

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

<b>Scientific Area/eas, Field/ds of Science</b>	Medical and Health Sciences (M 000): Medicine (M 001); Dentistry (M 002); Public Health (M 004) Natural Sciences (N 000): Biology (N 010)			
<b>Faculty, Institute, Department/Clinic</b>	Medical Faculty Institute of Biomedical Sciences Department of Anatomy, Histology and Anthropology			
<b>Course unit title</b> (ECTS credits, hours)	<b>Functional Neuroanatomy</b> 8 credits (216 hrs)			
<b>Study method</b>	<b>Lectures</b>	<b>Seminars</b>	<b>Consultations</b>	<b>Self-study</b>
Number of ECTS credits	-	-	1	7
<b>Method of the assessment</b> (in 10 point system)	<p>Presentation of the report: the report is presented on a chosen topic, which is coordinated with the coordinating lecturers. The doctoral student must analyze, review and present the newest scientific publications related to the relevant topic.</p> <p>Evaluation criteria:</p> <ul style="list-style-type: none"> <li>- novelty and relevance of the submitted material (2 points);</li> <li>- general structure and scope of the report, clear presentation of the knowledge, argumentation, conciseness and specificity (2 points);</li> <li>- summary, problematic issues, presentation and justification of conclusions (2 points);</li> <li>- presentation of the application of the reviewed knowledge in the dissertation (2 points);</li> <li>- organization of visual aids, ability to participate in discussion, control of questions, oratory skills (2 points).</li> </ul> <p>The minimal positive score is 5.</p>			
<b>PURPOSE OF THE COURSE UNIT</b>				
<p>The purpose of course is to present more detailed and profound anatomical knowledge about systemical and topographical anatomy of nervous systems (central and peripheral), its clinical anatomy, prenatal and postnatal development, variations, developmental anomalies, clinically important peculiarities of structure.</p>				
<b>THE MAIN TOPICS OF COURSE UNIT</b>				
<p><b>Nervous system: phylogenesis, ontogenesis and comparative anatomy.</b> Developmental anomalies of neural tube and adjacent structures, congenital defects of cerebral cortex, congenital defects of peripheral nervous system, neurocristopathies. Microscopical anatomy of central (CNS) and peripheral (PNS) nervous system. Morphology of nerve cells, their morphological and functional types, physiological properties, synapses. Neurotransmitters (neuromediators) in the CNS and PNS. Central and peripheral neuroglia, its oembrionic origin, classification, structure and functions. Neural endings, their structure and classification. Microscopical structure of cerebral and cerebellar cortex, interneuronal connections. Structure of peripheral nerves and ganglia. Clinical histology of CNS and PNS. Macroscopical anatomy of central (CNS) and peripheral (PNS) nervous system.</p> <p><b>Central nervous system.</b> <b>Spinal cord:</b> external and internal structure, topography, age related anatomy. Functional groups of nerve cells in the gray matter of spinal cord (somatic,</p>				

visceral, afferent, efferent, associative, commissural), subdivision into laminae and nuclei. Segments of spinal cord and structure of roots. Formation of spinal nerves. White matter of spinal nerves: ascending and descending pathways, their functional relations, intersegmentary connections. Spinal reflexes. Clinical anatomy of spinal cord. Paraplegia and quadriplegia.

### **Brain.**

Rhombencephalon (medulla, pons, cerebellum): external and internal structure. Gross anatomy of cerebellum, functional regions, internal structure, pathways, functional connections. Phylogenetic subdivision of cerebellum. Importance of cerebellum for motor systems.

Midbrain (mesencephalon): external and internal structure. Tectum: structure, connections and functions. Gray matter of the brainstem. Diencephalon: thalamus, epithalamus, hypothalamus. Structure and functions of epithalamus. Thalamic nuclei and their functions. Functional connections of diencephalon. Structure of hypothalamus and its importance for regulation of homeostasis.

Endbrain: surfaces, sulci and gyri. Cerebral cortex: layers, neurons and their connections, columnar organization and neuronal modules. Phylogenetic subdivision of cerebral cortex. Projectional, associative and motivational cortex. Brodman's map of human brain cortex, functional anatomy of main functional fields. Basal nuclei of the brain: topography and functional connections. Striate body, its functions. Complex of amygdaloid nuclei. White matter of the endbrain: associative, commissural and projectional fibers. Pyramidal pathways.

Somatosensory pathways. Proprioceptive pathways. Pathways of special senses – visual and hearing. Olfactory brain. Integrative structures of the nervous system, their functional relations and clinical anatomy: reticular formation, limbic system., extrapyramidal system. Structure of reticular formation and its importance in regulation activity of CNS., functional anatomy of monoaminergic systems of brain (dopaminergic, noradrenergic and serotonergic systems).

Neuroanatomical model of language, motor and sensory cortical centers of language.

### **Clinical anatomy of CNS.**

**Cerebrospinal liquor** (CSF) circulation: choroid plexuses, ventricular system.

**Meninges** of brain and spinal cord. Anatomical structures of dura mater. Blood supply of the brain, haematoencephalic barrier.

### **Peripheral nervous system.**

Gross anatomy of peripheral nervous system, variations, development and defects of development. Spinal nerves and plexuses. Cervical plexus: structure and topographical relations. Brachial plexus: structure and topographical relations. Branches of supraclavicular and infraclavicular parts of brachial plexus. Intercostal nerves. Structure and topographical relations of lumbar and sacral plexuses.

Coccygeal plexus. Clinical anatomy of nervous plexuses: anatomical points for lumbar puncture, nerve blocks, clinically important topographical relations in the PNS. Structure and topographical relations of cranial nerves. Clinical anatomy of cranial nerves. Clinically important peculiarities of cranial nerves and adjacent structures. Visceral nervous system: sympathetic, parasympathetic and enteric nervous systems. Functional and clinical anatomy of visceral nervous system.

Efferent and afferent visceral nervous system. Parasympathetic and sympathetic efferent pathways, ganglia and nerves. Structure of sympathetic trunk. Peripheral visceral system of the head and neck. Visceral system of lumbar region.

Neuroendocrine system. Chromaffin system. Diffuse neuroendocrine system (DES, APUD).

### **RECOMMENDED LITERATURE SOURCES**

1. Gray's Anatomy. The anatomical basis of medicine. 42nd edition. Edited by P.L. Williams et al. - Churchill Livingstone, Elsevier, 2020.

2. Todd Vanderah, Douglas Gould. Nolte's The Human Brain. An Introduction to its Functional Anatomy. Elsevier, 2020
3. Haines E. Neuroanatomy: an atlas of structures, sections, and systems. Lippincott Williams & Wilkins, 2012.
4. Moore K.L., Dalley A.F., Agur M.R. Clinically Oriented Anatomy (8th Ed.). Lippincott Williams and Wilkins, 2017.
5. Kandel E, Schwartz J, Jessell T. Principles of Neural Science. 5th ed. McGraw-Hill; 2013.
6. Lee, Thomas C; Mukundan, Srinivasan; Netter, Frank H (Frank Henry). Netter's correlative imaging. Neuroanatomy. Elsevier/Saunders, 2015.
7. Crossman A.R., Neary D. Neuroanatomy. 5th edition. An illustrated colour text. Saunders, 2015.
8. Schünke M., Schulte E.; Schumacher U.; MacPherson, B.; Stefan C. Thieme atlas of anatomy. Volume 3, Head, neck, and neuroanatomy; 2nd edition. Thieme, 2016.
9. Mtui E., Gruener G., Dockery P., Fitzgerald, M J T. Fitzgerald's clinical neuroanatomy and neuroscience. Seventh edition. Elsevier, 2016.
10. Patestas M.A., Gartner L.P. A textbook of neuroanatomy. 2nd edition, New Jersey : John Wiley & Sons Inc., 2016.
11. Noback CR et al. The Human Nervous System – Structure and function. 7th ed. Humana Press, 2012.
12. Snell's Clinical Neuroanatomy 8th Edition. Lippincott Williams and Wilkins, 2018
13. Lange Clinical Neurology and Neuroanatomy: A Localization-Based Approach (1st Ed.), McGraw Hill, 2016
14. Estomih Mtui, Gregory Gruener, Peter Dockery. Fitzgerald's Clinical Neuroanatomy and Neuroscience. 8th Edition, Elsevier, 2020
15. Paxinos G., Mai JK. The Human Nervous System. Elsevier Academic Press, 3rd edition, 2011.

#### **CONSULTING LECTURERS**

1. Coordinating lecturer: Arūnas Barkus (Assoc. Prof. Dr.).
2. Janina Tutkuvienė (Prof. Dr. HP).
3. Renata Šimkūnaitė-Rizgeliienė (Prof. Dr.).
4. Dalius Jatužis (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