

**DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES  
AT VILNIUS UNIVERSITY**

<b>Scientific Area/eas, Field/ds of Science</b>	Medicine and Health Sciences (M 000): Public Health (M 004)			
<b>Faculty, Institute, Department/Clinic</b>	Faculty of Medicine Institute of Biomedical Sciences Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine			
<b>Course unit title</b> (ECTS credits, hours)	<b>The Central and Peripheral Nervous System Physiology</b> 5 credits (135 hours)			
<b>Study method</b>	<b>Lectures</b>	<b>Seminars</b>	<b>Consultations</b>	<b>Self-study</b>
Number of ECTS credits	-	-	1	4
<b>Method of the assessment</b> (in 10 point system)	<p><u>Presentation and evaluation of the report:</u> the report is presented on a target topic, which is coordinated with the coordinating lecturers (the doctoral student must analyze, review and present the latest scientific publications related to the respective topic).</p> <p><u>Criteria for evaluating the report</u> (minimum readable score - 5):</p> <p>(a) relevance, novelty and relevance of the material submitted (2 points);</p> <p>(b) general structure and scope of the report, clear presentation of the knowledge, reasoning, brevity and specificity (2 points);</p> <p>(c) Summary, presentation and justification of conclusions (1 point);</p> <p>d) raising problematic issues, presenting the application of the reviewed knowledge in the dissertation (3 points);</p> <p>e) organization of visual aids, ability to participate in a discussion, management of questions, oratory skills (2 points)</p>			
<b>PURPOSE OF THE COURSE UNIT</b>				
<p>To provide a deeper knowledge base for research and scientific, evidence-based medical practice, to analyze and systematize knowledge, skills and competences in more detail and depth approach to the functioning of the human peripheral and central nervous systems, their interrelationship and mechanisms that regulate various vital body functions, the role of nervous systems in adapting the body to changing conditions. PhD student will be able to systematize information about the functioning of human organs and systems, their mutual communication and functional regulation mechanisms, providing a basic basis for theoretical knowledge practical work activities and research work, emphasizing the influence of the acquired knowledge physical, mental and general health of the body.</p>				
<b>THE MAIN TOPICS OF COURSE UNIT</b>				
<p><u>Physiology of membranes.</u> Transport of substances through the cell membrane. Passive and active ion transport across the cell membrane. Primary and secondary active transport. Ion channels. Selective permeability of channels. Concept of excitable tissue. Resting membrane and action potentials. Variety in different cell. Depolarization, repolarization, hyperpolarization. Sodium-potassium pump.</p>				

Nervous pulse spreading laws and mechanisms. The mechanism of the movement of an action potential through the axon and its conduction. Mechanism of propagation of nerve impulse in myelinated and unmyelinated nerve fibers and their physiological role in transmitting different information. Parabiosis.

Physiology of synapses. Classification. Central and peripheral synapses. Chemical and electrical synapses. Neurotransmitters. Synaptic transmission in central and peripheral synapses. Neuromuscular junction – the motor end plate. Transmission of impulses from nerve endings to skeletal muscle fibers: the neuromuscular junction.

Structure and function of the skeletal and smooth muscles. The most important general muscle functions. Molecular mechanism of muscle contraction. Sliding filament mechanism of muscle contraction. Relaxation of the muscle. Types of muscle contraction: single twitch, summation, unfused and fused tetanus. Skeletal muscle tone. *Rigor mortis*. Mechanics of body movement. Energy metabolism in skeletal muscle at rest and physical activity. Types of smooth muscle. Features of smooth muscle functions, membrane and action potentials of the smooth muscle. Nervous and hormonal control of smooth muscle contraction. Mechanics of body movement. The concept of fatigue, causes, mechanisms and significance. Fatigue prevention.

Central nervous System. General functions of central nervous system. Central nervous system neuron: the basic functional unit, neuroglia. Neural reflexes. Reflexes (classification, reflex arc). Nervous center concept. Features of nerve centers. The principles of neural coordination. Inhibition processes in CNS.

The physiological functions of the spinal cord, medulla oblongata, pons, midbrain, cerebellum and diencephalon. Reticular formation. Cerebral cortex: sensory fields, motor areas, association areas. Basal nuclei. Limbic system. Instincts. Emotions. Motivations. Adaptation. Conditioned reflexes. Cerebral blood flow, cerebrospinal fluid, and brain metabolism.

Introduction to cerebral cortex and high nerve activity. Behavior. Neurophysiology of language. Learning and memory. Neurophysiology of sleep.

General principles of sensory systems. Types of sensory receptors and the sensory stimuli they detect. Adaptation of receptors. Mechanisms of receptor potentials. Somatic sensations: tactile (touch, pressure, and vibration) and position. Pain, headache, and thermal sensation. Vision, visual acuity accommodation, adaptation. Sense of hearing. The chemical senses – taste and smell.

The concept of autonomic nervous system, functional characteristics and function of sympathetic and parasympathetic nervous system: excitatory and inhibitory actions. Cholinergic and adrenergic fibers. Receptors on the effector organs. Characteristics of autonomic reflex loop. Autonomic reflexes and their significance in medicine.

## RECOMMENDED LITERATURE SOURCES

1. John E. Hall. Guyton and Hall Textbook of Medical Physiology, 13th Edition. Elsevier, 2022
2. Silbernagl S, Despopoulos A. Color Atlas of Physiology. Thieme, Stuttgart, 7<sup>th</sup> edition, 2017
3. Koeppen B.M., Stanton B.A. Berne & Levy Physiology, 7<sup>th</sup> edition, 2017
4. Prenumeruojamos duomenų bazės: Prenumeruojama duomenų bazė: <https://www.clinicalkey.com/#/>
5. Prenumeruojama duomenų bazė: <http://accessmedicine.mhmedical.com/>
6. Silverthorn D.U. Human Physiology, an Integrated Approach, 7<sup>th</sup> edition, 2015
7. Theodore Tulchinsky, Elena Varavikova, Joel Matan Cohen. The New Public Health, 4th Edition. 2022
8. Walter F.Boron, Emile L. Boulpaep. Medical Physiology. Saunders; Elsevier, 3<sup>th</sup> edition. 2017

9. Prenumeruojama duomenų bazė: <http://accessmedicine.mhmedical.com/>
10. Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen L. Brooks. Ganong's Review of Medical Physiology, 25e.:  
<http://accessmedicine.mhmedical.com/content.aspx?sectionid=97163015&bookid=1>  
[Resultclick=2](#)
11. Jonathan D. Kibble, PhD, Colby R. Halsey, MD. Medical Physiology: The Big Picture.  
<http://accessmedicine.mhmedical.com/content.aspx?bookid=1291&sectionid=75575>  
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### **CONSULTING LECTURERS**

1. Coordinating lecturer: Valerija Jablonskienė (Assoc. Prof. Dr.).
2. Jonas Algis Abaravičius (Prof. Dr. HP).
3. Dalia Paškevičienė (Assist. Prof. Dr.).

### **APPROVED:**

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University:  
29<sup>th</sup> of September 2022

Chairperson of the Board: Prof. Janina Tutkuvienė