopoietic stem cell as a model for tissue differentiation. Clinical

applications of the hematopoietic stem cells: autologous and heterologous bone marrow transplantation. Gene therapy and gene editing: example of gene therapy: cure for Beta-thalassemia. Example of gene editing: cure for AIDS. Clinical applications of in vitro derived stem cell progeny: mesenchymal stem cell progeny for cell therapy, tissue repair and 3D organ printing for autologous organ transplantation. Induced pluripotent stem cells and their clinical application.

Physiology:
• Control theory: policies and components of control systems, general rules of modelling, negative and positive feedbacks and feedforward controls (and their examples) and homeostasis (2 hours)
• Biophysics: diffusion and transport of solutes and water through cell membrane (1:30 hours)
• Ion channels, transporters and their kinetics (2 hours)
• Basic physics of electricity, membrane resting potential (Nernst and GHK laws) and action potential (Hodgkin and Huxley experiments and model) (5 hours)
• Membrane equivalent RC circuit (2 hours)
• Conduction of electrical signals in nerve fibers: electrical model of the axon (Kirchhoff laws), electrotonic conduction, space and time constants, point-by-point regeneration, saltatory conduction (2 hours)
• Synapses (electrical and chemical), molecular mechanisms of exocytosis and synaptic integration, Hebbian rule and neuroplasticity (3:30 hours)
• The transmission of Impulses from nerve endings to skeletal muscle fibres; The molecular biology of acetylcholine formation and release (2 hours)
• The physiological anatomy of skeletal muscle and the general mechanism of muscle contraction (2 hours)
• The excitation of skeletal muscle: neuromuscular transmission and excitation-contraction coupling and muscle action potential (1:30 hours)
• Muscle fibers type and motor units (2 hours)
• Smooth muscle (2 hours)
• Hill’s experiment, setup and model of extra and intrafusal fibers (2 hours)
• Biomechanics of the human body (1:30 hours)

Metodi didattici

The aims of the course will be achieved by a combined approach between traditional inductive teaching method, innovative teaching, problem based learning and interactive learning, consisting of open-ended problems or tests taken at the end of particularly significant topics to consolidate their learning.

Modalità di verifica dell'apprendimento

The examination of the contents will be an integrated examination of the three modules.

• Assessment criteria of the histology module: The histological part is assessed by pre-test which will include the recognition of a tissue randomly chosen from those discussed during the course by optical microscopy. In this test, the student must prove that he is capable to describe and illustrate the criteria which lead him/her identify the nature of the tissue. The positive result of this test will allow the student to take the written test.
• With regard to the Anatomy part, it consists of a written test consisting of labelling of anatomical and radiological images and 8 multiple-choice questions followed each by a short motivation essay of a maximum 5-10 rows, by which the students must demonstrate an adequate knowledge of anatomy, with particular reference to functional, topographical and clinical anatomy. There will be an optional midterm, which might constitute credit for the final examination, focused on selected topics of cytology, histology and anatomy; the test will also consist of a written test, including short essays or multiple-choice questions.
• Concerning the Physiology part, this is done through a written multiple-choice, true-or-false and open questions test evaluating the acquired knowledge and understanding of homeostasis control, cell biophysics, basis on neuron activity and muscle physiology.

Finally, an integrated oral interview is performed to test the integrated aspects of the course, The ability to apply the knowledge and understanding, reworking them in a reasoned manner, is assessed with open-ended morpho-functional questions. Emphasis is placed on the students' communication skills and their ability to critically reformulate the learnt concepts. Students are also required to graphically represent models and relationships between physiological parameters.

Testi di riferimento

After the lessons covering a section of the program, students will be provided with the related didactic materials.

Anatomy
Susan Standring et al. Grey’s Anatomy: The Anatomical Basis of Clinical Practice. 41st Edition. Elsevier;
Friedrich Paulsen et al. Sobotta Atlas of Human Anatomy. 15th edition. Urban & Fisher (Elsevier);
Frank H. Netter. Atlas of Human Anatomy. 7th edition. Elsevier.

Histology
Barbara Young et al. Weather: Histology and Microscopic Anatomy. 6th edition. Elsevier.
James Lowe and Peter Anderson. Stevens and Lowe’s Human Histology. 5th edition. Elsevier.

Embryology: Keith Moore and T.V.N Persaud et al. The Developing Human. Clinically oriented Embryology. 11th revisited edition. Elsevier.

Physiology
Biophysics and quantitative aspects:
Joseph Feher, Quantitative Human Physiology: An Introduction, II edition, 2016
Organ Physiology:
Boron and Boulpaep, Medical Physiology, 3th Edition. Elsevier 2016;
Or alternatively:
John Hall, Guyton and Hall. Textbook of Medical Physiology, 14th edition, Elsevier 2020
Neurophysiology:
Kandel/Schwartz/Jessell, Principles of neural science, VI edition, McGraw-Hill Education 2021.

Altre informazioni

At the end of the course, the student should be able to:
• Describe the mechanism of regulation of membrane flow and potential
• Describe and understand the different tissues of the body and their embryological evolution.
• Describe the general organisation of the human body and more in detail of the musculoskeletal system with anatomo-functional bases of movement.
• Being able to model quantitatively the interaction between the investigated physiological parameters, knowing their range of normality, and their assessment methods and technologies.
• Know the main theories behind the investigated physiological functions and their key experimental bases.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	11	BIO/16, BIO/09, BIO/09, BIO/16, BIO/17, BIO/17

Stampa del 07/05/2025

Basic Life Sciences 2 [1205202]

Offerta didattica a.a. 2024/2025

Docenti: GIOVANNI DI PINO

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

Building upon the fundamentals of Chemistry, Biology and Physics, students must obtain a proficient knowledge and understanding of the organization of the nervous system and the organs of sense from a morphological and functional point of view.
Additionally, they must know the anatomical taxonomy and spatial relation of different structures of the central and peripheral nervous system.
Exploiting the comprehension of the neural development, students must understand the main functions of neural centres and their interaction, also with reference to their possible disfunction. Particular relevance is devoted to the plain comprehension of the quantitative aspects of models and rules determining the neural functions.

Prerequisiti

The course requires passing the Basic Life Science 1, Biology, Chemistry and General Physics II courses. The course is preparatory for Basic Life Sciences 3.

Contenuti del corso

Anatomy:

Neuroanatomy: Development of the central nervous system. Overview of the nervous system: general organization, meninges, CSF circulation and blood supply. Spinal cord. Brainstem and cerebellum. The Reticular formation. Diencephalon. Telencephalon. Cellular and molecular organization of the cerebral cortex. Motor pathways. Basal ganglia and cerebellum. Sensory pathways. Special sensory pathways: visual, auditory, vestibular, olfactory and gustative pathways. Limbic system: memory and emotional circuits. Circumventricular organs. Neuroanatomy of the principal neurotransmitters systems. Elements of Comparative Anatomy and artificial neuronal networks.
The sensory organs: the eye, the ocular annexes and the lacrimal glands. Muscle apparatus of the eye. The retina: cytology and functional anatomy. The ear: external ear, middle ear, internal ear: the cochlea and the Corti's organ: histology and functional anatomy; the vestibular organ. Gustative and olfactory receptor cells. Morphology of the sensory receptors of the skin and of the muscle and tendons receptors.
Peripheral nervous system: the cranial nerves. The nervous plexa: cervicalis, brachialis, lumbar and sacral. The functional distribution of the principal peripheral nerves of the upper and lower limb.
Development of sensory organs and peripheral nervous system. Elements of comparative Anatomy of the sensory systems.
Topographical Anatomy of the head and the neck

Physiology:

• Molecular Neurobiology (3 hours)
• Spinal Cord, motor and sensory tracts, spinal reflexes and their role in locomotion (5:30 hours)
• Brainstem, cranial nerves and breathing control (respiratory centres and genesis of respiratory rhythm) (5:30 hours)
• Hypothalamus and Autonomous Nervous System (peripheral branches and central components of ANS, and their effect on different organs) (2:30 hours)
• Neuro Enteric System and Neural Control of Gastrointestinal Tract (3 hours)
• Peripheral Somatosensory System and Peripheral Pain (2:30 hours)
• Cortical structure, organizations and function (Somatosensory Cortex and central elaboration of pain) (3 hours)
• Motor cortices and motor control (2:30 hours)
• Functional neuroimaging (EEG, MEG, fMRI…) (3 hours)
• Basal Ganglia (2:30 hours)
• Cerebellum (3 hours)
• Auditory system (inner ear, auditory transduction, vestibular system and auditory central nervous system) (2:30 hours)
• Language and Neurophysiology of Music and Creativity (3 hours)
• Chemical Senses (smell and taste) (2:30 hours)
• Mood and Anxiety (and their Disorders e.g., Depression), Motivation and Addictive States of Nutrition (3 hours)

• Sleep and Vigilance (sleep stages, sleep regulation, associated EEG and sleep disorders) (2:30 hours)
• Emotions (theories and neurophysiological substrates) (1:30 hours)
• Multisensory integration, body representation, peripersonal space and sensorimotor control and neurophysiology of tool use (1:30 hours)
• Neglect, Attention and Cognition (Conscious and Unconscious Mental Processes Attention and their disorders e.g., ADHD, Cognition Disorders e.g., Autism), Thought and Volition (and their Disorders e.g., Schizophrenia) (2:30 hours)
• Visual system (Eye and optics, visual transduction, visual receptive fields, visual processing and control of gaze) (3 hours)
• Learning and Memory and Aging Brain (2:30 hours)

Metodi didattici

The aims of the course will be achieved by a combined approach between traditional inductive teaching method, innovative teaching, problem based learning and interactive learning, consisting of open-ended problems or tests taken at the end of particularly significant topics to consolidate their learning.

Modalità di verifica dell'apprendimento

The evaluation of the contents will be done through an integrated examination of the two modules.

• For anatomy, the test will consist of an oral examination about: central nervous system, cranial nerves and sensory organs followed by an integrated written test consisting in one essay regarding innovative aspects of neuroanatomy, with integration of clinical neuroanatomy and comparative neuronatomy. The exams will take into account the ability of the students in the description of anatomical specimens, analysis of microscopic preparations and the answer to open questions, about neuroanatomy and topographic anatomy of the head, the neck and the limbs, as well as about innovative aspects of research in neuronatomy and evolution of the nervous system.
• Concerning the Physiology part, the test will evaluate the ability to associate anatomical structures with their main physiological function; Students are also required to understand and model the main neural functions; to comprehend the relation between physiological parameters and to graphically represent such dependencies.

Finally, a comprehensive oral interview is performed to evaluate the ability to integrate skills and knowledge acquired in the two modules. Emphasis is placed on the students' communication skills and their ability to critically reformulate the learnt concepts.

Testi di riferimento

After the lessons covering a section of the program, students will be provided with the related didactic materials.

Anatomy

David L. Felten et al. Netter’s Atlas of Neuroscience. 3rd edition. Elsevier.
Susan Standring et al. Grey’s Anatomy: The Anatomical Basis of Clinical Practice. 41st Edition. Elsevier;
Friedrich Paulsen et al. Sobotta Atlas of Human Anatomy. 15th edition. Urban & Fisher (Elsevier);
Frank H. Netter. Atlas of Human Anatomy. 7th edition. Elsevier.
Barbara Young et al., Weather: Histology and Microscopic Anatomy. 6th edition. Elsevier.
Keith Moore and T.V.N Persaud et al. The Developing Human. Clinically oriented Embryology. 11th revisited edition. Elsevier.

Physiology

Main textbook:
Kandel/Schwartz/Jessell, Principles of neural science, VI edition, McGraw-Hill Education 2021.

Biophysics and quantitative aspects:
Joseph Feher, Quantitative Human Physiology: An Introduction, II edition, 2016

Supplementary textbook (useful especially for organ physiology, which is mainly faced during the second semester):
Boron and Boulpaep, Medical Physiology, 3th Edition. Elsevier 2016;
Or alternatively:
John Hall, Guyton and Hall. Textbook of Medical Physiology, 14th edition, Elsevier 2020

Altre informazioni

Students must gain a solid knowledge of the principles characterizing the functional organization and the physiology of the human nervous system, considering the specificity of both central and peripheral structures. Such knowledge will be quantitatively-oriented specifically towards the sensorimotor mechanisms of the nervous system, including perception and sensation, pain, motor control and autonomic responses. Students are also expected to understand the control policies adopted for regulating human behaviours, emotions, sleep-wake cycles and cognitive functions.

More in details, at the end of the course, students should be able to:

• identify, map and label key functional structures and pathways in the brain
• understand the functional principles that govern the nervous system organization;
• understand the link between human nervous systems functions and animal and cell models on a molecular and cellular level in light of research applications;
• distinguish different methods and technologies to investigate human brain from a functional and structural point of view;
• describe different regions of the brain, differentiate their function and evaluate their potential clinical relevance;
• being able to model quantitatively the interaction between the investigated neurophysiological parameters and their assessment methods and technologies.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	13	BIO/09, BIO/09, BIO/09, BIO/16, BIO/16

Stampa del 07/05/2025

Basic Life Sciences 3 [1205204]

Offerta didattica a.a. 2024/2025

Docenti: MARCELLO D'AMELIO

Periodo: Secondo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	12	BIO/09, BIO/09, BIO/16, BIO/16

Stampa del 07/05/2025

Biochemistry [1205203]

Offerta didattica a.a. 2024/2025

Docenti: ALESSANDRO LEUTI, SILVIA ANGELETTI

Periodo: Ciclo Annuale Unico

Obiettivi formativi

The teaching aims at providing the essential knowledge to understand the chemistry behind the main cellular and physiological processes, and the role played by the main organic molecules in these functions. The student will study the structure and function of carbohydrates, lipids, proteins and nucleic acids, and will be introduced to the concept of metabolism and of its regulation in healthy and pathological conditions, while learning the thermodynamics that governs the metabolic fluxes. The course will also feature an application of these concepts to clinical biochemistry, to better understand how these processes are involved in the diagnostic process.

Prerequisiti

A basic knowledge of the cell structure (organelles and compartmentalization) and functions. A basic knowledge of inorganic chemistry concepts such as pH, pKa, solubility, buffer solutions, equilibria, as well as basic concepts of organic chemistry , such as functional groups and species, IUPAC nomenclature and the main reactions of organic molecules.

Contenuti del corso

Biochemistry syllabus

• Water: water structure and properties; hydrogen bonds and other electrostatic interactions; interaction between water and other organic compounds. Colligative properties.
• Amino acids and proteins: structure and function of amino acids. Classification and chemical-physical properties.
• Three-dimensional structure of proteins: primary, secondary, tertiary and quaternary structure of proteins; Ramachandran plot; protein folding.
• Protein Function: collagen, keratin and oxygen-transporting molecules: structure of hemoglobin and myoglobin, saturation, Bohr Effect, homotropic and heterotropic allosteric modulators of hemoglobin.
• Thermodynamics: concept of entropy, enthalpy and Gibbs free energy. - Enzymes: structure and properties of enzymes; catalysis; Michaelis-Menten kinetics; V0, Vmax and Km. Lineweaver-Burk plot. Reversible and irreversible inhibition
• Structure and role of carbohydrates: monosaccharides; oligosaccharides; polysaccharides; O- and N-glycosidic bond; starch; cellulose; glycogen.
• Nucleotides and nucleic acids: structure and functions; DNA and RNA.
• Structure and function of lipids: fatty acids; phospholipids; cholesterol; Eicosanoids and PUFA-derived endogenous signalling lipids.
• Biological membranes and transport.
• Biosignalling:
• Carbohydrate metabolism and its regulation: glycolysis; gluconeogenesis; pentose phosphate pathway; regulation of carbohydrate metabolism; glycogenesis; glycogen breakdown.
• Structural Biology
• Krebs Cycle: the role of pyruvate dehydrogenase, reactions and regulation of Krebs cycle.

• Lipid metabolism: lipoproteins;lipogenesis and lipolysis; beta-oxidation of odd- and even-chain, saturated and unsaturated fatty acids; ketogenesis; biosynthesis of fatty acids, phospholipids and cholesterol; regulation of lipid metabolism.

• Ammino acid metabolism: transamination; oxidative deamination; urea cycle; catabolism of ammino acids;
• Nucleotide metabolism.
• Heme synthesis and catabolism.
• Steroid Hormon biosynthesis
• Water- and fat-soluble vitamins: vitamin B complex and ascorbate, vitamin A, D, E, K; pathologies caused hypovitaminosis.
• Oxidative phosphorylation: chemiosmotic theory; mixed and pure electron transporters; redox loop and proton pump; mitochondrial complexes and ATP-Synthase.
• Examples of metabolic and enzyme-related diseases.
• Biochemistry of human organs: brain and immune system.

Clinical Biochemistry syllabus

• Biomarkers. Characteristics. Laboratory tests and results interpretation. Laboratory test automation: Total Laboratory Automation (TLA).
• Acid-base balance and blood gas. Definition of acids, bases, pH and buffer solution. pH homeostasis. Pulmonary and renal control of arterial pH. Simple acid-base disorders (metabolic and respiratory acidosis, metabolic and respiratory alkalosis. Anion GAP. Compensation. Mixed acid-base disorders. Blood gas analysis.
• Hydro-electrolyte balance. Fluid balance: body water and its distribution in body compartments. Gibbs-Donnan equilibrium. Osmotic pressure. Body water homeostasis: antidiuretic hormone, aldosterone and natriuretic hormone and related disorders from inappropriate secretion: SIADH, diabetes insipidus, hyperaldosteronism and hypoaldosteronism. Dehydration and overhydration. Electrolyte balance: Natremia, hypernatremia and hyponatremia. Kalaemia, hyperkalaemia and hypokalaemia. Chloremia, hyperchloremia and hypochloremia.
• Non-protein nitrogen. Overview of protein catabolism and nucleic acids. Determination of non-protein nitrogen in blood and urine. Blood urea nitrogen, ammonia, uric acid and creatinine.
• Carbohydrate metabolism. Glucose metabolism and hormonal regulation of glucose metabolism. Diabetes mellitus classification: type 1 diabetes, type 2 diabetes, impaired glucose tolerance, secondary diabetes, gestational diabetes, MODY (Maturity Onset Diabetes of the Young).
• Laboratory tests for the diagnosis and monitoring of the diabetic patient: assessment of fasting plasma glucose level, oral glucose loading curve test (OGTT), HbA1c assay, insulin assay, C-peptide assay, glycated hemoglobin and glycated plasma proteins (fructosamines). Laboratory tests in the acute and chronic complications of diabetes: ketonemia and ketonuria, lactic acid dosage, evaluation of acidosis and variation of the anion GAP, albuminuria dosage in diabetic nephropathy.
• Lipid metabolism. Metabolism, classification and composition of lipoproteins. Role of apoproteins in lipoprotein metabolism: apoA, apo B, apoC, apoE. Evaluation of the level of triglycerides, total cholesterol, HDL-cholesterol, LDL-cholesterol. Dyslipidemia and atherosclerosis.
• Blood cell count. Normal value and results interpretation. Laboratory diagnosis of thalassemia, hemoglobinopathies and anemia. Porphyria: disorders of porphyrins
• Hemostasis principles. Bleeding and thrombotic disorders
• Biomarkers in organ failure. The liver, the heart, the kidney, the pancreas
• Serum protein. Electrophoresis and results interpretation
• DNA technology: Large Probes used to detect copy number variations; Small Probes to detect point mutations; DNA Amplification by Polymerase Chain Reaction; Allelic Heterogeneity in the molecular genetic diagnosis; normal polymorphisms used as genetic markers;DNA Microarrays for genetic screening and gene expression analysis; DNA sequencing and Whole-Genome seuqnecing (WGS).

Metodi didattici
Ex-cathedra lectures, reading and interpretation of scientific literature, weekly student counselling.

Modalità di verifica dell'apprendimento
Written test on the topics covered during the lectures. Non-mandatory interview for students willing to improve the written test mark.

90 minutes written test, 10 short essays (8 Biochemistry, 2 Clinical Biochemistry, 350 max words each). Each short essay will be worth 0-30 points and the final grade will be the average of all the essays.

Testi di riferimento
Biochemistry
• Lehninger Principles of Biochemistry (D.L. Nelson and M.M. Cox) (main text)
• Voet’s Principles of Biochemistry (facultative)

Clinical Biochemistry
• Marshall - Lapsley - Day – Ayling. Clinical Biochemistry: Metabolic and Clinical Aspects - With Expert Consult access, 3rd Edition, Churchill Livingstone.
• Michael L. Bishop, Edward P. Fody, Carleen Van Siclen. Clinical Chemistry: Principles, Techniques, and Correlations. Jones and Bartlett Publishers, Inc, 2022
• Michael J. Murphy, Rajeev Srivastava, Kevin Deans. Clinical Biochemistry. Elsevier, 2023

The teacher will provide all the slides used in the lectures, as well as learning objectives of each topic covered in class.

Scientific papers

Altre informazioni

Knowledge and understanding
At the end of the course, the student must be able to describe the structure and general functions of the main organic molecules in human biology, as well as to describe the main pathways that orchestrate the metabolism of carbohydrates, lipids, proteins and nucleic acids, as well as the main elements of clinical biochemistry to which these elements are applied.

Applying knowledge and understanding
At the end of the Course, the student must be able to act to understand the main roles of organic molecules involved in cellular processes, and should be able to describe the connections between different metabolic pathways as they are constantly modulated during cellular homeostasis. He/she/they should be able to apply these concepts to the human pathologies that will be covered during the lectures.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	12	BIO/10, BIO/10, BIO/12

Stampa del 07/05/2025

Biology [1205101]

Offerta didattica a.a. 2024/2025

Docenti: ELENA SANTONICO

Periodo: Ciclo Annuale Unico

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	9	BIO/11, BIO/13

Stampa del 07/05/2025

Cardiorespiratory Diseases [1205306]

Offerta didattica a.a. 2024/2025

Docenti: FRANCESCO STILO, BIANCA ROCCA

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi

Cardiorespiratory Disease is an integrated course that includes the teaching of cardiovascular and respiratory diseases, radiology, and pharmacology. The course aims to address the themes of the individual subjects in a multidisciplinary manner, sharing different views in the approach to diagnosis and therapy, both medical and surgical, to the pathologies under study. This Course provides knowledge and experience through formal lectures and seminars, problem-based and case-based learning, and practical sessions at the bedside or in the simulation center.

Prerequisiti

To follow the course and make a profit from the proposed program, students should have a solid background in basic human anatomy and physiology, general pathology, and semiotics. Furthermore, students wishing to enroll in the course should possess the knowledge and critical understanding of biology, chemistry, physics, and mathematics and the integration of principles across the preclinical sciences.

Contenuti del corso

Cardiology: Physiology of the heart and coronary circulation. Clinical and instrumental diagnostics of the heart and vascular system. Pathophysiology of atherosclerosis and complications. Acute myocardial infarction with ST-segment elevation. Acute coronary syndromes without ST-segment elevation. Stable coronary syndromes. Coronary angiography and indications for coronary angioplasty. Heart failure. Cardiomyopathies. Aortic and mitral valve diseases. Hypertension. Arrhythmias. Cardiac arrest – sudden death. Conduction system disorders. Indications for pacemaker implantation, defibrillator, resynchronization therapy. Pericarditis, myocarditis, endocarditis. Congenital heart pathologies. Pulmonary embolism. Aortic dissection and aneurysms. Cardiac tumors.
Cardiac surgery: Pathophysiology and clinic of coronary artery disease, including indications and basic techniques of coronary artery bypass grafting. Pathophysiology, clinic and surgical indications of aortic and mitral valve disease. Basic principles of cardiac surgery techniques. Indication for the positioning of mechanical cardiovascular assistance devices and cardiac transplantation. Pathophysiology and surgical treatment of congenital heart defects. Indications and surgical techniques for the treatment of elective aortic pathology and in urgent conditions.
Vascular surgery: Atherosclerosis and principles of hemodynamics. Clinical and instrumental diagnostics of the circulatory system and vascular pathologies. Acute and chronic ischemia of the lower limbs (diabetic arterial disease, Leriche syndrome and Buerger disease). Cerebrovascular insufficiency (subclavian steal syndrome). Acute and chronic mesenteric ischemia. Renovascular hypertension. Aortic and visceral aneurysms. Aortic dissection. Vascular trauma. Venous pathology (insufficiency and thromboembolic disease – deep vein thrombosis and pulmonary embolism). Lymphatic pathophysiology (lymphangitis and lymphedema). Thoracic outlet syndrome. Vascular tumors.
Respiratory diseases:
Fundamental of physical examination of the respiratory system
Dyspnea, Chronic cough, Chest pain and main clinical presentations in respiratory medicine
Respiratory failure, acid-base regulation principles Interpretation of Arterial Blood Gas Tests
Introduction to respiratory system physiopathology. Definition of lung volume and capacity, evaluation of gas exchange efficiency and of respiratory muscles efficiency Dysfunctional patterns: obstructive and restrictive
Interstitial Lung Diseases
Chronic obstructive lung pathologies COPD (Chronic Obstructive Pulmonary Disease)
Chronic obstructive lung pathologies: Asthma
Non-tuberculous lung infections
Tuberculosis and atypical mycobacterial infections
Sleep breathing disorders: OSA (Obstructive Sleep Apnea) and CSA (Central Sleep Apnea)
Pleural diseases: physiopathology, clinical evaluation, diagnosis and treatment of: pleural effusion, pneumothorax, hemothorax, chylothorax and pleural neoplastic diseases
SARS-CoV-2 pneumonia
Rare lung pathologies and miscellanea Sarcoidosis, Alpha-1 antitrypsin deficiency, Cystic fibrosis, bullous diseases
Thoracic surgery: Pleural diseases: pleural effusion and pneumothorax. Isolated pulmonary nodules. Lung neoplasms: from diagnosis to treatment. Surgical treatment of mediastinal pathologies. Functional and neoplastic pathology of the esophagus: diagnostic and therapeutic procedures. Emergency thoracic surgery. Discussion of

clinical cases.
Diagnostic imaging and Introduction to digital images: Throughout the course, discussion of specific images will provide an introduction to basic radiological terminology, anatomy and physics used in medical imaging. Diagnostic and therapeutic procedures performed using radiological, echocardiographic or CT guidance will be described, together with specific indications and technical principles. Practical training in diagnostic imaging and interventional radiology units will allow students to test the knowledge acquired in “real life” scenarios.
Diagnostic imaging and Introduction to digital images:
- Introduction to thorax and cardiovascular imaging: technical bases of CT and MR angiography, basic radiological terminology and fundamentals of anatomy
- Thoracic Imaging in oncologic and non oncologic diseases. Low-Dose CT for Lung cancer screening and promising use of Artificial Intelligence in semiautomatic nodules and diffuse lung diseases detection.
- CT Angiographic imaging of main vascular diseases. Pros and cons of MRI Angiography and futuristic clinical scenarios
- Cardiac CT: clinical indications and role of CT in the diagnosis of main cardiac diseases. Latest cardiac CT advances (CT perfusion, fractional flow reserve-CT, evaluation of cardiac fibrosis with LIE acquisitions)
- Cardiac MRI: specific indications and main clinical uses. The novel CMR’s sequences (parametric T1 and T2 mapping, four-dimensional flow) and the impact of artificial intelligence (AI) in acquisition and post-processing.
- Diagnostic and therapeutic procedures performed using radiological CT or MR Imaging
- Practical training in diagnostic imaging units

Pharmacology:
General and applied pharmacology of cardiovascular diseases (drugs for Arterial hypertension, Arrhythmias, Heart failure, Ischemic cardiomyopathy). General and applied pharmacology of respiratory diseases (drugs for Asthma, Chronic Obstructive Pulmonary Disease).
Focus seminars will then follow to deepen knowledge of clinically oriented mechanisms of action, main toxicities, overall risk:benefit of each drug or classes of drugs.

Metodi didattici
The course contents will be delivered by integrating the different topics taught using lectures, problem-based and case-based learning, and interactive sessions. The first part of the course will consist of a three-week intensive period of formal lectures and seminars. Afterward, clinical practice sessions will start and integrate with formal teaching and interactive sessions. Students will be required to participate in discussions actively and join the multidisciplinary examination of clinical cases.

Modalità di verifica dell'apprendimento
The final exam will take place on completion of the class, in accordance with the sessions scheduled in the academic calendar. For this course, knowledge acquired and the ability to put in practice each of the topics taught will be evaluated with a written test. Students need to demonstrate adequate levels of whole-round understanding of all topics covered in the course alongside with suitable communication and judgement skills.

Practical test evaluation (clinical skills), written exam and oral exam.

The exam consists of a written and an oral optional test. The preparation acquired during the course will be assessed by administering a test, with equivalent questions based on the teaching modules. Within the test there will be questions of Cardio-Thoracic and vascular pathophysiology and principles of Imaging and Pharmacology, there will be examples of clinical cases such as those shown in lessons or dealt with during internships, the ability of critical analysis by the learner will be tested beyond to the patient, developing the most appropriate diagnostic path.
In the written test the student will have to demonstrate knowledge of the biological bases that lead to the development and progression of Cardiovascular pathology and states of emergency starting from the genetic, environmental and pathophysiological bases up to the clinical evolution of symptoms and the fundamental notions of radioogy, and the interactions between radiation and matter. Clinical cases will be included in the written test in order to assess the student's ability to coordinate the diagnostic-therapeutic process of acute patients.
The written test will consist of 90 multiple choice quizzes to be solved in 70 minutes.
The quiz will be divided as follows: 30 questions on Cardiology, 20 questions on Thoracic and Respiratory Pathology, 10 questions on Cardiac Surgery, 10 questions on Vascular Surgery, 10 questions on Radiology and 10 questions on Pharmacology.
For each correct answer one point will be given, for each wrong answer 0.20 will be deducted. In the end the score will still be calculated out of thirty.
With the written exam you can obtain a maximum mark of 26/30, to obtain higher marks it is necessary to take the oral exam.
The oral test will be carried out immediately after the communication of the scores of the written test or on a subsequent date and it will be possible to take it only if a score equal to or higher than 26 out of thirtieth is obtained in the written test. The grade of the oral exam is made up of the average of the 3 evaluations expressed by the 3 teachers/commissions.

Testi di riferimento

Cardiology:
• Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. Authors: Braunwald - Mann - Libby - Bonow - Zipes – Tomaselli. Publisher: Elsevier, 11th Edition, 2018; ISBN: 9780323462990
Cardiac Surgery:
• Master Techniques in Surgery: Cardiac Surgery by Frederick Grover and Michael J. Mack | 10 Mar 2016 Wolters Kluwer
Vascular Surgery:
• Rutherford's Vascular Surgery and Endovascular Therapy, 2-Volume Set, 9th Ed., Elsevier (textbook). By Anton N Sidawy and Bruce A Perler. ISBN Number 9780323427913
• Vascular and Endovascular Surgery: A Comprehensive Review, 9th Ed., Elsevier (textbook). By Wesley S. Moore. ISBN Number 9780323480116
• Comprehensive Vascular and Endovascular Surgery - 2nd Ed., Mosby Ltd. (textbook). By John W. Hallett, Jr., Joseph L. Mills, Jonothan Earnshaw, Jim A. Reekers, and Thom Rooke. ISBN Number 9780323057264
Respiratory Diseases:
J. Larry Jameson, Anthony S. Fauci, Dennis L. Kasper, Stephen L. Hauser, Dan L. Longo, Joseph Loscalzo Harrison's Principles of Internal Medicine, 20th edition – Publisher: Mc Graw-Hill

Stephen G. Spiro & Gerard A Silvestri & Alvar Agustí. Clinical Respiratory Medicine, 4th Edition
.
West JB. West's Pulmonary Pathophysiology, ninth edition - Publisher: Lippincott Williams and Wilkins

Online references:
Here listed are some web links to useful synopsis on the respiratory system anatomy and physiology. They can be viewed as a revising tool for basic notions required for the course.
1) https://youtu.be/toCAui5OIhQ
2) https://youtu.be/w642lNBo2LU
3) https://youtu.be/QmoxmlgQwj0
4) https://youtu.be/xcumNVISO4Q
5) https://youtu.be/IbhrIl-LbA0

Thoracic Surgery:
• National and international guidelines and articles from international literature will be provided during the lectures

Medical Imaging and Introduction to digital images:
• Core Radiology: A visual approach to Diagnostic Imaging. 1st Edition - Authors: Jacob Mandell. Publisher: Cambridge University Press – ISBN-13978-1107679689
• Learning Radiology: Recognizing the Basics. 4th Edition – Authors: William Herring. Publisher: Elsevier - ISBN-13978-0323567299
• CIRSE Standards of Practice Documents. https://www.cirse.org/education/standards-of-practice/cirse-documents/
• ESR Guidelines and Recommendations. https://www.myesr.org/publications/guidelines-and-recommendations

Pharmacology:
• Bertram G. Katzung and Anthony J. Trevor. Basic and Clinical Pharmacology 15th edition. Lange Publishing Co.
• Goodman and Gilman's The Pharmacological Basis of Therapeutics 14th edition. McGraw Hill Publishing Co.

Original and Review articles on specific and interesting topics will be recommended by the teachers during the course.

Altre informazioni

All areas could perform evaluation during flipped classroom testing students on the exposition and the treatment of clinical cases.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery "MedTech" (2022)	comune	20	MED/36, MED/10, MED/22, BIO/14, MED/11, MED/23, MED/21, MED/10, MED/22, MED/11,

MED/23, MED/21

Stampa del 07/05/2025

Physics and Chemistry [1205102]

Offerta didattica a.a. 2024/2025

Docenti: SARA MARIA GIANNITELLI

Periodo: Primo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	7	CHIM/07

Stampa del 07/05/2025

Electronics [1205303]

Offerta didattica a.a. 2024/2025

Docenti: GIORGIO PENNAZZA

Periodo: Primo Ciclo Semestrale

Obiettivi formativi
To provide students with the basic knowledge about electronic components and devices, methodologies for circuit analysis, and on the analog and digital topologies used in the most common IC.

Prerequisiti
No preparatory.
Suggested prerequisites: basic knowledge of electrical quantities, electronic components and circuit calculation strategies

Contenuti del corso
INTRODUCTION (4 h)
STC Circuits
SEMICONDUCTORS, DIODE AND TRANSISTOR (10 h)
Semiconductors. Diode. Circuits with diodes. BJT and MOSFET: I-V characteristics, functioning as an amplifier and logic inverter.
ANALOG INTEGRATED CIRCUITS (10 h)
Operational Amplifier. Feedback.
INTRODUCTION TO DIGITAL ELECTRONICS (6 h)
The inverter; logic family; A / D and D / A conversion. Combinatory circuits. Sequential circuits. Microcontrollers.

Metodi didattici
Lectures presenting the basic topics of electronics, the functioning of the fundamental devices and the most common circuit topologies (10 h).
Practical training using simulation SW and during laboratory session to show the application to specific real problems (10 h).
Workgroups in lab for testing simple electronics circuits (10 h).

Modalità di verifica dell'apprendimento
The Knowledge assessment methods will be based on oral tests.
This strategy for oral test will allow the verification of the student's communication skills regarding the specific topics of the course. The oral exam will take place gradually, allowing to verify the consolidation of basic knowledge and, gradually developing the required topic, allowing the student to demonstrate her/his ability to generalize the operation to more complex systems and apply this knowledge to the resolution of real simply problems.

The knowledge and skills acquired will be verified by means of a test structured into two moments in the context of a single oral test: a written question in which the student will have to demonstrate her/his mastery of the fundamental topics for which she/he will have 30 minutes; the content of this work will be presented by the student at the beginning of the oral exam (score from 0 to 15); a second question with which the student will be asked to apply their knowledge to the solution of a real problem (score from 0 to 15). The final mark out of thirty will be the sum of the two scores obtained in the two steps above.
The minimum sufficient mark to pass the exam, equal to 18/30, can be achieved by the student who will have demonstrated knowledge of the components and circuits presented in the course, knowing how to explain them in their most basic contents.

Testi di riferimento
Material provided by the teacher

Suggested texbooks

The Art of Electronics
Paul Horowitz, Winfield Hill

Altre informazioni
Applying knowledge and understanding
The acquired knowledge will give the student the ability to engage in a conscious and proactive way with the latest and most common IC and electronic technologies used in her/his professional field.
Making judgements
The student will gain the ability to enrich his/her knowledge thanks to his/her skill in reading ant interpreting technical documentation (e.g. datasheets).
Communication skills
The student will have to develop the ability to communicate, in a synthetic way and in general terms, the functioning of a component or an electronic circuit and to justify the choices made.
Learning skills
The student will be able to expand his knowledge thanks to the ability to read and interpret the technical documentation.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	3	ING-INF/01, ING-INF/01

Stampa del 07/05/2025

English Language [1205107]

Offerta didattica a.a. 2024/2025

Docenti: ADAM JAMES MARTIN

Periodo: Ciclo Annuale Unico

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	4	L-LIN/12

Stampa del 07/05/2025

Fundamentals of Computer Science [1205110]

Offerta didattica a.a. 2024/2025

Docenti: ROSA SICILIA

Periodo: Secondo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	5	ING-INF/05

Stampa del 07/05/2025

General Physics 1 [1205109]

Offerta didattica a.a. 2024/2025

Docenti: ALESSANDRO LOPPINI

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

The course aims to provide knowledge about the fundamentals of classical mechanics and thermodynamics and give a basic knowledge of physical laws. The primary learning objective is the development of the ability to grasp the essential aspects of physical processes, framing them with coherent descriptive and quantitative mathematical models related to biomedical engineering applications.

Prerequisiti

Precalculus. A basic prior knowledge of calculus is recommended.

Contenuti del corso

- Introduction. Physical quantities, measurement units systems. Scalar and vector quantities.
- Kinematics in one and two dimensions. Displacement, velocity, acceleration. Motion at constant acceleration. Falling body. Circular motion. Projectile motion.
- Single particle dynamics: Newton's laws. Inertia principle. Mass and force. The second and third laws of motion. Inertial and non-inertial reference systems. Weight force. Constraints and contact forces. Strings and springs. Friction. Drag forces
- Work and kinetic energy. Conservative forces and potential. Conservation of mechanical energy. Impulse and linear momentum. Systems of particles. Center of mass.
- Conservation of linear momentum. Kinetic energy of a system. Collisions.
- Rotations and rigid bodies dynamics. Torque. Moment of Inertia. Rotational kinetic energy. Rigid body rotation with fixed axis. Rolling motion. Static equilibrium. Elastic properties of solids.
- Angular momentum and conservation of angular momentum. Newton’s law of gravity and gravitational field. Kepler’s laws.
- Oscillations. Harmonic motion. Damped oscillations. Driven oscillations and resonance.
- Fluids. Density and pressure. Stevin's law. Buoyant force and Archimedes' principle. Fluids in motion: inviscid fluids and Bernoulli equation. Torricelli's law. Viscid fluids and Poiseuille's law.
- Thermodynamics and thermodynamic systems. Equilibrium states. Temperature and Kinetic theory of gases. Thermal equilibrium and thermometers. Zero law of thermodynamics. Ideal gases. Heat and specific heats. Latent heat. Thermodynamic processes. Work. Joule's experiment and first law of thermodynamics. Internal energy. Transfer of heat. Heat engines and the second law of thermodynamics. Thermodynamic cycles. Carnot engine. Irreversibility and Entropy.

Practical sessions on selected problems will be delivered for a total of 24 hours.

Metodi didattici

Theoretical and practical lectures focused on the topics of the course. Teaching methods involve frontal lectures, slides and whiteboard.

Modalità di verifica dell'apprendimento

Methods and Criteria for Learning Assessment:
Learning is evaluated through a written exam designed to assess the student's preparation on the theoretical and practical topics presented during the course. The exam lasts 2 hours and 30 minutes and includes 10 multiple-choice questions on theoretical concepts and 4 practical problems, to be solved by explicitly detailing all the mathematical steps required to derive the final results.

Criteria for Measuring Learning and Assigning the Final Grade:
The final grade is calculated based on the result of the written exam. For multiple-choice questions, each correct answer is awarded 1 point, and each incorrect answer is awarded 0 points. For practical problems, each problem is graded from a minimum of 0 points to a maximum of 5 points, depending on the correctness of the solution and the clarity of the mathematical steps. The maximum score is 30. To pass the exam, a minimum score of 18 is required. Cum Laude is awarded at the discretion of the lecturers in case of a perfect score and particular clarity and completeness in the exposition of the topics.

Testi di riferimento
- Slides and material produced by lecturers and uploaded on the e-learning platform.
- Suggested textbooks: Physics for Scientists and Engineers, Extended Version. 6th Edition, 2020. Paul A. Tipler, Gene Mosca. Macmillan.

Altre informazioni
Knowledge and understanding
Students will achieve an adequate knowledge of physical laws and related mathematical aspects on broad aspects of classical physics, including:
- Kinematics and Newtonian dynamics.
- Fluids.
- Calorimetry and thermodynamics.

Students will learn methodological-operational aspects of Physics to interpret and describe medical and engineering problems.

Applying knowledge and understanding
At the end of the course, students will be able to correctly use theoretical knowledge to solve practical problems and applications. Students will be able to interpret physical laws and apply them in different fields typical of medical and bioengineering applications.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	7	FIS/07

Stampa del 07/05/2025

General Physics 2 [1205108]

Offerta didattica a.a. 2024/2025

Docenti: ALESSANDRO LOPPINI

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi
The course aims to provide the fundamentals of electromagnetism and give a basic knowledge of physical laws. The primary learning objective is the development of the ability to grasp the essential aspects of physical processes, framing them with coherent descriptive and quantitative mathematical models concerning biomedical engineering applications.

Prerequisiti
Precalculus. A basic prior knowledge of calculus is recommended.

Contenuti del corso
- Electric charge. Conductors and insulators. Coulomb's law. Electric field of discrete charge distributions.
- Electric field of continuous charge distributions. Gauss's law.
- Electrostatic potential energy and electric potential. Capacitance and capacitors. Electrical energy. Batteries. Dielectrics.
- Electric current and Direct-Current circuits. Ohm's laws. Kirchhoff's rules. Combination of capacitors and resistors. Joule's effect. RC circuits.
- Magnetic force on moving charged particles, straight current-carrying wires and current elements. Torques on current loops. Hall effect.
- Sources of magnetic field. Biot-Savart law. Gauss's law for magnetism. Ampère's law.
- Magnetic flux. Induced electromotive force and Faraday's law. Len's law. Inductance. Magnetic energy. RL circuits.
- Displacement current and Maxwell-Ampère law. Maxwell's equations in integral and local form. The wave equation for electromagnetic waves. Electromagnetic spectrum.
- Properties of light. Reflection and Refraction. Polarization.
- Geometrical optics: lenses, mirrors, optical systems.

Practical sessions on selected problems will be delivered for a total of 16 hours.

Metodi didattici
Theoretical and practical lectures focused on the topics of the course. Teaching methods involve frontal lectures, slides and whiteboard.

Modalità di verifica dell'apprendimento
Methods and Criteria for Learning Assessment:
Learning is evaluated through a written exam designed to assess the student's preparation on the theoretical and practical topics presented during the course. The exam lasts 2 hours and 30 minutes and includes 10 multiple-choice questions on theoretical concepts and 4 practical problems, to be solved by explicitly detailing all the mathematical steps required to derive the final results.

Criteria for Measuring Learning and Assigning the Final Grade:
The final grade is calculated based on the result of the written exam. For multiple-choice questions, each correct answer is awarded 1 point, and each incorrect answer is awarded 0 points. For practical problems, each problem is graded from a minimum of 0 points to a maximum of 5 points, depending on the correctness of the solution and the clarity of the mathematical steps. The maximum score is 30. To pass the exam, a minimum score of 18 is required. Cum Laude is awarded at the discretion of the lecturers in case of a perfect score and particular clarity and completeness in the exposition of the topics.

Testi di riferimento
- Slides and material produced by lecturers and uploaded on the e-learning platform.
- Suggested textbooks: Physics for Scientists and Engineers, Extended Version. 6th Edition, 2020. Paul A. Tipler, Gene Mosca. Macmillan.

Altre informazioni

Knowledge and understanding
Students will achieve an adequate knowledge of physical laws and related mathematical aspects on broad aspects of classical physics, including:
- Electromagnetism.
- Geometrical optics.

Students will learn methodological-operational aspects of Physics to interpret and describe medical and engineering problems.

Applying knowledge and understanding
At the end of the course, students will be able to correctly use theoretical knowledge to solve the practical problems and applications. Students will be able to interpret physical laws and apply them in different fields typical of medical and bioengineering applications. The ability to apply knowledge and understanding to specific problems will be achieved through classroom practical sessions.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	5	FIS/03, FIS/03

Stampa del 07/05/2025

Initial Skills Verification - Chemistry [1205VER02]

Offerta didattica a.a. 2024/2025

Docenti:

Periodo: Primo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	0	CHIM/07

Stampa del 07/05/2025

Initial Skills Verification - Mathematics [1205VER04]

Offerta didattica a.a. 2024/2025

Docenti:

Periodo: Primo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	0	MAT/05

Stampa del 07/05/2025

Initial Skills Verification - Physics [1205VER05]

Offerta didattica a.a. 2024/2025

Docenti:

Periodo: Primo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	0	FIS/07

Stampa del 07/05/2025

Italian Language [1205106]

Offerta didattica a.a. 2024/2025

Docenti:

Periodo: Ciclo Annuale Unico

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	4	L-FIL-LET/12

Stampa del 07/05/2025

Mathematics and Computer Science [1205103]

Offerta didattica a.a. 2024/2025

Docenti: MARCO PAPI

Periodo: Primo Ciclo Semestrale

Obiettivi formativi
The course provides the students with the basic mathematical tools needed in engineering and is designed to increase their knowledge and understanding of Mathematical Analysis and Linear Algebra. Students get also acquainted with setting up and solving mathematical problems. By the end of the course, students should successfully tackle and solve nontrivial mathematical exercises, together with a clear understanding of the most important theoretical results discussed in the course.
The course attempts to present mathematics as an organized body of knowledge that will provide students with a sound basis for later use in engineering and applications.

Prerequisiti
Basic algebra, first and second-degree equations and inequalities, rational equations and inequalities, first and second-degree systems of equations and inequalities, equations and inequalities involving logarithms and exponentials, trigonometry, divisions by polynomials, irrational equations and inequalities, sums, set theory, inductive reasoning. Geometry: lines, circles, parabolas, ellipses and hyperbolas.

Contenuti del corso
Linear Algebra (Dr Marta Menci)
Systems of linear equations: Introduction to Systems of Linear Equations. Gauss Elimination and Gauss-Jordan Elimination. Applications of Systems of Linear Equations. Matrices. Operations with Matrices. Properties of matrix operations. The Inverse of a Matrix. Elementary Matrices. More Applications of Matrix Operations. Determinants. The Determinant of a Matrix. Determinants and Elementary Operations. Properties of Determinants. Applications of Determinants. Vector Spaces. Vectors in the Euclidean space. Subspaces of Vector Spaces. Spanning Sets and Linear Independence. Basis and Dimension. Rank of a Matrix and Systems of Linear Equations. Coordinates and Change of Basis.
Calculus and Real Analysis (Dr Marta Menci)
Mathematical models: A catalog of essential functions. New functions from old functions. Exponential functions. Trigonometric functions. Inverse functions and logarithms.
Number and Functions. Properties of Reals Numbers and Inequalities. Basics of Complex Numbers. Functions and Limits. The precise definition of a limit. The limit of a function. Calculating limits using the limit laws. Limit at infinity: Horizontal asymptotes. Continuity of Functions. Basic Properties of Continuous Functions. Derivatives: Derivatives and rates of change. The derivative as a function Differentiation rules: Derivatives of polynomials and exponential functions. The product and quotient rules. Monotonicity, Convexity, and Concavity. Absolute Minimum and Maximum. Local Extrema and Points of Inflection. Integration. The Riemann Integral. Riemann Sums. Integrable Functions. The Fundamental Theorem of Calculus. Indefinite integrals and the net change theorem. The substitution rule. Integration by parts.

Differential calculus for functions of several variables (Prof Marco Papi)
Partial derivatives, tangent plane, directional derivatives. The Hessian matrix. Optimization: local maxima and minima. Constrained extrema.
Ordinary differential equations (Prof Marco Papi)
Linear first and second order equations. Separated variables and Bernoulli differential equations. Existence and uniqueness of the local solution for the first order Cauchy problem. Local and global solutions. Matrix exponential and representation of solutions.

Metodi didattici
- Lessons (100 hours): the course topics and exercises are carried out in order to show the application to specific problems.
- Exercise sessions (25 hours), in classroom, with a weekly planning.

Modalità di verifica dell'apprendimento
Knowledge and skills will be verified by means of a written test including 5 practical open-form exercises and 5 multiple choice questions. The exercises and the questions will focus on the following topics: vector spaces,

matrices, systems of linear equations, functions of one real variable, integration of real functions, Linear Ordinary Differential Equations, functions of several variables.
The choice of the open-form for the exercises is aimed to assess the effective degree of learning and the autonomous elaboration ability of the students, as described in the course objectives. In particular, the written test aims to reward the ability to identify the most important aspects of each topic and to expose them correctly but also in a synthetic fashion. In the theoretical questions students are called to answer to questions mainly related to the theoretical contents of the course program. The written test total score is 32 (maximum) and the time assigned for the test completion is 2.5 hours.
The exam involves an evaluation which is expressed as a grade of out of 30. An exam is deemed to be passed successfully if the grade of written test is equal to or higher than 18/32. If the grade of the written test if higher than 30, the final mark of the exam is 30 cum laude.

Testi di riferimento

[1] D.C. Lay, "Linear Algebra and Its Applications", Addison-Wesley, Fourth Edition.
[2] J. Stewart, "Calculus, Early Transcendentals", Brooks/Cole, Seventh Edition.
[3] Walter Rudin, Principles of Mathematical Analysis, third edition, McGraw-Hill.

Altre informazioni

Knowledge and understanding
The course will transfer the following knowledge and understanding to the students:
- Linear Algebra: vectors, matrices, systems of linear equations;
- Differential and integral calculus: investigation of the main analytical properties of real-valued functions;
- Linear Ordinary Differential Equations.
- Functions of several variables;
- Vector and integral calculus for functions of several variables;

The student will be able to understand the basic concepts of Linear Algebra, including operations on vectors, matrices, and methods for solving systems of linear equations. Moreover, students will acquire knowledge in the field of differential and integral calculus, understanding the main properties of real-valued functions.

Applying knowledge and understanding
At the end of the course the students will be able:
- to investigate the nature of Vector Spaces;
- to discuss the results of Systems of linear equations and Linear Ordinary Differential Equations;
- to study and represent real-valued functions of one or several variables.

The students must also be able to solve problems of practical utility (e.g., on matrices, vectors, limits, integrals, and linear ordinary differential equations).

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	10	MAT/05, MAT/05

Stampa del 07/05/2025

Measurements, sensors and instrumentation [1205305]

Offerta didattica a.a. 2024/2025

Docenti: DANIELA LO PRESTI

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi
The course aims to provide fundamental knowledge about the methodologies and techniques used for estimating physical parameters and the measurement uncertainty. Additionally, it will cover the working principles and performance of the most widely used measuring systems, sensors, and transducers in medical applications giving basic knowledge of the main medical instrumentations and the essential standards that medical devices must meet.

Prerequisiti
No prerequisites except those required for access to the Laurea programme.

Contenuti del corso
The contents of the course are:

• Fundamental principles and concepts of measurement methods
Measurements of a physical parameter. Overview of general measurement systems. Units of Measurement: the International System of Units and other systems with a special focus on measurement units used in medical fields. Fundamental constants. Techniques for measurement unit conversion. Measurand and influencing factors. Measurement uncertainty. Analysis of static and dynamic measurements. Law of uncertainty propagation. Operation and significant figures. Significant difference between two experimental data. Experimental data representation: plots and tables.
• Measurement System Behavior
Measurement system behavior. Static metrological properties: range of measurement, calibration curve, sensitivity, resolution, discrimination threshold, accuracy, precision, linearity, signal-to-noise ratio. Dynamic metrological properties: response time, settling time, frequency response (magnitude ratio and phase shift). Repeatability and reproducibility. First- and second-order systems, error function gamma and logarithmic decrement. Load effects. Design of a measuring chain. Circuits for signal conditioning and processing. Amplification stages with a special focus on the ones used in some medical devices (e.g., electrocardiograph). Sampling and ADC. Displaying measuring instruments.
• Length and strain measurements
Measurement of length. Caliper, potentiometer. Measurements of strain. Mechanical and electrical strain gauge; electronics for strain gauge and temperature compensation. Medical application of this parameter.
• Measurements of mass, force, and moment.
Basic concepts of mass, force, and moment. Load cells. Medical application of this parameter.

• Pressure measurements
Basic concepts of pressure measurements. Barometer. Liquid manometer. Strain-based manometer. Differential pressure sensor. Medical application of this parameter and description of methods and instruments for human pressure measurements (e.g., arterial pressure invasive/noninvasive methods).
• Flow measurements
Pitot Tube. Massive and volumetric flow. Venturi Tube. Flow measurements based on pressure drops: orifice meter. Rotameter. Hot wire and hot film anemometer. Application in medicine of this parameter with a description of methods and instruments for flow measurements (e.g., mechanical ventilator, anesthesia workstation)
• Temperature measurements
Temperature standards and definition. Temperature scale. Thermometry based on thermal expansion. Electrical resistance thermometry. Thermocouples. Application in medicine of this parameter with a description of methods and instruments for temperature measurements (e.g., medical thermometer, temperature control of heated humidifier systems for mechanical ventilation).
• Biopotential measurements
Biopotential definition. Biopotential signals. Biopotential electrodes. Application in medicine of this parameter with a description of methods and instruments for biopotential measurements (e.g., electrocardiograph, electroencephalograph)

Metodi didattici
Lectures covered the course topics and included exercises to demonstrate their application to specific problems.

Modalità di verifica dell'apprendimento
The exam is designed to assess the knowledge and skills outlined in the specific learning objectives. These are evaluated through oral tests, where students are asked to explain specific topics from the course program. Each student will be required to discuss two topics from the course.
The exam is graded on a scale of 0 to 30, and a score of 18 or higher is required to pass. The final grade is determined by averaging the scores (out of 30) from the questions related to the two topics covered in the exam.

Testi di riferimento
- T. G. Beckwith, R. D. Marangoni, J. H. Lienhard. Mechanical Measurements Addison-Wesley Pub Company, Reading MA, USA.
- R.S. Figliola, D.E. Beasley. Theory and design for mechanical measurements. Wiley.
- Lecture notes which will be available via the e-learning platform of the Università Campus Bio-Medico di Roma.

Altre informazioni
Students will learn to analyze and select the most appropriate measurement system for specific applications. They will be taught to choose measuring systems that meet well-defined requirements for performing specific measurements in healthcare. The course will encourage students to enhance their understanding and analysis of its content. Students will develop the ability to communicate effectively, both succinctly and with the correct technical terminology, about the course topics. They will also expand their knowledge by learning to read and interpret data from measurement processes, estimate uncertainty, and understand the working principles and metrological properties of measuring systems and sensors. Additionally, students will learn about the main medical instrumentations and standards for medical devices. Their learning ability will increase throughout the course due to the interactive teaching methods employed.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	5	ING-IND/12

Stampa del 07/05/2025

Medical Humanities 1 [1205104]

Offerta didattica a.a. 2024/2025

Docenti: GIAMPAOLO GHILARDI, FRANCESCA FIORI

Periodo: Ciclo Annuale Unico

Obiettivi formativi

According to E. Pellegrino, one of the most famous and prominent Medical Humanities experts, fundamentally Medicine is moral. It is neither a natural nor a science although it often depends upon both for its technical and communal progress. Medicine, especially as clinical practise, is moral because the defining element of its practise is the patient-physician relationship, and that relationship is profoundly principled and often based upon ethical rules and duties. The integrated course “Medical Humanities 1” aims to provide students with some essential tools from the humanities (Anthropology, Ethics, and History) necessary to understand the nature of the patient-physician relationship, keeping in mind what William Osler, a pioneer of modern Medicine said: “The good physician treats the disease; the great physician treats the patient who has the disease.” In order to be able to reach this goal in their profession, medical students need to know themselves, as well as their future patients as human beings in the context of histories, cultures and values.
The course therefore aims to provide a clear understanding of the rich and large set of values, virtues, and moral characteristics which are connected with medical practice.

Prerequisiti

None

Contenuti del corso

Anthropology:
Introduction/general overview.
What anthropology is.
On Truth.
Anthropology and Technologies.
Homo faber/homo sapiens.
Anthropology and industry 4.0.
Anthropology and Medicine.
Transhumanism. Posthumanism.
Humanism and humanities.
Leonardo and humanism.
Recap of the programme.

Ethics:
Introduction/general overview.
What ethics are.
Why ethics in medicine.
Ethical schools. Free will.
Libet’s experiments on free will.
The trolley dilemma.
Utilitarianism and consequentialism.
Consciousness. Agency: what does it mean to be a moral agent.
Ethics and Rhetoric. The good words.
Ethics and communication between doctor and patient.
The notion of personhood.
Virtues. Epistemic virtues.
Recap of the programme.

The History of Medicine in Twelve Machines:
1. Introduction. Specula and forceps: to the roots of medicine.
2. The stethoscope and the instrumental diagnostic revolution.
3. The inhaler. When surgery knocked out pain.
4. The ophthalmoscope. At the origins of modern ophthalmology.

5. Under pressure. The sphygmograph, the sphygmomanometer and their two visionary inventors: Étienne-Jules Marey and Scipione Riva Rocci.
6. The X-rays apparatus. Wilhelm Röntgen and the radiological revolution.
7. The negative pressure chamber and the controversial figure of Ernst Ferdinand Sauerbruch.
8. The electrocardiograph. How to cope with a crazy heart.
9. The iron lung and the long battle against polio.
10. The microscope and the discovery of the invisible.
11. The heart-lung machine and the taboo of open-heart surgery.
12. The electroconvulsive therapy machine. Just a skeleton in the closet of modern psychiatry?

One hour class will be dedicated to each of these subjects.

Social Psychology
• Introduction, definition, and topics studied by Social Psychology.
• Norms and cultures.
• Social groups
• Stereotypes and prejudices.
• Bias in social life, in medicine and science
• Social robots, social animals and swarm robotics.
• Affective science and emotions. What emotions are. Theory of emotions.
• Empathy
• Altruism and helping behavior

Metodi didattici
The aims of the class will be achieved by a combined approach involving a traditional inductive teaching method, video projections, and interactive learning. These different teaching approaches will be combined in the same weeks, as well as within the same lectures. The students will always be stimulated and will not be treated as passive learners but will be called to actively participate in the lectures. The teaching methods promote classroom engagement and cooperation. Both the interactive lectures and group activities will entail the active involvement of students.

Modalità di verifica dell'apprendimento
The final exam will take place at the end of each course, in the sessions scheduled by the academic calendar. The exam will be both written (anthropology and Ethics and Social Psychology), involving a combination of multiple choice and short answer questions, and oral (History of Medicine and Social
Psychology). The questions will evaluate the students' ability to critically reformulate the learnt concepts and their ability to critically apply the knowledge and understanding.

Testi di riferimento
Besides the material uploaded on the E-Learning platform:

Anthropology:
• James. A. Marcum, The virtuous physician, the role of virtue in Medicine, Springer, 2012
• G. Ghilardi, "Analogia Sensuum: The knowing body", in: N. Di Stefano, V. Tambone (eds.), About the living body, Nova science, New York 2016, pp. 15-31
• G. Ghilardi, L. Campanozzi, V. Tambone, "Humanities: Methods for Medical Training", in Journal of Medical Diagnostic Methods, vol. 5, Issue 1, 2016

Ethics:
• J. Seifert, The philosophical diseases of medicine and their cure, philosophy and ethics of medicine, Springer, 2004
• V. Tambone, G. Ghilardi, "An ethical evaluation methodology for clinical cases", Persona y Bioética, 20 (1), 2016, pp. 48-61
• G. Ghilardi, "Epistemological remarks on Libet's experiments on free will", Rivista Internazionale di Filosofia e Psicologia, 6 (1), 2015, pp. 110-119
• V. Tambone, G. Ghilardi, Philosophy and Deontology of Medical Practice, Ethics of the work well done in bio-medical sciences, SEU, Roma 2020

History of medicine:

Powerpoint presentations of each lecture, will be shared through the ELEA platform.

The contents of the course can be found in:
• A draft provided by professors.
Further optional reading:

• Luca Borghi, Sense of Humors. The Human Factor in the History of Medicine, KDP Publishing 2022

Social Psychology

Slides of the lectures (including the discussed scientific works) will be shared with the students.
• Stangor, C. (2015). Social groups in action and interaction. Routledge.
• Feldman Barrett, L. (2017). How emotions are made: The secret life of the brain. Mariner.

Altre informazioni

The final mark will be in the range of 18-30/30 it will be a weighted average of the final grades in Anthropology (1/4), Ethics (1/4), History of Medicine (1/4), Social Psychology (1/4). The “laude” will be assigned to highlight an optimal integration among the topics of the different modules.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	4	MED/02, M-PSI/05, M-FIL/03

Stampa del 07/05/2025

Medical Humanities II [1205206]

Offerta didattica a.a. 2024/2025

Docenti: FRANCESCO DE MICCO

Periodo: Primo Ciclo Semestrale

Obiettivi formativi
The course aims to provide students with the knowledge and skills (a) to understand the main deontological issues of the medical profession (general duties of the medical doctor, relations with the citizen, relations between patient and physician, relations with other healthcare workers).

Prerequisiti
According to the Study Manifesto, there is no propaedeuticity for this Integrated Course.

Contenuti del corso
- Deontology and Code of Ethics
- The medical profession
- The Professional Order
- Freedom and independence of the profession
- Professional secrecy and the protection of confidentiality
- Emergency services
- Resource Utilization
- Patient safety and clinical risk management
- Relations with the citizen in specific care contexts
- Respect for the dignity of the patient in a relationship of trust
- Informing the patient and obtaining consent to the medical act
- Issues at the beginning of human life
- Issues at the end of human life
- Experimentation
- Intra- and inter-professional relations
- Relations with public and private healthcare facilities
- Empowering and aesthetic medicine
- Informatisation and healthcare innovation

Metodi didattici
Lectures, case analyses, reflective learning

Modalità di verifica dell'apprendimento
- Written examination aimed at testing the actual degree of learning, the ability to critically rework the acquired knowledge and present it in a comprehensible manner, the ability to identify the elements characterising the course topics.
- 16 multiple-choice questions
- Each correct answer counting for 2 points; either incorrect answer or answer not given count for 0 points
- The minimum grade to pass written exam is 18 (9 correct multiple-choice questions); the maximum grade is 32 (16 correct multiple-choice questions), which corresponds to 30 cum laude.

Testi di riferimento
- Slides and material produced by the lecturer will be uploaded onto the e-learning platform.
- Laura Palazzani. Bioethics and Biolaw: theories and questions. G. Giappichelli Editore, Torino, 2018

Altre informazioni
- Knowledge and Understanding

To know and understand the deontological principles that characterise the professional autonomy and responsibility of the physician.

- Applied Knowledge and Understanding

Deciding, planning and implementing effective and safe care interventions that comply with quality standards and are based on scientific evidence, respecting legal and ethical responsibilities, with a personalised and integrated approach that considers individual and community needs, thus improving the health status and general well-being of the people involved.

- Autonomy of Judgment
Use critical thinking to understand the phenomena that characterise the reality of care and deontological reflection.

- Communication Skills
Presenting and discussing one's decisions with colleagues and other professionals, even in situations of moral distress, in order to ensure transparency, accountability and enrich one's point of view, contributing to a collaborative and understanding working environment.

- Learning Ability
Deal autonomously and critically with the study of deontology for the acquisition of new knowledge and understanding of new phenomena.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	2	MED/43

Stampa del 07/05/2025

Medical Himanities III [1205301]

Offerta didattica a.a. 2024/2025

Docenti: LAURA LEONDINA CAMPANOZZI

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi
The Medical Humanities III (Ethics of Technology) Course aims to present the ethical implications of the development and use of technologies in medicine, providing students with the conceptual tools to understand the different moral perspectives underlying the concerns and challenges raised by these technologies. Thereby, students will learn useful approaches to think critically and proactively, and to address questions about how they should act in the ethical evaluation and application of different technologies in medicine.

Prerequisiti
- Knowledge of fundamental concepts in ethics and knowledge of the basics of moral reasoning acquired during the Medical Humanities 1 Course.
- No propaedeuticity required

Contenuti del corso
Introduction/general overview. Systematics of the ethics of technologies. Biomedical technologies and ethical issues: practical examples. Ethics of artificial intelligence in medicine and its prudential governance. Telemedicine and remote assistance. Biomedical technologies, sustainability ethics and distributive justice. Ecological design, and responsible research and innovation. Medical profession and subjectivity as lenses for studying technology. One Health Plus technologies.

Metodi didattici
Frontal lectures and seminars, group work, guided discussions based on clinical cases or videos related to the course topics, aimed at promoting students' critical and proactive participation and greater involvement.

Modalità di verifica dell'apprendimento
Learning will be assessed through a written examination on the Course content and will aim to evaluate knowledge of the topics and the ability to critically review them.
The assessment of the learning will be carried out through a written test delivered via the e-learning platform and available on the Course page. The test will consist of 16 multiple-choice questions of two points each, for a total maximum of 32 corresponding to a mark of 30 cum laude. The minimum mark for passing the exam is 18, corresponding to 9 correct answers.

Testi di riferimento
Some chapters of: Hansson, S. O. (Ed.). (2017). The ethics of technology: methods and approaches. Rowman & Littlefield.
- Lecture notes. Slides, articles and handouts provided by the teacher in the classroom and on the e-learning platform.

Altre informazioni
Knowledge and understanding of the ethical implications of the development and use of technologies in the medical field;
- Applied knowledge and understanding. At the end of the Course, the student should be able to apply the acquired knowledge to ethically relevant and/or conflicting situations concerning the evaluation of the development and use of technologies in healthcare;
- Autonomy of judgement regarding the contents addressed during the Course, whether dilemmas or ethical challenges associated with biomedical technologies, and be able to justify and critically argue their positions;
- Communicate what has been learnt during the Course accurately, consciously and personally, using the specific language of the discipline.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	2	MED/43

Stampa del 07/05/2025

Pathology Immunology and Microbiology [1205302]

Offerta didattica a.a. 2024/2025

Docenti: ANDREA MARRA, SILVIA ANGELETTI, GIUSEPPE PERRONE

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

Course overview
• Experimental medicine and pathophysiology (11 CFU)
• Microbiology and clinical microbiology (3 CFU)
• Clinical pathology (1 CFU)
• Anatomical Pathology (4 CFU: 3+1 clinical practice)

EXPERIMENTAL MEDICINE AND PATHOPHYSIOLOGY [11 CFU]
(Dr. Andrea Marra, Prof. Mario Cioce, Dr. Veronica Gatti, Prof. Vito Michele Fazio)

Course overview and learning outcomes

The Experimental medicine and pathophysiology course aims to provide a comprehensive understanding of the mechanisms of human diseases at the molecular, cellular and systemic (organism-based) levels. Students will learn about the homeostatic mechanisms and the consequences of their disruption in disease. The course will cover the foundational aspects of pathology and immunology, as follows:

• Cellular and molecular pathology: this module will dissect i) the causes and consequences of damage to cells, tissues, and organs; ii) the mechanisms of how cells and tissues respond to different types of injury or stress, and how these responses can lead to the development of a disease; iii) the cellular and molecular processes underlying ageing, vascular pathology and cancer;

• Pathophysiology: this module will explore the mechanisms of disease development, focusing on the underlying pathogenetic processes that contribute to the onset and progression of the most common human diseases;

• Immunology and immunopathology: this module will dissect the mechanisms of defense against pathogens and responses to injury, as well as the causes and consequences of both innate and adaptive immune dysfunctions (immunopathology).

Expected learning outcomes

At the end of the course, students will gain knowledge on:
• The biological principles underlying the development of human diseases;
• Recognize the biological principles that govern the onset, progression, and outcomes of pathological processes, from molecular to organismal levels;
• Molecular and cellular basis of cancer
• Vascular pathology and immunopathology
• Immune responses to infections
• Pathophysiology of the major human diseases and their clinical correlates

MICROBIOLOGY AND CLINICAL IMMUNOLOGY [3 CFU]
(Prof. Silvia Angeletti, Dr. Roberta Campagna)

Course overview and learning outcomes

The Microbiology and clinical microbiology course will provide the students with strong basis in the essential principles and practices related to the microbic world. Students acquire the skills to identify and categorize microorganisms such as bacteria, viruses, fungi, and protozoa, utilizing both theoretical concepts and hands-on laboratory methods. This understanding is fundamental for understanding the roles these organisms have in health and disease.
One of the core competencies developed in this course is the ability to conduct laboratory experiments with precision and accuracy. Students become proficient in aseptic techniques, cultural methods, and various microbiological assays that are essential for the isolation and identification of pathogens. They gain hands-on

experience with advanced equipment, such as microscopes and spectrophotometers, enhancing their technical skills and fostering critical thinking in experimental design and troubleshooting.
Moreover, the course emphasizes the importance of clinical microbiology in diagnosing infections and informing treatment strategies. Students learn to interpret laboratory results and apply their findings to real-world clinical scenarios. This includes understanding antimicrobial susceptibility testing, which is vital for selecting appropriate therapeutic interventions and managing infectious diseases.
Additionally, knowledge of microbial genetics and biochemistry allows students to appreciate the mechanisms of pathogenicity and resistance. This understanding is crucial for developing novel antimicrobial strategies and public health initiatives aimed at controlling outbreaks and promoting community health.
The course includes a specific focus on the study of human microbiota foundations in clinical microbiology setting. focusing on the specific concept of how the differente array of microorganisms residing within our bodies plays a crucial role in our overall health and well-being. This new area of research highlights the importance for clinical microbiology students to understand the complex connections between humans and their microbes. In addition, the rise of antibiotic resistance is a pressing concern in modern medicine. Through a comprehensive analysis of the microbiota, students can better understand how antibiotics alter microbial communities, promoting resistance and diminishing the effectiveness of these important drugs. This insight is crucial for improving responsible antibiotic use and developing strategies to mitigate resistance.
Furthermore, during the course, insights will be provided to the students about Molecular diagnostic methodologies that play a critical role in the diagnosis of infectious diseases, reshaping the field of medical diagnostics in significant ways. These advanced techniques, which include polymerase chain reaction (PCR), next-generation sequencing (NGS), and various other nucleic acid amplification tests, allow for the rapid and accurate identification of pathogens at the genetic level. The importance of these methodologies will be illustrated along with their ability to detect even trace amounts of microbial DNA or RNA, enabling clinicians to diagnose infections much earlier than traditional culture methods. This early detection is vital, particularly for diseases caused by fast-acting pathogens such as viruses and bacteria, as it allows for timely interventions that can significantly improve patient outcomes and reduce morbidity and mortality rates.

Expected learning outcomes
At the end of the course, the students will understand how the integration of molecular diagnostic methodologies into clinical practice is indispensable for the effective management of infectious diseases. Their capacity for rapid, accurate, and specific diagnosis not only enhances patient care but also strengthens public health responses, demonstrating their pivotal role in combating infectious diseases worldwide. In summary, the course in microbiology and clinical microbiology not only imparts essential scientific knowledge but also promotes practical laboratory skills, critical thinking, and effective communication, preparing graduates for diverse careers in healthcare, research, and public health.

CLINICAL PATHOLOGY [1 CFU]
(Prof. Silvia Angeletti)

Course overview and learning outcomes

The Clinical Pathology course provides students with a comprehensive understanding of disease mechanisms and their implications in clinical practice. This course equips students with a unique blend of theoretical knowledge and practical skills essential for diagnosing and understanding various health conditions.
Firstly, students gain in-depth knowledge of pathology, including the mechanisms of disease, cellular adaptations, and the impact of pathological processes on human health. This foundation allows them to analyze the underlying causes of illnesses, ranging from infectious diseases to cancers and autoimmune disorders.
Moreover, the program emphasizes diagnostic techniques, where students learn how to interpret laboratory results and correlate them with clinical symptoms.
In addition to technical skills, the Clinical Pathology course encourages the development of critical thinking and problem-solving skills. Students are trained to evaluate complex clinical scenarios, synthesize information from various sources, and make informed decisions regarding patient care. This analytical mindset is crucial in pathology, where precise diagnosis can significantly influence patient treatment.
Furthermore, effective communication is a key competency acquired through clinical pathology training. Students learn to articulate their findings and collaborate with other healthcare professionals, ensuring a multidisciplinary approach to patient management. This promotes collaboration and improves the overall quality of healthcare delivery.
Finally, the ethical dimensions of practicing clinical pathology are emphasized throughout the course. Students learn the significance of ethics in managing patient information and making diagnostic decisions, improving the sense of responsibility and integrity that is essential in the medical profession.

Expected learning outcomes
The Clinical Pathology course equips students with broad set of skills including comprehensive knowledge of disease processes, technical laboratory skills, analytical thinking, effective communication, and a strong ethical framework. These competencies prepare them for successful careers in various healthcare settings, contributing to improved patient outcomes and advancements in medical science.

ANATOMICAL PATHOLOGY [4 CFU: 3+1 clinical practice]
(Prof. Giuseppe Perrone)

Course overview and learning outcomes

The Anatomical Pathology course aims to provide students with the tools to learn the pathological basis of organ and apparatus diseases and to be able to integrate macroscopic changes, histological and cytological modifications and molecular alterations into the clinical picture. The main diagnostic procedures in surgical pathology, the professional tasks, responsibilities and fields of activity of the anatomical pathologist will also describe.

Teaching methods: frontal lessons supported by visual means and professional training activities in the Anatomical Pathology Hospital Unit.

The course will cover the foundational aspects of principal procedures and techniques in anatomical pathology, cardiovascular pathology, respiratory pathology, as follows:

• PRINCIPAL PROCEDURES AND TECHNIQUES in ANATOMICAL PATHOLOGY. Cytological and histological examinations; frozen intraoperative examinations. Histological, histochemical, immunohistochemical and molecular biology techniques.

• CARDIOVASCULAR PATHOLOGY. Arteriosclerosis. Pathological bases, macro- and microscopic evolutionary aspects and complications of myocardial infarction, heart attack and chronic ischemic heart disease.

• RESPIRATORY PATHOLOGY. Alveolar and interstitial pneumonia. Pneumoconiosis. Lung granulomatous disease. Primary and post-primary tuberculosis. - Histological and cytological diagnosis of lung cancer, histological classification of lung cancers, tumor stages and evaluation of predictive parameters of response to systemic treatments - Pleural mesothelioma.

Expected learning outcomes
At the end of the course, the student has to:
· become acquainted with the most important diagnostic tools (exfoliative and aspirative cytology, histology, cytology, frozen section) and techniques (immunohistochemistry and molecular pathology) of the anatomical pathology;
· be aware of the possible applications of such tools in preventive medicine (cytological and molecular screening), in clinical diagnostics and in the evaluation of prognostic and predictive parameters;
· be able to properly interpret and integrate in the clinic the information provided by the pathology report for an appropriate therapeutic decision-making process.

Prerequisiti
Basic Life Science III, Biochemistry.

Contenuti del corso
EXPERIMENTAL MEDICINE AND PATHOPHYSIOLOGY [11 CFU]
(Dr. Andrea Marra, Prof. Mario Cioce, Dr. Veronica Gatti, Prof. Vito Michele Fazio)

Module 1. Molecular and cellular pathology
• Definitions of health, homeostatic equilibrium and disease
• Types of cellular and molecular responses to stress and toxic stimuli: mechanisms of cell and tissue adaptation (hypertrophy, hyperplasia, atrophy. regression, metaplasia and dysplasia), injury and death
• Wound healing: Tissue renewal, repair and regeneration
• Programmed cell death

Module 2. Inflammation
• The acute inflammatory response
• Chronic inflammation (histophlogosis), fibrosis, stem cells and tissue renewal
• Chronic granulomatous reactions
• Inflammation and cancer

Module 3. Vascular pathology
• Hemostasis and coagulation
• Atherosclerosis
• Thrombotic disorders

Module 4. Tumor biology
• The basis of cancer: definition, nomenclature and epidemiology
• Cellular and molecular hallmarks of cancer
• Genetic and non-genetic mechanisms of tumorigenesis
• The tumor micro- and macro-environment

• The cancer-immunity cycle
• Cancer as a systemic disease
• Principles of precision medicine in oncology: applying omics and informatics
• Cancer models: patient avatars, animal models and 3D cultures
• Principles of cancer immunotherapy

Module 5. Pathophysiology
• Disorders of the respiratory system: obstructive and restrictive diseases
• Cardiac diseases (heart failure, acute myocardial infarction, cardiomyopathies, arrythmias) and hypertension
• Disorders of the liver and biliary tract
• Diabetes mellitus and metabolic syndrome
• Acute and chronic kidney disease
• Electrolyte disorders and acid-base disturbances
• Shock: basic pathobiology and types of shock
• Disorders of the hematopoietic and lymphoid system

Module 6. Immunology and immunopathology (Dr. Andrea Marra)
• Introduction to immunology
• Leukocyte circulation and migration into the tissue
• Innate immunity
• Histocompatibility complex and antigen presentation
• Immune receptors
• T cell activation
• Lymphocyte tolerance
• Differentiation and function of T cells
• B cell activation and antibody production
• Humoral immunity
• Mucosal immunology
• Immunopathology: hypersensitivity reactions, primary and secondary immunodeficiencies; autoimmunity

MICROBIOLOGY AND CLINICAL IMMUNOLOGY [3 CFU]
(Prof. Silvia Angeletti, Dr. Roberta Campagna)

Module 1. Cellular microbiology and clinical bacteriology
• General information about prokaryotic cells and bacterial cell wall
• Biosynthesis of the bacterial cell wall, bacterial growth curves, and bacterial culture media
• Bacterial pathogenesis, enzymes (Lecithinase: destroys the phospholipids of cell membranes. Protease: degrades the host's proteins, facilitating invasion), structural components (Capsule: a gelatinous structure that surrounds certain bacteria, helping them evade the host's immune system. The capsule can prevent phagocytosis. Cell wall); bacterial toxins (exotoxins-and endotoxins)
• Pre-analytical, analytical, and post-analytical phases of clinical bacteriology
• Antibacterial agents
• Role of clinical microbiology in antimicrobial stewardship programs
• Systematic bacteriology and main groups of bacterial species of clinical interest: Staphylococci (Staphylococcus aureus, coagulase-negative staphylococci, streptococci, enterococci and pneumococci, Bacillus anthracis and Bacillus cereus, Corynebacterium diphtheriae, Listeria monocytogens, Neisseria (Neisseria meningitidis, Neisseria gonorrhoeae,),Mycobacteria (Mycobacterium tuberculosis,) and non-tuberculous mycobacteria(NTM),Enterobacteriaceae (E. coli, Salmonella, Shigella, Klebsiella, Citrobacter, Enterobacter, Serratia, Proteus, and Yersinia); Vibrio cholerae, Campylobacter, Helicobacter pylori, Brucella, Bordetella (Bordetella pertussis), Pseudomonas aeruginosa, Acinetobacter, Legionella (Legionella pneumophila), Clostridia (Clostridium tetani, Clostridium botulinum, Clostridium perfringens, Clostridioides difficile), Spirochetes (Treponema pallidum, Borrelia, and Leptospira), Chlamydia (Chlamydia trachomatis, Chlamydia psittaci, Chlamydophila pneumoniae), Mycoplasmas (Mycoplasma pneumoniae and genital mycoplasmas)
• Human microbiota, methods and tools for research and diagnostics in microbiology and clinical microbiology
• Serological and molecular diagnostics.

Module 2. Mycology and parasitology
• Antimicrobial susceptibility testing; characteristics of clinically relevant fungi. Yeasts and filamentous fungi (Candida spp.; Dermatophytes Malassezia furfur; Cryptococcus neoformans; Nocardia; Aspergillus)
• General Information on Parasites, Hosts, and Vectors
• Parasites and Parasitism
• Human intestinal parasites (protozoa and metazoa) classification, biological cycle, pathogenesis, epidemiology
• Blood and tissue parasites in humans: classification, biological cycle, pathogenesis, epidemiology
• Zoonosis caused by parasites: classification, biological cycle, pathogenesis, epidemiology

Module 3. Virology (Dr.ssa Roberta Campagna)
• General virology: structure and classification of animal viruses
• Stages of the viral replication cycle and the pathogenesis of viral infections

• Main families of viruses of human interest (pathogenesis, diagnosis, therapy and prophylaxis): Herpesviridae, Orthomyxoviridae, Papillomaviridae, Retroviridae (HIV), viral hepatitis, Hepadnaviridae (HBV), Flaviviridae (HCV) and Picornaviridae (HAV)
• Viruses responsible for recurrent infections: focus on herpes virus type seven
• Infections of the skin and mucous membranes: focus on papillomaviruses
• Exanthematous diseases associated with viral infections
• Virological diagnostics of viral infections: direct and indirect diagnosis, molecular diagnostics of respiratory virus infections: focus on influenza virus and epidemic viruses (SARS, MERS, SARS-CoV-2)

CLINICAL PATHOLOGY [1 CFU]
(Prof. Silvia Angeletti)

• Biological sample collection; transport and storage
• CBC examination: iron deficiency anemia; macrocytic anemia; haemolytic anemia; lymphoproliferative diseases
• Coagulative tests
• Diagnosis of diabetes and other endocrine disorders; hepatic failure; renal failure; dyslipidemics; diagnosis of myocardial infarction
• Hydro-electrolytic imbalances; enzymes and their diagnostic use
• Tumor markers
• Laboratory diagnosis of the most relevant bacterial and viral infections: hepatitis, pneumonia, urinary tract infection and sepsis
• ODDS ratio, ROC curves, laboratory errors
• Quality in the clinical laboratory: introduction to quality systems; clinical laboratory certification and accreditation; internal quality control (Levy-Jennings quality charts); external quality control (VEQ)
• Presentation of clinical cases to practically illustrate the correct use of laboratory tests in terms of appropriate request, accurate reporting, and communication with the clinician
• The ethical use of laboratory testing in diagnosing common diseases: this represents a fundamental topic in medicine, as it involves the responsibility of health professionals in managing information and diagnostic results
• Information and consent: patients are adequately informed about the laboratory tests that will be performed
• Access to tests: it is necessary to ensure that all patients have equitable access to diagnostic tests.
• Interpretation of results: Laboratory professionals must interpret laboratory test results carefully, taking into account the patient’s overall clinical picture.
• Privacy and confidentiality: test results must be treated with the utmost confidentiality.
• Management of false positives and negatives:it is important to be aware of the limitations of laboratory tests.

ANATOMICAL PATHOLOGY [4 CFU: 3+1 clinical practice]
(Prof. Giuseppe Perrone)

Module 1. Principal procedures and techniques in anatomical pathology.
• Cytological and histological examinations
• frozen intraoperative examinations
• Histological, histochemical, immunohistochemical and molecular biology techniques.

Module 2. Cardiovascular pathology
• Arteriosclerosis.
• Pathological bases, macro- and microscopic evolutionary aspects and complications of myocardial infarction, heart attack and chronic ischemic heart disease.
• Congenital heart disease. Cardiomyopathies
• Aneurysms. Vasculitis. Hypertensive heart disease. Myocarditis. Endocarditis. Rheumatic disease. Valvopathies. Pericarditis.

Module 3. Respiratory pathology
• Alveolar and interstitial pneumonia
• Pneumonia
• Lung granulomatous disease
• Primary and post-primary tuberculosis
• Lung abscess. Pneumoconiosis. Pleuritis. Viral pneumonia. Allergic pneumonia. Sarcoidosis.
• Histological and cytological diagnosis of lung cancer, histological classification of lung cancers, tumor stages and evaluation of predictive parameters of response to systemic treatments
• Tumors of the larynx. Atelectasis. ARDS. Pulmonary embolism and infarction. Chronic obstructive pulmonary disease (pulmonary emphysema, chronic bronchitis, bronchial asthma, bronchiectasis).
• Pleural mesothelioma.

Metodi didattici
The course includes frontal lessons and monographic courses. External speakers may be invited to lecture on specific topics.

Modalità di verifica dell'apprendimento
The final assessment will consist of a written test followed by an oral examination. The written test will include 70 questions (multiple choice examination) on:

• Experimental medicine and pathophysiology: 32 questions
• Immunology and immunopathology: 8
• Microbiology and clinical immunology: 12 questions
• Clinical pathology: 4 questions
• Pathology: 14 questions

To pass the exam, the student must correctly answer at least 30 questions, ensuring a minimum number of correct answers in each module by correctly answering at least half of the questions in each module.

Each correct answer is worth 0.5 points, no answer yields 0 points, and each incorrect answer deducts 0.5 points.

A score of 30 cum laude is achieved by answering more than 62 questions correctly.

Students who score above 35 on the written test will qualify for the oral examination.

The oral examination will cover questions from each module, and the final grade will be calculated as a weighted average of the scores from both the written test and the oral examination across all modules.

Testi di riferimento
Powerpoint slides which will be presented during the course will be available in .pdf format through the UCBM e-learning portal. Scientific articles or other teaching materials will be discussed and shared during the lessons.

Recommended textbooks

• Experimental medicine & pathophysiology, and anatomical pathology: Robbins and Cotran Pathologic Basis of Disease, 10th edition. Elsevier 2020.

• Immunology and immunopathology: A.K. Abbas, A.H. Litchman, J.S. Pober, Cellular and molecular immunology, 10th edition. Elsevier 2021.

• Microbiology: Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller. Medical Microbiology. 9TH Edition. Elsevier 2020.

• Clinical pathology: Michael Laposata. Laposata's Laboratory Medicine Diagnosis of Disease in Clinical Laboratory Third Edition. McGraw-Hill Education.

Altre informazioni
D1- KNOWLEDGE AND UNDERSTANDING ABILITIES
The student must demonstrate knowledge of the main mechanisms responsible for the development of diseases in humans; the causes of cell/tissue damage and death; molecular and cellular immunology; fundamental pathogenetic mechanisms associated with immunity, inflammation and carcinogenesis.

In addition, the student should be familiar with the biological fundamentals of microbiology, the pathogenesis of the major infectious disorders, and the laboratory methodologies necessary to support the clinical management of the patients.

Further, the clinical pathology course will equipe the student with the knowledge on the basic mechanisms of human diseases, technical laboratory skills, analytical thinking, and rigorous ethical approach.

Furthermore, at the end of the Anatomical Pathology course, the student has to:
· become acquainted with the most important diagnostic tools (exfoliative and aspirative cytology, histology, cytology, frozen section) and techniques (immunohistochemistry and molecular pathology) of the anatomical pathology;
· be aware of the possible applications of such tools in preventive medicine (cytological and molecular screening), in clinical diagnostics and in the evaluation of prognostic and predictive parameters;
· be able to properly interpret and integrate in the clinic the information provided by the pathology report for an appropriate therapeutic decision-making process.

D2-ABILITY TO APPLY KNOWLEDGE
The student should have acquired knowledge enabling him/her to recognize the mechanisms responsible for the development of a disease and to identify specific pathological conditions with applicative possibilities in the

prevention, diagnosis and therapy of diseases. The ability to use these tools will be an integral part of the student's future professional life, in health care and/or experimental research. These skills will be assessed through the final examination.

D3-INDEPENDENT JUDGEMENT
The student must demonstrate that he/she has acquired the ability to critically evaluate and connect the topics tested. Capacity for constructive synthesis, ability to contextualize and connect different scientific evidence.
These skills will be tested both by means of the written test and through application-oriented oral questions. These skills will be assessed through the final examination.

D4-COMMUNICATION SKILLS
The student should be able to describe the principles and concepts learnt during the course by expressing himself/herself clearly, in appropriate terms and using appropriate examples. This ability will be assessed during the oral interview.

D5-KNOWLEDGE ABILITIES
The student must be aware of his or her own scientific growth in a critical and autonomous manner, be able to make correct use of the study material provided and be able to delve into it independently. These skills, as far as possible, will be stimulated by the lecturer proposing during the lessons.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	20	MED/04, MED/05, MED/07, MED/07, MED/08, MED/08

Stampa del 07/05/2025

Pharmacology and Medical Genetics [1205207]

Offerta didattica a.a. 2024/2025

Docenti: FIORELLA GURRIERI, EMANUELA SALVATORELLI

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi
The course brings together two main branches: Pharmacology and Medical Genetics, strictly connected within the modern concept of precision medicine. In essence, the main objective is to start from the foundations of the two fields and move towards the knowledge of the genetic load in human diseases, the potential for tailored treatments and the opportunities for cause-related rather than disease-related therapies. Basic concepts in human genetics and drug metabolism will be included.

Prerequisiti
The students are requested to have acquired key competences during the courses of Biology, Chemistry, Biochemistry, Physiology and Pathophysiology.

Contenuti del corso
Medical Genetics:

• Basics concepts of genetics: from Mendelian inheritance to complex diseases (FG and CL)
• Human Genome Organization (CL)
• Human chromosomes and their associated diseases (CL)
• Genetic Load in medicine (genetic tests – genetic counselling- clinical genetics) (FG)
• Genetics of fetal diseases (including principles of prenatal diagnosis) (FG)
• Deviations from Mendelian genetics: Imprinting, dynamic mutation diseases (FG and CL)
• Fundamentals of molecular genetics techniques used in medical genetics (CL)
• Bioinformatic tools in Medical genetics: classification of variants (CL)
• Population Genetics (FG)
• Neuropsychiatric diseases and genetics (CL)
• Genetics in oncology (FG and CL)
• Cardiogenetics (FG)
• Genetics and thoracic diseases (FG)
• Genetics and autoinflammatory disease (FG)
• Principles of Medical GenETHICS (FG)
• Precision Medicine (FG)
• The concepts of polygenic risk score for diseases (FG)
• Epigenetic Signatures (CL)

General Pharmacology:
• Clinically oriented principles of pharmacokinetics, pharmacodynamics and drug metabolism
• Principles of drug development and clinical trials
• Principles of mutagenesis and teratogenesis
• Genetically-oriented new methodologies in drug development and clinical trials
• Assessing efficacy and safety
• Bioequivalent and biosimilar drugs

Metodi didattici
The teaching methodology will consist of a combination of traditional platform lessons, class seminars, interactive discussion on selected topics or on topics of interest for the students, practical activities both in the clinics and in the laboratory. The students will be stimulated to select an article from the medical literature and to briefly expose its contents to the whole class. Because the two disciplines of this Course share interests in preclinical and clinical fields, multidisciplinary seminars will be organized and relevant topics will be jointly discussed.

Modalità di verifica dell'apprendimento
At the end of the course the final exam will take place, in agreement with sessions scheduled in the academic

calendar. For Pharmacology, the knowledge gained and the ability to apply it will be verified by a written test. The text will include 16 multiple choice questions formulated to assess student capability to move around different topics.

The evaluation (marks expressed as 30/30, w/wo honours) takes the following points into account:
- to each correct question will be given a score of 2 point
- to each wrong or not-answered question will be given a score of 0 point
- to pass the test the student needs to achieve a score of not less than 18/30
- honours can be awarded only if the student will correctly answer to all 16 questions

For Medical Genetics the exam will also be written with multiple choice questions (16 questions) and short assays/problems (3).
The evaluation (marks expressed as 30/30, w/wo honours) takes the following points into account:
- to each correct multiple choice question will be given a score of 1 point
- to each wrong multiple choice question will be given a score of -1 point
- for each short assays/problems the maximum score is set to 5 points each with no penality for wrong or not answering
- to pass the test the student needs to achieve a score of not less than 18/30
- honours can be awarded only if the student will correctly answer to all multiple choice questions and short assay/problems

In the event of irregularities during the written test, the teachers can ask students to take an oral exam.

Marks of the two modules will be averaged to give a final mark, in proportion to the CFU of each courses

Testi di riferimento
Medical Genetics:
Medical Genetics - Jorde Carey Bamshad, 6th edition, Elsevier
Medical Genetics - G. Bradley Schaefer, James N. Thompson Jr. Mc Graw Hill
Clinical cases will be presented and discussed throughout the course. Attendance of the genetic outpatients clinic is strongly recommended as an “hands on” activity

General Pharmacology:
- Bertram G. Katzung and Anthony J. Trevor. Basic and Clinical Pharmacology 15th edition. Lange Publishing Co.
- Goodman and Gilman's The Pharmacological Basis of Therapeutics 14th edition. McGraw Hill Publishing Co.

Altre informazioni
Medical Genetics. Students must achieve an appropriate perception and knowledge of the genetic background of human diseases. Basic concepts of human genetics will be critical. They will know the characteristics of the main genetic conditions. They have to gain knowledge about clinical and molecular methods necessary to reach a correct genetic diagnosis.
They will understand the main principles of modern methodologies for gene-hunting and for disease modelling and precision medicine. They will be exposed to the principles of the ‘Omics science’
Pharmacology Students will be introduced to the principles and methodologies of drug development, going from identification of druggable diseases to the main characteristic a potential candidate should have in terms of pharmacokinetics, pharmacodynamics, efficacy and safety. Students should therefore be acquainted with genetic drivers and/or perturbers of efficacy and/or safety and the role that such factors may have in defining pharmacological opportunities in investigational and real life settings.
For both Modules students will be exposed to bioethical issues inherent to the preclinical genetic diagnosis, the genetic identity of the patient, the compassionate use of drugs, the management of off target results in genomic analysis.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	6	BIO/14, MED/03, MED/03

Basic Life Sciences 3 [1205205]

Offerta didattica a.a. 2024/2025

Docenti: ALESSANDRO LOPPINI

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi
The course aims at providing basic knowledge of the mathematical tools to model physiological processes, from the cell scale up to the organ and system scale. The eventual objective is to provide students with a quantitative approach to physiology which would allow them better understanding of body functions, exploitable for both descriptive and predictive scenarios.

Prerequisiti
Basic knowledge of Mathematics (Calculus), Physics, and human Physiology.

Contenuti del corso
- Models of neurons: Hodgkin-Huxley model, cable equation and applications. Synapses and plasticity. Integrate-and-fire. Firing rate models.
- Models of muscles: Cross-bridge model. Extra- and intra-fusal fibers models. Motor control.
- Electrophysiological models of cardiac tissue: sinoatrial node cells, ventricular cells. Cardiac tissue modeling: 1D and 2D models of ventricular tissue. Heart dipole vector and ECG.
- Circulatory system modelling. Blood flow and Poiseuille’s law. Vessel resistance and compliance. Cardiac pump and cardiac output. Simple models of circulatory system. Windkessel effect.
- Models of gas exchange in the respiratory system. Capillary-alveoli gas exchange. Carbon Dioxide removal model. Oxygen uptake model. Ventilation-perfusion.
- Models of renal physiology. Glomerular filter model. Urinary concentration: countercurrent mechanism.

Metodi didattici
Theoretical and practical lectures addressing the topics of the course. Teaching methods involve frontal lectures with slides and whiteboard, computer simulations of simple models, work in groups for in-depth study of selected models.

Modalità di verifica dell'apprendimento
Learning evaluation criteria and methods
The Knowledge is assessed through a written test and an oral interview, designed to verify the student's preparation on the topics presented during the course. The written test is focused on topics presented during the lectures. The oral interview is focused on a review of the written test and on an oral presentation of a group work on an in-depth study of specific a model, selected from a list prepared by the lecturers.

Criteria for learning assessment and final score
The written test lasts 2 hours and includes 2 open questions (worth 8 points each, for a total of 16 points) and 8 multiple-choice questions (worth 1 point each, for a total of 8 points) on the models presented in the class. The oral presentation related to the group work on the selected modeling application is assessed with a mark ranging from 1 up to 6 points. To pass, a student has to reach the minimum score of 18. The maximum grade is 30, with possible laude.

Testi di riferimento
- Slides and material produced by lecturers and uploaded on the e-learning platform.
- Suggested textbooks: Mathematical Physiology, James Keener and James Sneyd. Mathematical Foundations of Neuroscience, G. Bard Ermentrout , David H. Terman. Quantitative Human Physiology, Joseph Feher.

Altre informazioni
Knowledge and understanding
Students will achieve an adequate knowledge of the main mathematical models used in physiology, including applications to:
- neurons electrophysiology
- muscles contraction

- cardiac electrophysiology
- respiration
- blood circulation
- renal filtration

Applying knowledge and understanding
At the end of the course, students will be able to formulate coherent conceptual models of physiological processes, and identify the correct mathematical framework able to describe them quantitatively, at the desired level of detail. Further, students will be able to interpret the assumptions behind the specific models used in physiology, understanding their domain of applicability, descriptive and predictive power, and limits.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	5	FIS/07, FIS/07

Stampa del 07/05/2025

Probability and Statistic [1205201]

Offerta didattica a.a. 2024/2025

Docenti: MASSIMO CICCOZZI, MARCO FORTI

Periodo: Primo Ciclo Semestrale

Obiettivi formativi
The course aims to introduce students to statistics, enabling them to read a scientific paper and perform key calculations in the field of epidemiology.

Prerequisiti
Mathematics

Contenuti del corso
Probability and Statistics
General introduction
• Descriptive statistics: numerical measures and representation.
• Basics of probability
☐ Discrete probability distributions
☐ Continuous probability distributions
☐ Introduction to likelihood
☐ Study of elected distributions
☐ Random variables connected to Normal
Inference:
• Hypothesis testing
• ANOVA
Linear models:
• OLS assumptions
• Properties of OLS estimators
• Regression analysis and model building
Survival analysis
• Essential concepts
• Sample selection
• Survival objects
• Case-control studies
• Kaplan–Meier estimates
• Logistic regression
• Censured data
• The Cox proportional hazards model

Metodi didattici
In-person lectures complemented by a computer laboratory.

Modalità di verifica dell'apprendimento
Written and oral exam

Testi di riferimento
• The statistical analysis of failure data – Kalbfleisch & Prentice
• Survival analysis: techniques for censured and truncated data – Klein & Moeschbeger
• Statistical inference – Casella & Berger
• Introductory Statistics With R – Peter Daalgard
• Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R - Christian Heumann, Michael Schomaker & Shalabh
• First Course in Probability, A 9th Edition - Sheldon Ross
• Statistica, principi e metodi – Cicchitelli, D'Urso & Minozzo
• Statistica per le decisioni – Domenico Piccolo
• Other material provided by the teacher
Other material provided by the teacher

Altre informazioni
The assessment of learning involves assigning a final grade on a scale of thirty points. The final grade will be calculated by weighting the grade obtained in relation to the credits of the two modules taught.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	6	SECS-S/02, MED/01

Stampa del 07/05/2025

Signal and Imaging Processing [1205304]

Offerta didattica a.a. 2024/2025

Docenti: ROSARIO FRANCESCO GRASSO, LEANDRO PECCHIA

Periodo: Ciclo Annuale Unico

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Medicina e Chirurgia

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Laurea Magistrale Ciclo Unico 6 anni	Medicine and Surgery “MedTech” (2022)	comune	12	ING-INF/06, ING-INF/05, MED/36, MED/36

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