UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Human Physiology

2021-1-I0101D004

Aims

Expand knowledge of human physiology and medical physics through learning from researchers in their fields. There is an emphasis on integrating systems and whole body function, which makes this teaching methodologically very relevant in order to be skillful in nursing and midwifery professions. Biophysics: statics and its applications to the equilibrium of the human body, hydrostatic and hydrodynamic of the circulatory system, physics of radiation. The general aims of the course are to provide students with basic knowledge of Physics and Physics of radiation, necessary to carry on their profession

Contents

Human Physiology course aims to give the student the concepts that govern integrated body functions in the living organisms. Emphasis is put on relationships between health and body homeostasis, from the cells to the organ systems. Thus, an attempt will be made to define the limit of physiological adaptation to environmental conditions or to a developing disease. The course also aims to provide the basic principles of biophysics and medical physics needed to understand the biophysical mechanisms underlying the more relevant physiological processes.

Detailed program

PHYSIOLOGY - Cellular physiology: homeostasis; the properties of the plasma membrane; transports (the diffusion, primary and secondary active transport); osmosis. Basic Electrophysiology: membrane potential; action potential; nerve impulse propagation; synapses. Muscle physiology: muscle contraction; electromechanical coupling; relationships between force-length and strength-speed into the muscles; types of motor-neuron units. Blood's functions: hematopoietic cells; red cells and gas delivery; immunity system; hemostasis. Cardiovascular system: hemodynamic of circulation; systemic pressure and mechanical properties of blood vessels; adjustment of systolic and diastolic pressure; blood velocity; systemic and pulmonary circulation; the venous system. The heart

as a mechanic pump: mechanical work of the heart; cardiac output; self-regulation of cardiac output; regulation of heart rate and electrocardiography. Physiology of the interstitial tissue: exchange of liquid between capillaries and interstitium; the function of the lymph: the volume control of the interstitial fluid. Respiratory system: functional anatomy of the respiratory system; pulmonary ventilation; the ventilation-perfusion mismatch; mechanical properties of the lung and chest wall; the diffusion of gases: the alveolar-capillary units; hemoglobin saturation curve; gas transportation. The kidneys function: functional anatomy of the nephron; the mechanism of glomerular filtration; the renal clearance: filtration function, reabsorption and secretion; proximal tubular functions, Henle's loop functions; sodium and water balance. Digestive system: gastrointestinal motility; gastrointestinal secretions and digestion; absorption of food nutrients and dietary balance. Acid-base balance. Skin: function; bed rest pressure ulcers. MEDICAL PHYSICS – Physical quantities. Conversions between physical quantities. Unit of measurement and changes of the unit of measurement. Vector and scalar quantities. Operations with vectors and vector properties. Concept of force, moment of a force. Equilibrium of a rigid body, examples of the equilibrium of the human body. The levers and their application: lever gain. Elements of statics of rigid bodies. Statics and dynamics of fluids: ideal fluids and real fluids; Archimedes, Stevin, Bernoulli, Poiseuille laws; Reynolds number and turbulence; applications of fluid dynamics to cardiovascular system. The structure of the atomic nucleus: radioactive decay (alpha radiation, beta +, beta -, gamma); law of radioactive decay; radioactivity (Becquerel, Curie); X-ray and production of X-rays; Law absorption of X-rays; elements of dosimetry.

Prerequisites

Basic knowledge of Chemistry, Biochemistry, and Mathematics.

Teaching form

In the Covid-19 emergency period classes take place in mixed mode: asynchronous/synchronous videotaped lessons and blended learning.

Textbook and teaching resource

PHYSIOLOGY - Sherwood L. (2012) Fondamenti di Fisiologia Umana, Piccin-Nuova Libraria. Open choice by students among the Medicine Library’s Physiology text books. MEDICAL PHYSICS - Scannicchio D. Giroletti E. (2015) Elementi di Fisica Biomedica, Edises, Milano.

Semester

1st Year, 2nd Semester

Assessment method

Written exam. In the Covid-19 emergency period, the exams will be carried out electronically through the platforms made available by the University.

Office hours

Previous appointment