UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

General Physiology II

2223-2-H4102D010-H4102D031M

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, cardiac cell excitability, the physiology of sensory systems, motor control, muscle contraction and the foundamentals of the cardiac and respiratory physiology 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.

Physiology of the body barriers.

The Blood Brain Barrier and the Air-Blood Barrier structure and function. Transcellular and paracellular permeability, electrical trans endothelial resistance measurements in vitro models.

Cell excitability and neurotransmission. Integration of synaptic inputs.

The resting membrane potential. Genesis and propagation of action potential, EPSP and IPSP, the synaptic transmission, LTP and LTD.

Electric activity of the brain (introduction to EEG).

Introduction to the Electrophysiology of the Brain. Synaptic Currents and Volume Conduction. Origin of EEG: Cellular Sources. Main Types of Rhythmical EEG activities. Phenomenology and Functional Significance of sleep

Sensory and Motor Units. Signal trasduction and coding.

Sensory receptors -intensity, duration and position

Pain Perception - nociceptors, anatomical distribution, actrivation and sensitization mechanisms

Emodynamics.

Define the organization and hemodynamic of systemic circulation. Arteries, arterioles, capillaries, venules and veins. Lymphatic system. Hemostasis and coagulation**.**

Fundamentals of Respiratory Physiology. Physiology of Ventilation. Gas exchanges, diffusion and Fick's law.

Prerequisites

Deep knowledge of anatomy, biology, genetics and physics

Teaching form

The teaching methods will include lectures, videos, and class discussions. Lessons in attendance, subject to any changes following the COVID pandemic situation.

In case of pandemic restrictions the courses will be delivered in mixed mode from asynchronous remote with synchronous videoconferencing events (WEBEX)

Textbook and teaching resource

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

- Dale Purves, George J. Augustine, David Fitzpatrick, William C. Hall, Anthony-Samuel LaMantia, Richard D. Mooney, Michael L. Platt, Neuroscience (6th Edition) – eBook - Sinauer Associates (Oxford University Press); 6th edition

- Susan E. Mulroney, Adam Myers, Netter's Essential Physiology, Elsevier

Semester

First semester

Assessment method

There will not be on going 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.

Exams written, in case of pandemic restrictions, will be provided by the platform https://esamionline.elearning.unimib.it, access to which will be activated for the date and time of the exam.

Office hours

The professor receives by appointment upon agreement by e-mail.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING