DIPARTIMENTO DI SCIENZE

COURSE: Physiology			
ACADEMIC YEAR: 2018/19			
TYPE OF EDUCATIONAL ACTIVITY: Basic			
TEACHER: Monica Carmosino			
e-mail: monica.carmosino@unibas.it		website:	
phone: 335-6302642		mobile (optional):	
Language: italian			
ECTS: 6 frontal lessons	n. of hours: 48 frontal lessons	Campus: Potenza Dept.: Sciences Program: **BIOTECNOLOGIE (L2)**	Semester: II From 06/03/2019 to 15-30/06/2019

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course aims to put students in conditions of:

- Understanding of the physical, chemical and molecular basis of fundamental cellular physiological processes such as: the membrane electrical polarization, the genesis of the action potential (excitability), the communication between cells via synapses, muscle contraction, transduction of physiological stimuli into electrical signals by receptor cells of the sensory systems.
- Understanding, knowing and describing the functioning of the systems: somatoestesia and its sub-modes (touch, pressure, pain, termoestesia, proprioception).
- Understanding, knowing the physical basis of the cardiovascular and respiratory systems, explaining the physiological processes in terms of the appropriate physical and chemical laws and understand the method of application of such laws.
- understanding and learning the functioning of the excretory system with particular regard to the formation of urine;
- understanding, learning the functioning of the respiratory system with particular attention to the laws that govern the exchange of gases between lung and blood;
- Understanding, knowing the main lines of the four fundamental processes of the digestive physiology: motility, secretion, digestion and absorption.
- Understanding, knowing and describing the nervous and humoral regulatory mechanisms of these systems and their coordination in the execution of specific tasks such as: the homeostasis of plasmatic pH, osmolarity and extracellular fluid volume, the regulation of blood pressure and cardiac output, the regulation of the gastro-intestinal secretion and the regulation of the frequency and intensity of breathing.

PRE-REQUIREMENTS

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

SYLLABUS

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

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

Electrical phenomena of membranes. Physics-chemical bases of membrane potential and resting ionic flow. Role of the sodiumpotassium 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)

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

TEACHING METHODS
Theoretical lessons using PowerPoint presentations and movies.

EVALUATION METHODS
Oral examination

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

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.

EXAMINATION SESSIONS (FORECAST)[1]
29 -01-2019, 20 -02-2019, 8-05-2019, 24 -07-2019, 23-10-2019, 18-12-2019

SEMINARS BY EXTERNAL EXPERTS YES □ NO □ X

FURTHER INFORMATION

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.