UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Physiology 1 A

**2223-2-H4101D253-H4101D020M**

## Aims

It is essential that all medical students receive sufficient exposure to the physiological concepts underlying the functions of the human body that will provide the basis for further studies in pharmacology, pathology, pathophysiology and medical clinics and surgery. Curricular objectives are mainly focused on the normal function of the body, however, the material is presented in a context that prepares students for their role as doctors. Therefore, whenever possible, clinical examples will be used to illustrate physiological baseline principles.

## Contents

The course is based on the systematic presentation of physiological concepts based on the functions of the human body. The mechanism leading to an imbalance of function cannot be appreciated without a deep understanding of the biophysical and physiological basics. Therefore, such mechanisms that ensure the functions at the cellular level, tissues, organs and apparatus and at the integrated level will be introduced. **In particular, this module of the course will address the cellular physiology and the physiology of the renal and digestive systems.**

## Detailed program

**Cellular physiology.** Transport through the plasma membrane, diffusion, active and passive transports. Transport mediated by carriers and ion channels

**Basis of electrophysiology.** Membrane potential; electrical characteristics of the cell membrane; membrane channels; ion exchanges, electrical model of the cell membrane; equilibrium potential of an ion (Nerst's law). Sodium-potassium pump. Electrical events in excitable cells. Action potential; propagation of the nervous impulse. Synapses in the central nervous system. Electrical synapses and chemical synapses. Neurotransmitters. Post-

synaptic potentials; facilitation and inhibition mechanisms; spatial and temporal summation.

**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.

**Renal System**

The fluid compartments of the organism. Electrolyte homeostasis. Antidiuretic hormone. Natriuretic peptides. Role of aldosterone.

Functions of the renal system.. Nerve control of renal function. The nephron. The renal corpuscle. Ultrastructure of the glomerular capillaries. Glomerular filtration. Glomerular filtration coefficient. Starling forces in glomerular filtration. Glomerular Filtration Rate. Regulation of the glomerular filtration rate. Myogenic regulation, tubulo-glomerular feedback (adenosine, renin)

Resorption and tubular functions. Minimum urinary volume required. Maximum concentration of urine. Countercurrent multiplication mechanism. Generation and maintenance of the medullary hyperosmolar gradient. Clearance and renal function. Definition of clearance. Calculation of the clearance for a given compound. Clearance of inulin. The clearance to evaluate renal plasma flow (PAI). Osmolar clearance. Clearance of free water.

Acid-base balance. Henderson-Hasselbach equation. Renal mechanisms for regulating blood pH Chemical buffer systems, bicarbonate reabsorption, hydrogen excretion, urine buffer systems (phosphate and ammonia).

**Digestive System**

Functions and general characteristics. Structure of the gastro-intestinal tract. Secretion. Motility. Nervous control of the digestive function. Enteric nervous system. Electrophysiology of smooth muscle cells of the gastrointestinal tract. Hormonal control of motility of the gastrointestinal tract (gastrin, CCK, secretin). The oral cavity. The chemical senses of taste: physiology of taste and smell. Salivary secretion. Stomach and gastric secretion (composition and regulation). Intestinal secretions. Pancreatic secretion (composition and regulation). Liver secretion (composition and regulation). Digestion and absorption.

## Prerequisites

Knowledge of the introductory courses indicated in the guidance of the degree course

## Teaching form

Lectures will be held in presence.

Whenever possible, clinical case analyzes will be proposed for the evaluation of the specific physiological parameters.

## Textbook and teaching resource

KLINKE, Fisiologia EdiSES

CONTI, Fisiologia Medica, EDIERMES

GUYTON & J.E. HALL, Fisiologia medica, Piccin

D’ANGELO, PERES, Fisiologia, EDIERMES

GRASSI, NEGRINI, PORRO Fisiologia Medica, POLETTO EDITORE

MC ARDLE, KATCH, KATCH, Fisiologia applicata allo sport, CEA

KANDELL, SCHWARTZ, JESSEL, Principi di Neuroscienze, CEA

## Semester

First Semester

## Assessment method

There will be no ongoing tests.

The exam consists in an oral 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

## Sustainable Development Goals

GOOD HEALTH AND WELL-BEING