



General information	
Academic subject	<b>General Physiology with Elements of anatomy</b>
Degree course	SCIENZE E TECNOLOGIE ERBORISTICHE E DEI PRODOTTI PER LA SALUTE
Year of study	II
European Credit Transfer and Accumulation System (ECTS)	8
Language	Italian
Academic Year	2021-2022
Academic calendar (starting and ending date)	March-June
Attendance	20-30 students

Professor/ Lecturer	
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Virtual headquarters	Microsoft Teams
Tutoring (time and day)	Every day. Please check teacher's availability by email

Syllabus	
<b>Learning Objectives</b>	The aim of the course is to provide fundamental knowledge about main physiological mechanisms at cellular and systemic level and to provide structural details about cells and organs. The physiological reference framework obtained is fundamental for understanding the functional alterations found in pathology
<b>Course prerequisites</b>	Basic knowledge of cell biology: structure and composition of the plasma membrane, role of intracellular organelles.
<b>Contents</b>	CELL PHYSIOLOGY: Models of plasma membrane. Cellular membranes. Epithelial membranes: role of various types of junctions. Diffusion: Fick's law. Simple diffusion of molecules across biological membranes. Net transport and one-way flows. Osmosis. Coefficient of reflection. Water diffusion. Osmosis in isolated cells. Facilitated transport, criteria to distinguish it from simple diffusional transport. Primary active transport. Secondary active transport. Equilibrium potential. Diffusion potential. Membrane potential and its ionic genesis, role of the Na-K ATPase pump. Transports through channels. Membrane ion channels. Selectivity of ion canals. PROPERTIES AND CHARACTERISTICS OF NEURONS: Electrical communication: Local potentials. Action potentials. Electrical model of the membrane. Constant field concept. Conductance law. Action potential: ionic genesis. Excitability threshold. Passive properties of the nerve fiber: space constant and time constant. Conduction of the nerve impulse in the myelinated and unmyelinated fibers. Absolute and relative refractoriness. Electrical synapses. Chemical synapses: classification. Excitatory synapses. Inhibitory synapses. Presynaptic inhibition. The neuromuscular synapse: Ionic basis of the genesis of the excitatory and inhibitory post-synaptic potential. Neurotransmitters and post-synaptic transduction mechanisms. Spatial and temporal summation of synaptic inputs and coding. SENSORY RECEPTORS: Types of receptors and their functions. General classification and properties. Adequate stimulus. Transduction processes. Factors influencing the amplitude and duration of the receptor potential. Coding of sensory information. Receptor adaptation. Skin receptors. Proprioceptors: neuromuscular and Golgi corpuscles. Labyrinth receptors. Cochlear receptors. Inner ear: organ of Corti. Mechanical electrical transduction. Photoreceptors:



	<p>anatomy of the eye. Retina, cones and rods. Color vision. Light adaptation and dark adaptation. Monosynaptic and polysynaptic reflexes. Golgi tendon reflex. Myotatic reflex. AUTONOMOUS NERVOUS SYSTEM: Anatomic-functional organization of the ANS. Pre- and post-ganglionic neurotransmitters. Adrenergic and cholinergic receptors. Effects of ortho- and para-sympathetic stimulation. MUSCLE TISSUE: Anatomy of the muscle and cytology of the muscle fiber. Molecular basis of muscle contraction. Excitation-contraction coupling. Motor units and units recruitment. Isotonic and isometric contraction. Tetanus. Smooth muscle cell structure. Molecular basis of contraction. Characteristics of single-unit and multi-unit smooth muscle. Excitation-contraction coupling. Tonic smooth muscle contraction. Heart anatomy. Cardiac cell cytology. Electrical signals in the heart: action potentials of the common myocardium and pacemaker cells, origin of heartbeat, propagation of the depolarizing wave. Refractory periods of the heart, electrocardiogram. Mechanical properties: molecular basis of contraction, excitation-contraction coupling. Cardiac cycle. Strength and work of the heart. Intrinsic and extrinsic regulation of the cardiac activity. CIRCULATORY SYSTEM: Anatomical characteristics and functions of the arteries, arterioles, capillaries, veins. Hemodynamic. Factors that influence the exchanges of gas and nutrients at capillary level. Formation and reabsorption of extracellular fluid. Factors affecting the venous return of the blood to the heart. Characteristics of the small and large circle. Blood pressure and its measurement. Short- and long-term blood pressure control mechanisms. RESPIRATORY SYSTEM: Anatomy and functions of the lung and the alveolar tissue. Lung volumes and capacities. Anatomical and physiological dead space. Mechanics of pulmonary ventilation. Function of the surfactant. Changes in intrapulmonary and intrapleural pressure during the respiratory cycle. Ultrastructure of the alveolo-capillary barrier. Diffusion of respiratory gases. Pressure gradients of oxygen and carbon dioxide. Factors affecting the exchanges of respiratory gases. Oxyhaemoglobin dissociation curve. Transport of oxygen and carbon dioxide in the blood. Nervous control of pulmonary ventilation. Chemical regulation of respiration. RENAL SYSTEM: Anatomy of the kidney and the urinary system. Glomerular filtration. Filtration flow. Self-regulation of renal blood flow and glomerular filtration. Tubular reabsorption. Tubular secretion. Renal Clearance and its significance. Renal threshold of excretion. Renal mechanism of urine concentration and dilution. Factors regulating diuresis. Role of the renin-angiotensin-aldosterone system in regulating the volume and composition of the extracellular fluid. Acid-base balance of the organism. Mechanisms of pH regulation. Respiratory regulation of acid-base balance. Renal regulation of acid-base balance. GASTRO-INTESTINAL SYSTEM: Anatomy of the gastrointestinal system. Chewing and swallowing. Motility of the stomach, small intestine and gallbladder. Salivary, gastric, pancreatic and biliary secretion. Nervous and hormonal control of motility and secretions. Digestion of carbohydrates, lipids and proteins. Absorption processes in the small intestine and large intestine.</p>
<b>Books and bibliography</b>	<p>Anatomia e Fisiologia. Martini, Ober, Nath, Bartholomeow, Petti. Edises. Fisiologia umana. Un approccio integrato. Dee U. Silverthorn, Pearson Fisiologia. C.L. Stanfield: umana, EdiSES.U., Fisiologia. R.M. Berne, M.N. Levy. Casa Editrice Ambrosiana Distribuzione esclusiva Zanichelli</p>
<b>Additional materials</b>	<p>Digital resources associated with textbooks will be used whenever possible</p>



Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
<b>Hours</b>			
64	64	-	136
<b>ECTS</b>			
8			
Teaching strategy			
	Power-point presentations will be used to support frontal teaching. Slides presented in class will be made available to the student in electronic format (pdf files) and will be shared through the platform Teams. The power-point presentations are organized as introductory and explanatory material, useful to drive students' work on the textbook.		
Expected learning outcomes			
<b>Knowledge and understanding on:</b>	<ul style="list-style-type: none"><li>○ Acquisition of advanced knowledge in the biophysics of membrane transports and diffusive processes.</li><li>○ Acquisition of advanced knowledge in the field of cell physiology and the communication mechanisms between the cells.</li><li>○ Acquisition of advanced knowledge in organ physiology with details of human anatomy.</li><li>○ Understanding of the integration mechanisms between different organ systems</li></ul>		
<b>Applying knowledge and understanding on:</b>	<ul style="list-style-type: none"><li>○ Ability to present, critically analyse and solve theoretical problems regarding cellular and organ functions. Ability to autonomously analyse and re-elaborate graphs and data taken from scientific articles published in international journals and on online databases</li></ul>		
<b>Soft skills</b>	<ul style="list-style-type: none"><li>● Making informed judgments and choices<ul style="list-style-type: none"><li>○ Autonomy in the choice and critical evaluation of different information or opinions (available in experimental articles, review articles and accredited scientific sources, also in English) regarding issues related to cell and organ physiology.</li></ul></li><li>● Communicating knowledge and understanding<ul style="list-style-type: none"><li>○ Ability to present, in written and oral form, the knowledge acquired with properties of language, scientific terminology and appropriate graphic tools.,</li></ul></li><li>● Capacities to continue learning<ul style="list-style-type: none"><li>○ Ability to independently select, understand and learn concepts of cell and organ physiology from accredited scientific sources, also in English.</li></ul></li></ul>		
Assessment and feedback			
Methods of assessment	The evaluation will include, in addition to the final oral exam, one or more ongoing tests. The test will consist of a written paper, composed of open questions. The final grade will be determined by the average of the grades scored by the students in the intermediate written tests (if passed) and in the final oral exam. This academic year the ongoing tests may not be carried out due to the epidemiological emergency from COVID-19.		
Evaluation criteria	<ul style="list-style-type: none"><li>● Knowledge and understanding<ul style="list-style-type: none"><li>○ ability to connect various topics of study with each other and with current notions</li></ul></li></ul>		



	<ul style="list-style-type: none"><li>• Applying knowledge and understanding<ul style="list-style-type: none"><li>○ ability of proper verbal exposure, critical analysis and resolution of theoretical problems on cellular and organ functions</li></ul></li><li>• Autonomy of judgment<ul style="list-style-type: none"><li>○ ability to argue the proposed theses</li></ul></li><li>• Communicating knowledge and understanding<ul style="list-style-type: none"><li>○ ability to use appropriate language and graphic tools in presenting the topics</li></ul></li><li>• Communication skills<ul style="list-style-type: none"><li>○ ability to use appropriate language and graphic tools in presenting the topics</li></ul></li><li>• Capacities to continue learning<ul style="list-style-type: none"><li>○ ability to independently learn cellular and organ physiology concepts from accredited scientific sources</li></ul></li></ul>
Criteria for assessment and attribution of the final mark	The evaluation will include, in addition to the final oral exam, one or more ongoing tests. The test will consist of a written paper, composed of open questions. The final grade will be determined by the average of the grades scored by the students in the intermediate written tests (if passed) and in the final oral exam.
<b>Additional information</b>	

