Study program: Integrated academic studies of Medicine

Course title: Physiology

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Course status: compulsory

ECTS Credits: 24

Condition: Anatomy

Course aim:

The aim of the physiology study is that the students gain knowledge about the functioning, the mutual integration and interactions of cells, tissues, organs, organic systems and human organism as a single unit, as well as the forms of their organization, regulation and mechanisms for maintaining homeostasis in the changing external and internal conditions.

Expected outcome of the course:

The acquired knowledge in physiology should provide students with a logical understanding of the fundamental mechanisms of physiological processes in the body, ways of maintaining homeostasis at the level of the cell membrane, cell, organ and organic system and maintaining health in the complex, but integrative human body. Students should understand the nervous and humoral regulatory mechanisms and the principles of functioning of the organism and organ systems in different states and under the influence of external and internal changes. Such knowledge should provide them a successful understanding of pathophysiological processes and prepare to work with different clinical subjects. Students should acquire basic knowledge of laboratory equipment and work in laboratory conditions, general principles and rules of the attitude towards the respondent or patient and to learn how to properly conduct basic examinations that give insight into the physiological state of the organism, which will enable them to participate safely in practical learning within professional within professional subjects and clinical practice.

Course description

Theoretical education

Introduction in physiology: Functional organization of human body and control of homeostasis. Cells as basic living units of human body, their functional parts and their function. Special importance and role of the cell membrane and their structures. Transport through biological membranes. Basics of the homeostatic mechanisms. **Respiration:** Respiratory pathways. Respiratory surface. Ventilation. Phonation and speech. Lung volumes and capacities. Physiological characteristics of pulmonary circulations. Transport of gases to the cells. Main and accessory respiratory musculature. Interpleural pressure. Regulation of respiration. Kinds and types of respiration. Respiration in the conditions of decreased and increased atmospheric pressure. **Blood:** General functions of blood. Blood plasma. Red blood cells. White blood cells. Immunity and immune bodies. Platelets. Coagulation and haemostasys. Blood types. Transfusion and transplantation. **Heart, circulation and lymph**: Functional characteristics of circulation. Morphofunctional characteristics of the heart muscle. Pericardium. Specialized excitable and conductive system of the heart. Spciphic bioelectrical events in the working and specialized heart muscle. Heart cycle. Heart sounds. Heart haemodinamics. Registration and analysis of ECG. Regulation of the heart. Polycardiography. Basic characteristics of the circulation. Blood vessels. Arteries. Capillaries and exchange of substances. Veins. Lymph system. Regulation of local blood flow. Regulation of blood pressure. Neurohumoral mechanisms of blood vessels diameter regulation. **Digestion** Basic functions of the digestive system. Basic movements in the digestive tract. Digestion in the mouth. Saliva, regulation of salivation. Vomiting. Digestion in the stomach. Digestion in the small intestine. Roles of the pancreas in digestion. Bile. Digestion in the large intestine. Resorption in different parts of digestive tract. Regulation of digestive juices excretion. Liver. Defecation. **Metabolism**: Role of nutrients. Minerals and vitamins. Methods of investigation of the metabolism. Respiratory quotient. Basal metabolism. Metabolism in physical activity. Design of the daily menu. **Thermoregulation**: Mechanisms of maintenance of the temperature balance of the body core. Physical and chemical thermoregulation. Physiological basis of hypo- and hyperthermia. **Excretion:** Physiological roles of the kidneys. Ultrastucture of the nephrons. Glomerular filtration, filtration membrane, pressures and autoregulation. Mechanism, level and changes of the tubular reabsorption and secretion. Tubulo-glomerular feedback. Role of kidneys in the homeostasis of the osmolality, volemia, ionia, blood pressure. Renal concentration power. Regulation of kidney function. Quantity and quality of the urine. Miction. **Excitable tissue:** Resting potential. Action potential. Laws of excitation. Local answer. Refractoriness. Action potential propagation. Accomodation. **Senses:** General features, division and basic function Senses. Receptors. Vision. Light refraction part of eye. Light receiving part of eye. Lenses and ophthalmoscopy. Hearing. Equilibrium. Muscle-joint perception. Tactile and termal perception. Visceroreception. Smell and taste. Pain and analgesic system. **Muscles:** Division of muscles in body. Morpho-functional characteristics of sceletal muscles. Neuro – muscular synapses. Conection between excitation and contraction. Sceletal muscle contraction. Different muscle

contractions. Types of muscle fibers. Motor unit. Muscle tone. Energetics of muscle contraction. Work, power and muscle fatique. Morpho-physiological characteristics of smooth muscle. **Autonomous nervous system:** Sympathetic and parasympathetic nervous system: structure, classification, of the vegetative ganglia and their function, specific mediators. Division of vegetative reflexes and the significance of dual organ inervation. Effects of the autonoumous nervous system in the inner organs functioning. **Endocrinology:** Basic characterstics of hormones and endocrine glands. Thyreoid gland. Parathyreoid gland. Pancreas. Suprarenal gland. Male and female gonades. Pituitary gland: hormones, function, and regulation of secretion. Hypothalamo-pituitary complex. Regulation of glucose homeostasis. Regulation of calcium homeostasis. Other organs with endocrine role: thymus, epyphiseal gland, spleen, heart and kidney. Tissue hormones. **Physiology of central nervous system:** Neuron. Neuron types and classifications. Synapses in CNS. Neuromediators, neuromodulators and neurotrophic factors. Neuroglia. Nervous center. Organization of nervous system. Inhibition in CNS. Spinal cord. Medulla oblongata and pons. Reflex function. Functional significance of conductive pathways in medulla oblongata. Mid brain. Reticular formation of brainstem. Thalamus Hypothalamus. Limbic structures of the brain. Cortex. Specific organization of cortex cerebri. Functions of left and right hemisphere of the brain and their connection. Basal ganglia. Cerebellum. Alertness and sleeping. Cognitive functions. Memory and learning. Brain circulation and metabolism.

Practical education

Excitable tissue (registration and analysis of single muscle contraction; registration and analysis of complex muscle contraction – tetanus; summation, influence of intensity of stimuli on the size of muscle contraction, maximal muscle contraction with different loads; ergography; dynamometrics; influence of temperature and fatigue on muscle contraction). **Breathing** (CO_2 content in inhaled end exhaled air; model of the ribs; puls oximetry; spirometry; spirography; forced spirometry,). **Blood** (plasma buffers, sedimentation, hematocrit, concentration of haemoglobin according to Sahli metod, hemolysis, red blood and white blood cell count; white blood cell formula; time of coagulation and bleeding). **Digestion** (digestion in the mouth; rodanindes in the saliva; qualitative and quantitative examination of the stomach acid). Metabolism (VO_2 max, Astrand test; OGT test; anthropometry; BMI; bioelectric impedance). **Heart and the circulation** (ECG; extrasystole; puls; measurement of the blood pressure; auscultation; polycardiography, capillaries). **Excretion** (general characteristics of the urine, chlorides in the urine; urine sediment; glucose, keton bodies and proteins in urine;). **Senses** (examination of the eyes, ears and hearing, balance, surface and deep sensibility). **Nervous system** (spinal reflexes of the decapitated frog; spinal shock; testing of the reflex arc; examination of the reflexes of clinical significance; EEG; EMNG, reaction time).

Literature

Compulsory

1. Guyton AC. Textbook of medical Physiology. Esevier, 2016.

Additional

1. Despopulos A, Silbernagl S. Color Atlas of Physiology. Thieme, 2009.
2. Bruce KM. Berne & Levy Physiology. Mosby Elsevier, 2010.
3. Costanzo LS. Physiology. Elsevier, 2014.

Number of active classes	**Theoretical classes:** 150	**Practical classes:** 120

Teaching methods: lectures; laboratory work.

Student activity assessment (maximally 100 points)

Pre-exam activities	**points**	**Final exam**	**points**
Lectures	15	Written	70
Practices	15	Oral	
Colloquium		.....	
Essay			