



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Biomedicina, Neuroscienze e Diagnostica avanzata		
ACADEMIC YEAR	2023/2024		
MASTER'S DEGREE (MSC)	NEUROSCIENCE		
INTEGRATED COURSE	BIOCHEMISTRY AND PHYSIOLOGY - INTEGRATED COURSE		
CODE	21031		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	BIO/10, BIO/09		
HEAD PROFESSOR(S)	EMANUELE SONIA	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	GIGLIA GIUSEPPE	Professore Associato	Univ. di PALERMO
	EMANUELE SONIA	Professore Associato	Univ. di PALERMO
CREDITS	11		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<p>EMANUELE SONIA Thursday 11:00 13:00 Sezione di Biochimica, Dipartimento BioNeC, Policlinico, via del Vespro 129 90127 Palermo</p> <p>GIGLIA GIUSEPPE Tuesday 16:40 18:40 Campus Universitario - Padiglione 11 CEPAS, via G. Mule,1 Caltanissetta Thursday 16:40 18:40 Campus Universitario - Padiglione 11 CEPAS, via G. Mule,1 Caltanissetta</p>		

DOCENTE: Prof.ssa SONIA EMANUELE

PREREQUISITES	The prerequisites are basic Biochemistry and Physiology knowledge. In particular, concerning Biochemistry the students should know structure and function of the principal biologic macromolecules and the molecular basis of metabolism. As concerns Physiology, knowledge of basic mechanisms underlying cell, tissue, organs, and systems organization and homeostasis is required.
LEARNING OUTCOMES	<p>Knowledge and understanding - The course has the objective to provide the students with the acquisition knowledge and understanding of: 1) metabolic biochemistry of nerve cells 2) The functional specificity of nervous system and the biochemical mechanisms involved in physiological and pathological conditions. 3) The molecular basis of neurodegenerative diseases 4) the macro and microscopic, molecular and electrophysiological basis and functions of Central and Peripheral Nervous systems of the human body, even including some specific advanced topics in the field (5) The principal experimental techniques in both biochemical and physiological fields with a particular attention to the experimental design.</p> <p>Ability to apply knowledge and understanding: Ability of applying the knowledge of the principal regulatory mechanisms of neural circuit functions from a biochemical and physiological point of view, as well as their integrative actions.</p> <p>Ability to collect and interpret data considered useful to inform judgments on basic aspects of the disciplines of the course. Ability to communicate information, ideas, problems and solutions related to the same disciplines.</p> <p>Making judgments: Being able to formulate hypotheses, collect and critically evaluate data, to solve problems. Being able to formulate personal judgments to solve analytical and critical problems ("problem solving") and being able to independently search for scientific information, without waiting for it to be provided to them.</p> <p>Communication ability: during the course, the importance to communicate in a clear manner the biological significance of the biochemical and physiologic processes will be underlined as well as the application field of experimental techniques analyzed. Moreover, interaction activity and collaboration with the formation of working groups will be stimulated.</p> <p>Learning ability: The course will be structured in a manner that allows to develop the necessary skills for further studies in Biochemistry and Physiology with a high grade of autonomy and capacity to design research experiments.</p>
ASSESSMENT METHODS	<p>The evaluation of student's knowledge is based on an oral exam including questions on the program treated and precisely on topics regarding Biochemistry and Physiology. The exam aims to ascertain that the student has the disciplinary knowledge in Biochemistry and Physiology in accordance with what is specified in Learning Outcomes and correct use of scientific language and speaking ability. The evaluation, expressed in thirty, will be expressed as follows:</p> <ol style="list-style-type: none">1) 18-21: when the objectives reached are just sufficient and acquired knowledge is limited2) 22-24: when the acquired knowledge and the ability to elaborate the topics are decent3) 25-27: when the acquired knowledge and the ability to elaborate the topics are good4) 28-30: when the acquired knowledge and the ability to elaborate the topics are very good5) 30 cum laude: when the acquired knowledge and the ability to elaborate the topics are excellent
TEACHING METHODS	Biochemistry and Physiology frontal lectures, exercises on experimental activity in both Biochemistry and Physiology and critical analysis of scientific papers published in international journals

**MODULE
PHYSIOLOGY**

Prof. GIUSEPPE GIGLIA

SUGGESTED BIBLIOGRAPHY

Kandel, Eric. "Principles of Neural Science, Fifth Edition (Principles of Neural Science (Kandel))". ISBN 0-07-139011-1

AMBIT	50505-Discipline del settore biomedico
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INDIVIDUAL STUDY (Hrs)	81
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COURSE ACTIVITY (Hrs)	44
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EDUCATIONAL OBJECTIVES OF THE MODULE

The aim of the course is to provide the biophysical and physiological bases of central and peripheral nervous systems functions. There will be a special focus on synapses, plasticity and neural network organization as well as basic knowledge of effects of damages resulting in neurological disease.

SYLLABUS

Hrs	Frontal teaching
7	General Design of the Nervous System; Basic Physics of Membrane Potentials; Resting Membrane Potential of Neuron
8	Neuron Action Potential; Propagation of the Action Potential; Recording Membrane Potentials and Action Potentials techniques; The synaptic transmission ; probability of quanta release: Reliability and Efficacy of Synaptic transmission; Post-synaptic potentials
6	Transmission of Impulses from Nerve Endings to Skeletal Muscle Fibers: The Neuromuscular Junction; Drugs That Enhance or Block Transmission at the Neuromuscular Junction; Physiological aspects of Neuromuscular Junction Disorders; Physiologic modeling of repetitive nerve stimulation
6	Integrative functions of Neurons; Central Nervous System Vs Peripheral Nervous System Synapses; Synaptic Plasticity (Activity dependent, STP, LTP, LTD, Homeostatic); Comparing the Nervous System with a Computer
3	Sensory Receptors, Neuronal Circuits for Processing Information; Types of Sensory Receptors and the Stimuli They Detect; Transduction of Sensory Stimuli into Nerve Impulses
2	Nerve Fibers That Transmit Different Types of Signals and Their Physiologic Classification; Transmission of Signals of Different Intensity, Duration and Submodalities
Hrs	Workshops
4	Recording membrane potentials: hands -on
3	Recording membrane potentials, playing with ionic concentrations and conductance of a neuron: a software simulation
5	Building and working on a Neuron equivalent circuit: hands on

MODULE BIOCHEMISTRY

Prof.ssa SONIA EMANUELE

SUGGESTED BIBLIOGRAPHY

- Basic Neurochemistry (Principles of molecular, cellular and medical neurobiology) Brady, Siegel, Albers, Price. Academic Press. Elsevier.

ISBN 9780080959016 Eight edition

- Selected Review from current scientific literature.

AMBIT	50507-Discipline del settore biomolecolare
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide knowledge of the biochemical mechanisms involved in the functions of nervous system cells and to focus on molecular alterations that contribute to the development of neurodegenerative diseases. In addition, the course aims to give an overview of modern biochemical techniques that can be applied to both diagnostic and therapy of neurological diseases. Finally, another important objective is the acquisition of capability to critically analyze international scientific papers and design research experimental work.

SYLLABUS

Hrs	Frontal teaching
2	General metabolism principles. Glycemia regulation and glucostatic liver function. Importance of normo-glycemia maintenance for cerebral function.
4	Brain cell metabolism with particular reference to metabolic integration neuron-glia. Brain GLUT and exokinase. Insulin and central nervous system.
2	Blood brain barrier: structure and function
4	Axonal transport. Myelin sheath and complex lipids. Lipid roles in neurotransmission. Cerebrosides and gangliosides. Gangliosidosis.
2	Mechanism of neurotransmission. Sodium and potassium channels. Calcium channels.
8	Neurotransmitters. Acetylcholine synthesis and degradation. Neuromuscular junction and nicotinic colinergic synapses. Myasthenia gravis. Muscarinic colinergic synapses. Glutamate synthesis. Glutamate receptors. GABA synthesis. GABA receptors. Catecholamines synthesis. Catecholamines receptors. Serotonin. Enkephalins and endorphins. Tetanus and botulism. Short term and long term memory. Dopamine and cocaine. Presynaptic vesicles fusion mechanisms.
4	Folding and regulation of protein turnover, folding intermediates, folding models, thermodynamic folding funnel for simple and complex proteins. Molecular order and disorder. Intrinsically unstructured proteins (IUPs) and their roles in misfolding disease. Misfolding and neurodegenerative diseases. Free scale network and "interactomes". Roles of FUS e TDP43 proteins and their alteration in amyotrophic lateral sclerosis (SLA).
4	Moonlighting proteins. alpha-synuclein and its role in Parkinson disease. PARK genes. Role of 26S proteasoma and ubiquitination in neurodegenerative diseases.
2	Oxidative stress and cell defence systems, antioxidants, oxidative stress disease, neurodegeneration.
2	Molecular aspects of Alzheimer disease. Beta amyloid protein. Amyloidogenic pathway: Therapeutic perspectives.
6	From classic apoptosis to alternative death pathways: necroptosis, pyroptosis and autophagy and Activation of autophagic flow as a mechanism of cell survival. Crosstalk between autophagy and apoptosis. Deregulation of cell death in some neurodegenerative diseases. Techniques for evaluation of different types of cell death.
Hrs	Practice
6	Critical study and analysis of scientific papers published in international journals.
6	Methods for studying cell death and autophagy. Cell culture. Flow cytometry, fluorescence microscopy. Western blot.