

FUNDAMENTALS OF NEUROSCIENCE	
GENERAL INFORMATION	
Course coordinator	Professor Marija Heffer, MD, PhD
Assistant/Associate	Associate Professor Antonio Kokot, MD, PhD Assistant Professor Nikola Bijelić, PhD Marta Balog, PhD Zvonimir Popović, MD Edi Rođak, MBiol
Study Programme	Integrated undergraduate and graduate university study of Medicine
Status of the course	Mandatory
Year of study, semester	2nd year, 3rd semester
ECTS	8
Workload (hours)	Lectures (20); Seminars (46); Exercises (24)
Expected number of students	70
COURSE DESCRIPTION	
Course objectives	
Introduce students to the structure and function of the central and peripheral nervous system, developmental processes and molecular mechanisms underlying the physiological and pathophysiological processes involved in the development, maturation, maintenance and aging of the human brain and cognitive processes and emotional experience of the world as a prerequisite for understanding neuropsychiatric diseases, but also the normal cognitive, emotional, linguistic and social development of the child.	
Enrolment requirements and entry competencies	
Adopted learning outcomes from the learning sets of the 1st year of study	
Learning outcomes at the Programme level	
1.1, 2.1, 2.2, 2.3, 3.4, 3.5, 4.2	
Learning outcomes (5-10)	
<p>After listening to lectures, seminars and exercises, independent learning and passing exams, students will be able to:</p> <ol style="list-style-type: none"> 1. Identify and describe the basic parts of the entire nervous system, explain their interconnections, and describe the structure, connections, and functions of the main types of nerve and support cells in the central, peripheral, autonomic, and enteric nervous systems; 2. Describe and explain the cellular, laminar, columnar and areal cortical structures as well as the main neural networks of the human cerebral cortex and predict the consequences of hereditary organizational disorders, or acquired injuries; 3. Describe the most important ontogenetic and phylogenetic (especially fetal and perinatal) stages of development of the central and peripheral nervous system, assess the consequences of disorders of major developmental mechanisms and metabolic disorders, and interpret the mechanisms of degeneration and regeneration of the central and peripheral nervous system; 4. Describe the structure of special (visual, auditory, vestibular, olfactory, gustatory, olfactory) and general somatic (pain and temperature sensations, touch, proprioception and vibration) sensory systems, major cortical and subcortical motor systems, autonomic, endocrine, and limbic systems of the human brain and discuss their interactions; 5. Understand and analyze clinical-pathological correlations between injuries/dysfunctions in 	

the nervous system, as well as the neurological symptoms and signs that arise from these maladies. Based on clinical symptoms and signs, students must be able to differentiate and diagnose parts of the central and peripheral nervous system that are malfunctioning.

6. Connect the structure and function of ion channels and pumps with resting membrane potential and action potential formation. In addition, explain the role of endogenous and exogenous ligands and their binding to the corresponding receptors with the action of secondary messengers, as well as the activation of downstream signaling pathways involved in normal and pathological synaptic signaling mechanisms, as well as the occurrence of short-term and long-term synaptic plasticity, in the context of addiction;

7. Analyze the differences between innate (instinctive) and learned behavioral repertoire and main epicenters, structural and functional connections, role and disorders of major neural networks of the cerebral cortex, as well as subcortical structures, which mediate alertness and awareness, spatial attention skills, object and face recognition, short-term memory transformation in long-term memory, symbolic/linguistic abilities of language comprehension and speech production, declarative and non-declarative memory, emotional regulation, planning of actions with regard to time and space, executive abilities, social interactions, and thinking about one's own and other people's mental states;

8. Recognize and evaluate physiological (wakefulness, sleep) and pathological changes in the state of consciousness;

9. To connect the vascular territories of blood vessels of the brain with the consequences of ischemic and hemorrhagic vascular incidents, and to argue the role of cerebrospinal fluid and the occurrence of elevated intracranial pressure of the brain;

10. Correctly select and evaluate different methods of imaging the structures and activities of the human brain with regard to the physiological or pathophysiological condition that is clinically desired to be monitored.

Course content

Lectures

Basic division and morphology of the central nervous system. Modern techniques of nervous system imaging methods. Brain development. Electrical properties of neurons and the action potential. Voltage-dependent membrane permeability. Ionic channels, ion-pumps and carriers. Addictions. Brain metabolism. General structure of motor systems. Central and peripheral nervous system potential for regeneration. The role and defects of the associative cerebral cortex. Sleep and wakefulness - states of consciousness.

Seminars

Synaptic transmission. Neurotransmitter systems. Short-term and long-term neuroplasticity. General sensory systems - pain, touch and proprioception. Anatomy of the eye and retina. Visual pathway, organization of visual cortex and extrastriatal cortical fields. Eye movements and sensory-motor integration. Ear anatomy, auditory pathway and integration of information from both ears. Vestibular system. Chemical senses. Lower and upper motoneuron and motor loops. Autonomic nervous system. Hypothalamus and pituitary gland. Constructions of neural networks. Experience-induced modifications of neural circuits and critical developmental periods. Neurophysiological basis of sexuality. Speech and language development. Memory and amnesia. Emotions and social interactions.

Exercises

Histological structure of the nervous system. Structure and function of the spinal cord and brainstem. Diencephalon. Telencephalon. Basal ganglia - structure, function and pathophysiology. Cerebellum. Limbic system. Vascular circulation and cerebrospinal fluid spaces.

Mode of teaching
Lectures; Seminars; Exercises
Student obligations
Attendance at all forms of classes is mandatory, and the student must access all knowledge tests. A student may justifiably miss 30% of each form of instruction. Unfinished exercise must be colloquial.
Monitoring student work (<i>alignment of learning outcomes, teaching methods and grading</i>)

Teaching activity	ECTS	Learning outcome	Student activity	Assessment methods	Grade points	
					Min.	Max.
Class attendance	0.5	1-10	Presence in class, solving tasks related to additional written and video materials	Record	3	6
Attending exercises	0.5	1-5	Attendance and active participation in exercises, preparation for the practical part of the exam	Exercise diary	3	6
Knowledge testing in seminars	1	1-7	Mastering the materials for the written and oral part of the exam	Moodle knowledge tests	6	12
Test of practical knowledge	1	1-5	Learning to recognize structures on anatomical specimens	Structure recognition exam in front of a teaching associate	6	12
Written exam	2.5	1-10	Learning for the written exam	Written exam	16	32
Oral exam	2,5	1-8	Learning for the oral exam	Oral exam	16	32
Total	8				50	100

Calculation of final grade:

Grades obtained during the oral exam are added to the points earned during the course. The evaluation is performed by absolute distribution, i.e. on the basis of the final achievement and is

compared with the numerical system as follows:
 A - excellent (5): 80-100 points; B - very good (4): 70-79.99 points; C - good (3): 60-69.99 points; D - sufficient (2): 50-59.99 points

Required reading (available in the library and through other media)

Title	Number of copies in the library	Availability through other media
1. Purves D, Augustine GJ, Fitzpatrick D, Hall WC, LaMantia AS, White LE. Neuroscience, 6th ED., October 2017.	5	

Additional reading

Kaplan. Neuroscience – part III, USMLE

Course evaluation procedures

Anonymous, quantitative, standardized student survey on the subject and work of teachers conducted by the Office for Quality of the Medical Faculty Osijek.

Note /Other

E-learning is not included in the norm of subject hours, but it is used in teaching and contains links to various pages, video and audio materials available on the website.