UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

General Physiology I

2122-2-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 is based on the systematic presentation of physiological concepts underlying the functions of the human body. The sequence of events leading to an imbalance of a specific function cannot be appreciated without a deep understanding of the basic biophysical and physiological mechanisms. Therefore, these mechanisms that guarantee functions at the cellular and tissue level will be presented. In particular, membrane transports, neuronal, muscular and cardiac cell excitability, the physiology of sensory systems, the motor control and muscle contraction will be analyzed.

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.

Prerequisites

Anatomy, biology, genetics and phisics

Teaching form

Lectures. In the Covid-19 emergency period classes take place in mixed mode (asynchronous / synchronous videotaped lessons) with some events, where possible, in presence. Whenever possible, clinical case analyzes will be proposed for the evaluation of the specific physiological parameters.

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.

Semester

First Semester.

Assessment method

There will be no ongoing tests. In the Covid-19 emergency period, the exams will be carried out electronically through the platforms made available by the University.

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.