UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

General Physiology I

2425-2-H4102D010-H4102D030M

Aims

The course aims to provide knowledge about cellular functions at the basis of systems physiology. At the end of the course, the student will be able to understand how a cell can perform its vital functions to guarantee the homeostasis of the tissue to which it belongs thanks to its basic mechanisms. The student will be able to use this knowledge for the interpretation of the pathophysiological signs and symptoms, as a starting point for the study of the physiology of the individual systems subsequently treated in the vertical tracks.

Contents

The course covers various crucial aspects of human physiology. Membrane Transport includes the structure and function of cellular membranes, the movement of solutes across them, and a comparison between ion channel-mediated and transporter-mediated transport, with examples of pathophysiological transitions. Calcium Ion Homeostasis describes the factors and mechanisms to maintain adequate calcium levels, preventing hyper- or hypocalcemia. Neuro-muscular Junction examines synaptic transmission and contraction of smooth and striated muscles, highlighting differences among various muscle tissues. Cardiac Electrical Activity encompasses the ionic basis of cardiac automaticity, ventricular action potential, the relationship between ECG and cardiac electrical events, and introduces cardiac channelopathies. Finally, Extracellular Volume and Osmolarity Control discusses intra- and extracellular compartments, fluid diffusion in the vascular system, and the role of the lymphatic system, including the Starling hypothesis.
During the course, the effects of the aging process and gender differences on human physiology will be emphasized.

Detailed program

Transports across the cell membranes.

Structure and function relation of the cellular membranes. Movement of water or solutes through a selectively permeable membrane. Carrier-mediated transports (uniport, symport, antiport) and ion channels. Examples of pathophysiological transition.

Calcium homeostasis.

Describe the mechanisms by which the body maintains adequate calcium levels in order to prevent hypercalcemia or hypocalcemia.

Neuromuscular junction. Physiology of the contraction in smooth and striated muscles.

Describes the events of synaptic transmission leading to contraction of skeletal muscle. Excitation-contraction coupling in the skeletal and cardiac muscle. Compare and contrast the basic types of muscle tissue

Electric activity of the heart (introduction to ECG)

The electrical activity of the heart. Ion basis of automaticity. Currents flowing during the early and later phases of the ventricular action potential. Understanding the relationship between ECG and cardiac electrical events. Outline about cardiac channelopathies.

Control of extracellular volume and osmolarity. Starling hypothesis.

Diffusion of extracellular fluid between the blood (vascular) and interstitial fluid spaces; body fluid compositions.. Relevance and physiology of the lymphatic system.

Prerequisites

Anatomy, biology, genetics and phisics

Teaching form

Lectures. The professor's lectures begin with an initial part where concepts are presented (lecture-based mode), followed by an interaction with the students that shapes the subsequent part of the lecture (interactive mode).

Textbook and teaching resource

Guyton & J.E. Hall, *Textbook of Medical Physiology*, Elsevier;

E. R. Kandel, J. H. Schwartz, T. M. Jessel, S. A. Siegelbaum, A. J. Hudspeth, *Principles of neural science*, Mc Graw Hill Medical;

Boron WF, Boulpaep EL, *Medical Physiology*, Ed. Elsevier.

Reviews or scientific papers recommended by the Professor During Lectures

Semester

First Semester.

Assessment method

There will be no ongoing tests.
The exam consists in a written test. Open questions will be posed to the student in order to evaluate the general knowledge of the topics. Moreover, the student will be asked to answer to questions that require the analysis of a complex phenomenon, its rationalization and the application of specific physiology principles and to solve simple exercises. Finally, a clinical case may be presented which will require the analysis of the interconnections between different physiological variables in the light of the theoretical paradigms.

Office hours

The professors receive by appointment upon agreement by e-mail
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Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY