UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Organs and Functions

2122-3-E0201Q053

Aims

The course is divided into two modules. The first module aims to provide the biotechnology student with the basic concepts of general physiology; the second module aims to provide an overview of the structure (anatomy) and the mechanisms that govern the function of organic systems.
In particular, at the end of the course the student will have acquired the following skills:

Knowledge and understanding
To be able to translate cellular physiology information to organ physiology

Applied knowledge and understanding
To be able to apply the laws of physiology together with those of physics and biochemistry to understand the mechanisms underlying complex phenomena

Making judgments
To be able to evaluate what has been learned with great critical sense

Communication skills
To comprehensively communicate what has been learned with a correct scientific terminology

Learning skills
To learn critically a large part of the scientific literature on the physiology of higher organisms

Contents

The first module of the course deals with topics of cell physiology with particular attention to transmembrane

transports, to the electrical signals of cell membranes, to the physiology of neurons and muscle cells. The course then addresses the physiology of human organ systems, starting from the sensory somatic nervous system, the special senses of vision and hearing. The second module of the course illustrates the functioning of most human organ systems, such as the somatic and vegetative nervous system, the endocrine, cardiovascular, respiratory, renal and digestive systems.

Detailed program

Cellular physiology
-Plasma membranes, passive and active transmembrane transports. Ion channels, structure and function. Electrical properties of the plasma membrane (membrane potential and passive properties of cell membranes).
-Neurons, structure and function. Voltage dependent ion channels, genesis and propagation of the action potential. Electrical and chemical synapses, excitatory and inhibitory synapses. Neuromuscular junction.
-Skeletal and cardiac muscle, structure and function. Excitation-contraction coupling, comparison between skeletal and cardiac muscle.
-Smooth muscle, structure and function. Endothelium-smooth muscle relationship.
System Physiology
-Somatic nervous system: sensory and motor system anatomy.
Sensory neuron: transduction, transmission and encoding of the sensory stimulus. Overview of somatosensory system. Photoreceptors, visual photo-transduction and retinal circuits. Ear, hair cells and mechano-electrical transduction of the sound signal.
Movement programming and execution. Parallel systems in movement control (cerebellum and basal nuclei). Spinal reflexes.
-Limbic System: Pulsional behaviors. Thermoregulation
-Autonomic nervous system: Sympathetic and parasympathetic system. Autonomic reflexes (baroceptors, chemoceptors).
-Endocrine system: Hypothalamus-hypophysis system and peripheral glands (thiroid, surrenal, gonads). Endocrine systems with peripheral control (e.g. insulin, glucagone, renin-angiotensin).
-Cardiovascular System: The heart: electrophysiology, mechanical function. Arteries, veins, capillary exchanges. Integrated homeostasis of pressure and volume.
-Respiratory System: Lung mechanics, alveolus -blood exchanges, gas transport in blood. Pulmonary circulation and its regulation.
-Excretory system: Anatomo-functional organization of the renal parenchyma. Glomerular filtration mechanism and its regulation. Reabsorption and tubular secretion mechanisms. Renal clearance. Role of the kidney in the acid / base balance. Volume, osmolarity and electrolyte concentrations control.
-Digestive system: Digestion phases: cefalic, gastric, intestinal. Esocrine pancreas. Liver and bile formation. Absorption: sugars, aminoacids, lipids, water. Lipid transport in blood.

Prerequisites

Background: basics of biochemistry and physics
Specific prerequisites: none.
General prerequisites: Students can take the exams of the third year after having passed all the exams of the first year of the course.

Teaching form

Classroom lectures.

Teaching language: italian.

Textbook and teaching resource

Learning material (slides of the lessons) is available at the e-learning platfrom of the course.

Recommended textbook:
"Fisiologia – Molecole, cellule e sistemi", D'Angelo E. & Peres A Eds, Edi Ermes.

Semester

First semester

Assessment method

Written test (quiz) + oral examination.

The written test (35 min): 30 multiple-choice questions concerning the whole course content. Students with sufficient mark (> 18/30) can take the oral examination; the written examination mark does concurr to the final grade.
Oral examination: it is concerning the whole course content. Students will be asked to reason about problems not necessarily explored during classroom lectures. This allows to verify not only the acquisition of basic concepts and methodologies, but also the student's ability to create links and apply his/her knowledge to specific problems.

Office hours

Contact: on demand, upon request by mail to lecturer.