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**COURSE: Physiology**

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ACADEMIC YEAR: 2019/20

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TYPE OF EDUCATIONAL ACTIVITY: **Basic**

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TEACHER: **Monica Carmosino**

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Language: **italian**

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ECTS: 6 frontal lessons

n. of hours: 48 frontal  
lessons

Campus: Potenza

Dept.: Sciences

Program: **BIOTECNOLOGIE (L2)**

Semester: II

From 02/03/2020 al

31/05/2020-

20/06/2020

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**EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**

**Knowledge and understanding:** the student should demonstrate to first understand the fundamental principles of cellular functioning, the characteristics of membrane transporters and the ability of excitable cells to generate and propagate electrical signals. It should also include the functioning of individual organs such as the heart, lungs, kidneys, gastro-enteric apparatus and sensory receptors. Finally it will have to understand how the various organs cooperate in the regulation of blood pressure, in the hydrosaline balance and in the regulation of the partial pressure of O<sub>2</sub> and CO<sub>2</sub> in the blood.

**Ability to apply knowledge and understanding:** based on the knowledge acquired, the student should be able to identify pharmacological targets and biomolecules useful for the development of both technological drugs and diagnostic tests.

**Making judgments:** the student should prove to be able to make an independent judgment using the basic knowledge acquired when placed in front of the request to resolve a physiological need of the human organism.

**Communication skills:** the student should demonstrate synthesis skills, ability to identify the fundamental information relating to the functioning of complex systems such as respiratory and urinary systems, to demonstrate the ability to link one subject to another, and to have acquired the proper terminology of the matter.

**Learning skills:** the student should have developed skills necessary to continue the course of study with a high degree of autonomy in the courses of Pharmacology and Toxicology and Pathophysiology and Immunology of the specialist degree course in 'Biotechnology for Medical, Pharmaceutical and Veterinary Diagnostics'.

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**PRE-REQUIREMENTS**

knowledge in cell biology and biochemistry are needed. The examination of human anatomy is a prerequisite to sustaining the Physiology exam.

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**SYLLABUS****Cellular Physiology (12 h)**

Functional characteristics of the plasma membrane. Membrane receptors. Membrane transporters. Ion channels: voltage-dependent and ligand-dependent.

Electrical phenomena of membranes. Physics-chemical bases of membrane potential and resting ionic flow. Role of the sodium-potassium pump. Action potential: its genesis and propagation in myelinated and unmyelinated fibers.

Synapses. Electrical and chemical synapses. Presynaptic and postsynaptic mechanisms of chemical transmission. Excitatory and inhibitory postsynaptic potentials. classical neurotransmitters and neuropeptides: synthesis, release, inactivation, interaction with membrane receptors.

Sensory receptors. Classification of sensory receptors. Process of stimulus transduction. Primary sensory coding: encoding the type of stimulus, its intensity, duration and location.

Striated muscle cell. Structure of the striated muscle cell. Molecular mechanisms of contraction. Excitation-contraction coupling. The transmission of excitation in the neuromuscular junction. Graduation of the force of muscle contraction.

**Physiology of systems (36 h)**

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*Nervous system.*

Somatic nervous system: Functional anatomy of the peripheral and central nervous system. Blood-brain barrier. Glial cells. Sensory neurons, motor and interneurons. Reflex arc. Superior control of reflex activity. Sensory and motor systems and their topographic representation in the cerebral cortex.

Special senses: Visual system, auditory, vestibular, taste and smell: specific stimuli, specific receptors, signal transduction mechanisms, dedicated pathways.

Autonomic nervous system: Functional anatomy of the autonomic nervous system: sympathetic and parasympathetic section. pre- and post-ganglionic chemical mediators. Nicotinic and muscarinic cholinergic receptors. Adrenergic receptors alpha and beta. Effects of sympathetic and parasympathetic stimulation of various organs and systems. Autonomic reflexes.

*Cardiovascular system*

Organization of the cardiovascular system: General scheme of the cardiovascular system. Characteristics of small and large circle. Composition, size and functions of blood. Blood cells. Hemostasis and blood clotting.

Mechanical activity of the heart: Functional anatomy of the heart. Myocardial structure. Mechanical events of the cardiac cycle. Variation of pressure and the volume of blood in the atria and ventricles.

Electrical characteristics of cardiac cells. Genesis heart rhythm. electrical conduction in the heart. Refractory time in the heart. Excitation control and conduction in the heart.

Vascular system. Features and functions of arteries, arterioles, capillaries, veins and lymphatic vessels. Hemodynamics: relationship between flow, pressure and resistance. Pressure profile in the systemic circulation. Return of venous blood to the heart. Capillaries exchanges. Local blood flow control.

Regulation of cardiac output. Cardiac output: normal values and range of variation. Mechanisms of cardiac output regulation: regulation of heart rate and stroke volume.

Regulation of systemic blood pressure. Normal values and range of variation of blood pressure. Blood pressure regulation systems: rapid, medium, and long term.

*Respiratory system*

Gas exchange in the lungs and tissues. Composition of atmospheric and alveolar air. Ultrastructure of the air-blood barrier. Physical factors that determine the exchange of oxygen and carbon dioxide in the lungs and in tissues. Biological factors that influence gas exchange in the lungs and tissue level.

Transport of oxygen and carbon dioxide in the blood. Oxygen transport in the blood. Oxyhemoglobin dissociation curve, its biological significance and factors affecting it. Carbon dioxide transport in the blood. Physical and biological factors that influence it.

*Renal system*

Basic renal processes. Functional Anatomy of the kidney. Processes involved in the formation of urine. Glomerular filtration: glomerular filtration barrier, filtration speed, physiological control of glomerular filtration. Reabsorption and tubular secretion. Renal clearance.

Diuresis regulation. Mechanism of urine concentration: multiplier mechanism and the countercurrent exchange. Regulation of renal reabsorption of water and sodium.

*Gastrointestinal system*

Motility and secretion in the stomach, pancreas and intestine. Digestion and absorption of sugars, proteins and lipids

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**TEACHING METHODS**

Theoretical lessons using PowerPoint presentations and movies.

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EVALUATION METHODS

Oral examination

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TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

**Fisiologia umana. Un approccio integrato** di [Dee U. Silverthorn](#)

**Fisiologia: dalle molecole ai sistemi integrata** di [Emilio Carbone](#), [Federico Cicirata](#), [Giorgio Aicardi](#)

**Fisiologia** di [Cindy Stanfield](#)

**Vander fisiologia** di [Eric P. Widmaier](#), [Hershel Raff](#), [Kevin T. Strang](#)

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INTERACTION WITH STUDENTS

Explanations related to teaching course are released mainly after class.

Alternatively students can meet the teacher in the days Wednesday and Thursday from 15:00 to 17:00, at the teacher's office in the Department of Sciences.

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EXAMINATION SESSIONS (FORECAST)<sup>1</sup>

23/01/2020; 27/02/2020; 12/03/2020; 25/06/2020; 30/07/2020; 24/09/2020; 29/10/2020; 15/12/2020;

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SEMINARS BY EXTERNAL EXPERTS    YES     NO  X

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FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.