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## HUMAN PHYSIOLOGY II - channel 3

BIO/09 - 7 CFU - 1° Semester

### Teaching Staff

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### LEARNING OBJECTIVES

Knowledge of the mechanisms involved in the maintenance of homeostasis in relation to internal and environmental modifications.

Knowledge of the electrophysiological and functional mechanisms in single cells, tissues, organs and their interactions.

Knowledge of the mechanisms involved in autonomic nervous functions and endocrinology.

Knowledge of neurobiological and psychophysiological basis of sensory functions, motor behavior as well as emotional and cognitive interactions between the subject and the environment.

Knowledge of the experimental approach in neuroscience and transferability from bench to bedside.

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### DETAILED COURSE CONTENT

- The organism as an integrated system: omeostasis and regulatory mechanisms.
- Central nervous system: anatomical and functional organization. Cerebrospinal fluid: chemical and physical properties and its function. Blood-brain barrier.
- Cerebral cortex: structure and functional organization. Cortical areas. Intracortical, ascending and descending projections. Electrical activity of the cerebral cortex. Imaging systems.
- Diencephalic structures and their functions. Thalamus: nuclei and projections.
- Sleep and its stages. Electroencephalographic rhythms. Neural systems involved in sleep control and circadian rhythms. Hypotheses about the physiological role of sleep. Seizure activity of the cerebral cortex.
- Brainstem and spinal cord: lamination of grey matter and hodology of ascending and descending pathways. Cranial nerves and spinal nerves.

- Sensory systems: transduction of the stimulus. Receptors: classification, mechanisms of action, threshold, adaptation. Classification of nerve fibers.
- Somatic sensory system: skin, muscle and articular receptors. Pain. Receptive fields. Ascending pathways. Sensory cortex. Evoked potentials.
- The eye and vision: optical properties of the eye. The retina and the physiology of photoreceptors. Visual cortex. Stereopsis and binocular vision.
- Physiology of smell and taste.
- The ear: the cochlear receptors and transduction of sound stimuli. Auditory cortex.
- Vestibular system: structure and function. Response to linear and angular acceleration of the head.
- Motor control. Spinal reflexes: extension and stretch reflex; alpha-gamma loop; withdrawal reflexes. Central pattern generators and their control.
- Descending pathways: corticospinal, rubro-spinal, vestibulo-spinal, reticulo-spinal pathways. Spinal cord hemisection and its sensory and motor effects. Spinal shock.
- Muscle tone and posture regulation. Segmental and suprasegmental regulation of muscle tone. Decerebrate rigidity.
- Vestibular reflexes. Kinetosis. Ocular movements.
- Cerebellum: functional anatomy of archi-, paleo- and neo-cerebellum. Effects of cerebellectomy.
- Basal ganglia and their anatomical and functional organization.
- Motor cortex and overview of the voluntary movement regulation and control.
- Neurophysiology of behavior: generalities. Limbic system. Emotions and their functional roles. Anxiety and aggression. Motivation, reward and addiction. Drinking, eating and sexual behavior.
- Higher functions of the central nervous system: cortical association areas and integrative processes. Learning and memory. Conditioning. Brain lateralization and dominance. Perception. Language. Consciousness.
- Regulatory systems: hypothalamus, autonomic nervous system, endocrine system. Definition and hormone classification. Biosynthesis, secretion, transport, activation and inactivation of hormones. Mechanisms of action.
- Sympathetic and parasympathetic systems. Catecholamines and adrenal medulla.
- Neuroendocrine systems: hypothalamus and posterior hypophysis.
- Adenohypophysis and its hormones.
- Adrenal gland and response to the stress. Chemical properties and functions of steroid hormones.
- Prostaglandins, endorphins and endocannabinoids.
- Thyroid hormones and their functions. Physiopathology of the thyroid gland.

- Physiopathology of the endocrine pancreas and mechanisms of regulation of glucose levels.
- Calcium and phosphate metabolism; bone physiology. Hormonal control of the blood levels of calcium and phosphate ions.
- Physiology of human reproduction. Functions of female reproductive organs: ovarian, uterine and hormonal cycle. Contraception. Physiology of pregnancy and birth. Lactation and its neuroendocrine regulation. Functions of male reproductive organs: functional anatomy of seminal ducts and glands. Spermatogenesis. Hormonal regulation of male reproductive functions.

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## **TEXTBOOK INFORMATION**

1. Fisiologia Medica - by Fiorenzo Conti - Edi-Ermes, 2nd edition
  2. Fisiologia Medica - Guyton and Hall - Edra Masson - 13th o 12th italian edition
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