UNIVERSITY OF NOVI SAD
FACULTY OF MEDICINE

Study program: Doctoral Academic Studies in Biomedical Sciences

Name of the subject: ORGANIZATION, CELLULAR COMPONENTS, MORPHOLOGY AND FUNCTIONS OF THE CENTRAL NERVOUS SYSTEM

Teacher(s): Oto F. Barak, Siniša S. Babović, Dušica L. Marić, Biljana Đ. Srdić Galić, Mirela M. Erić, Bojana S. Krstonošić, Nikola M. Vučinić, Ivan Đ.Čapo

Status of the subject: compulsory

Number of ЕСПБ points: 20

Condition: -

Goal of the subject

The aim of the course is to get students acquainted with the organization, cellular components, morphology and functions of the central nervous system at a higher level, and to show them current aspirations in the field of neurobiological research. Within this course, the development, complete anatomy and physiology of the central nervous system with elements of structural, functional and advanced neuroimaging will be presented. It will also present new, state-of-the-art methods and current issues in neuroscience, as well as some pathological conditions where modern approaches expand knowledge beyond the framework of classical diagnostics.

Outcome of the subject

This course would enable students to acquire knowledge and experience in the field of basic neuroscience that are necessary for independent research. Students would get acquainted with the latest scientific knowledge in the field of neuroanatomy, neurophysiology and neuroimaging, as well as with modern techniques used in research. With mentoring, students would be trained to recognize and solve a scientific problem, introduce new techniques and approaches. Through lectures and practical work, students would learn to follow and analyze contemporary scientific literature, develop and conduct original research and present the results of their work at scientific and professional conferences, as well as in scientific journals.

Content of the subject

Theoretical lectures

1. Organization of the motor system
2. Sensory substitution system
3. Cognitive systems
4. Brain neuroplasticity
5. Autonomic nervous system
    - Autonimic control of heart rate and blood pressure
    - Non-invasive assessment of autonomic regulation of heart rate - Heart rate variability (HRV)
    - Baroreflex sensitivity
    - Autonomic dysfunction (especially in chronic heart failure, stroke, diabetes, tetraplegia)
    - Parasympathetic reactivation after exercise
6. Cerebral circulation and cerebrovascular biology
    - Neurovascular unit (NVU)
    - Blood-brain barrier (BBB)
    - Changes in NVU and BBB in chronic inflammation
    - Regulation of cerebral blood flow
    - Cerebral vasoreactivity
    - Autoregulation of cerebral blood flow
    - Vegetative regulation of cerebral blood vessels
    - Neurovascular coupling (NVC)
7. Glymphatic system
8. Methods of visualization of the nervous system
    - Structural neuroimaging
    - Functional neuroimaging
    - Advanced neuroimaging

Practical lectures

1. From tissues to neurons - histological techniques of neuron impregnation

2. Application of neurohistological research methods: review of neurons and neural pathways of fetal brain and adult human brain
3. Development of a test plan for laboratory animals
4. Heart rate variability (HRV)
5. Baroreflex sensitivity
6. Parasympathetic reactivation after exercise
7. Ultrasound of the internal carotid artery
8. Ultrasound of the vertebral artery
9. Transcranial Doppler of the anterior, middle and posterior cerebral arteries
10. Cerebral vasoreactivity to hypoxia
11. Autoregulation of cerebral blood flow
12. Neurovascular pairing

Recommended literature

Compulsory

1. Michael-Titus A, Reverst P, Shortland P. The Nervous System Basic Science and Clinical Conditions, 2nd edition, Churchill Livingstone Elsevier, London, 2010
2. Mtui E, Gruener G, Dockery P. Fitzgerald's Clinical Neuroanatomy and Neuroscience, 7th edition Elsevier, Philadelphia, USA, 2016
3. Felten DL, O'Banion MK, Summo Maida M. Netter's Atlas of Neuroscience, 3rd edition, Elsevier, Philadelphia, USA, 2016
4. Hendelman JW. Atlas of functional neuroanatomy. 2nd Ed. Taylor & Francis Group. Boca Raton London New York 2006.
5. Scarabino T, Salvolini U. Atlas of morphology and functional anatomy of the brain. Springer Berlin Heidelberg 2006.
6. Matsumoto A. Sexual differentiation of the brain. CRC Press LCC 2000.
7. Monkhouse S. Cranial nerves functional anatomy. Cambridge Uneversity Press 2006.
8. Cipolla MJ. The Cerebral Circulation, 2nd edition, Morgan and Claypool Life Sciences, Mississippi, USA, 2016.
9. Willie CK, Tzeng YC, Fisher JA, Ainslie PN. Integrative regulation of human brain blood flow. J Physiol. 2014;592(5):841-859.
10. Bailey DM. The brain in hypoxia; curiosity, cause and consequence. Exp Physiol. 2016;101(9):1157-1159.
11. Nešić M. Neuronauke, Medicinski fakultet, Niš, 2013.

Supplementary

the student will be presented with literature for each methodical unit of theoretical lessons

Number of active classes	**Theory:** 60	**Practice:** 45

Methods of delivering lectures

Lectures, workshops, seminars

Evaluation of knowledge (maximum number of points 100)

activity during lectures: 20
labwork: 20
seminars: 20
written exam: 40