

General Information	BACELOR DEGREE IN BIOTECHONOLOGIES
Title of the subject	Physiology and elements of Biophysics
Degree Course (class)	INDUSTRIAL AND AGRI-FOOD BIOTECHNOLOGIES (Class L-2)
ECTS credits	8
Compulsory attendance	yes
Language	Italian
Academic year	2020/2021

Subject Teacher		
Name and Surname	Grazia Tamma	
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Place and time of reception	Biology building, 4 th floor, room 48	
ECTS credits details	Discipline sector (SSD)	Area
	BIO/09	Characterizing activities---

Study plan schedule	Year of study plan		Semester	
	II		I	
Time management	Lessons	Laboratory	Exercises	Total
CFU	6	2		8
Total hours	150	50		200
In-class study hours	48	24		72
Out-of-class study hours	102	26		128

Syllabus

Prerequisites / Requirements	

Expected learning outcomes (according to Dublin descriptors)

Knowledge and understanding	Acquisition of basic knowledge of the biophysical, molecular and functional mechanisms of transport and communication systems across plasma membranes. Understanding the homeostatic mechanisms of organisms at the molecular, cellular and systemic level. Understanding and application of general physiological mechanisms in living organisms. Acquisition of knowledge of the principles of electrophysiology.
Applying knowledge	Application of physiological methodologies for research in cellular and molecular physiology.
Making informed judgments and choices	Acquisition of autonomy in experimental planning and in the strategies needed to apply physiological techniques in order to

	investigate molecular and cellular physiology
Communicating knowledge	Acquisition the correct scientific terminology in order to autonomously understand and interpret the scientific bibliography in the field of physiology
Capacities to continue learning	Acquisition of the ability to understand the texts and scientific literature in the field of physiological disciplines
Study Program	
Content	<p>First part - Principles of cellular physiology and cell biophysics. Functional organization of the cell - Cellular and extracellular environment. - Plasma membranes. Micelles and liposomes. -Composition and structure of membranes: Lipids, Proteins and Carbohydrates. Fluid mosaic model. Membrane domains: lipid-raft. Recombinant DNA technology for the study of membrane proteins. Transmembrane transport mechanisms Membrane permeation. Acting forces: chemical, electrical and electrochemical potential. Fick's law. Osmosis and osmotic balance. Simple diffusion. Facilitated diffusion. Transport mediated by membrane proteins. Primary and secondary active transports. ABC transporters and drug resistance. Cystic fibrosis: pathology associated with alterations of the CFTR channel. Transepithelial transport; Aquaporins. Vesicular transport mechanisms. Biogenesis of vesicles. Transport mediated by vesicles (exocytosis, endocytosis, transcytosis and kiss and run). Protein sorting mechanisms of regulation. Dysfunctions of the sorting mechanism: pathological implications. Physiological and biophysical approaches for the study of vesicular traffic.</p> <p>Second part - Electrophysiology Ion equilibria and membrane potential Electrochemical potential. Equilibrium potential and Nernst's law. Gibbs-Donnan equilibrium. Diffusion potential. Henderson's law. Equation of Hodgkin and Katz. Membrane potential at rest. Excitability Electrical properties of the membrane. Graded potentials. Ionic basis of the action potential. Phases and ionic theory of action potential. Voltage dependent channels. Action potentials in nerve, skeletal muscle and heart cells. Propagation of action potential. Canalopathies. Salting conduct. Electromechanical coupling in contraction. Synaptic transmission Electrical synapses. Excitatory chemical synapses. Inhibitory chemical synapses. Synaptic integration. Neurotransmitters: classification, chemical nature and pharmacology. Modulation of synaptic activity. Drugs for the study of synapses. Recombinant DNA technology for the study of some synapses. The role of the calcium ion in the release of neurotransmitters. SNARE proteins.</p> <p>Part Three - Signal transduction Signal transduction Membrane receptors and cellular messengers. Principles of communication between cells: via paracrine, endocrine and autocrine. Second and third messengers. Hormones, classification, control of their release, mechanisms of action. Biotechnological approaches for the study and synthesis of hormones. Neurormones. Paracrine signals of a lipid nature. Growth factors and mechanism of action and biotechnological applications</p> <p>Fourth part - The immune system Cell-mediated antibody responses</p>

Bibliography and textbooks	Cell Physiology and Biophysics - Taglietti Casella (Edises) Physiology - Bern & Levy (Ambrosiana Publishing House) Physiology - D'Angelo & Peres (Edi Ermes)
Notes to textbooks	The recommended texts must be integrated with other material suggested by the Professor during the lessons
Teaching methods	Lectures with the use of PowerPoint and laboratory exercises
Assessment methods (oral, written, ongoing assessment)	Oral interview
Evaluation criteria (describe criteria for each of the above expected outcomes)	The exam will be used to verify the acquisition of the contents of the discipline and how the topics have been understood and connected to each other. In addition, the ability to integrate physiology with other biological disciplines will be verified, a capacity particularly appreciated for the purposes of an evaluation very high
Further information	