Doctoral Program in Neuroscience

Compulsory subjects

Program Director: *Prof. Dr. Gábor Jancsó, full professor, professor emeritus*

Neurophysiology I (Lead instructor: Dr. Péter Sántha; Institute of Anatomy, Histology, and Embryology; 28 hours/6 credits, semester 1)

Neurophysiology II (Lead instructor: Dr. Péter Sántha, Institute of Anatomy, Histology, and Embryology; 28 hours/6 credits, semester 2)

Neuroanatomy (Lead instructor: Prof. Dr. Antal Nógrádi, Institute of Anatomy, Histology, and Embryology; 28 hour/6 credits, semester 1 or 3)

Course description

Informing students on course requirements

Program: PhD full-time training, mandatory subject
Course: **Neurophysiology 1**
Course Code: **EODI-NEUSC-01**
Academic year/Semester: 2025/26 – 1. semester
Educator and contact details (e-mail): Peter Sántha santha.peter@med.u-szeged.hu
Type of course: lecture/seminar/practice/laboratory
Weekly hours of the course: 2 hours
Credit vale of the course: 6
Type of examination: **final exam at the end of semester**, practice exam, other:
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course):
Purpose of course: The Neurophysiology 1st course is a mandatory course for postgraduate (PhD) students, which deals with the main theoretical (and in part practical research and medical/clinical) concepts of Neurophysiology.

Outcome requirements of the course (specific academic results to be established by the course): see below

Topics:

1. Membrane physiology - basics of the cellular neurophysiology

Transmembrane transport processes, functions of the ion pumps and channels, resting membrane potential, electrotonic (graded) membrane potentials, action potential, propagation of the AP

2. Synaptic transmission

Structure of the chemical and electrical synapses, neurotransmitters, molecular mechanism of the release and actions of neurotransmitters, synthesis and inactivation of the neurotransmitters, ionic mechanisms of the post synaptic potentials/currents, pre- and postsynaptic facilitation and inhibition, modulation of the synaptic strength, synaptic plasticity

3. Cellular aspects of the sensory transduction process

Classification of sensory receptor cells, molecular mechanisms of the sensory transduction, generator (sensory) potential, encoding of the sensory signal, receptive field, spatial and temporal resolution, functional morphology of the primary sensory neuron

4. Peripheral organisation of the autonomic nervous system (ANS)

Divisions of the ANS, organisation of the spinal cord segment, autonomic afferents and efferents, principal neurotransmitters in the ANS, origin of the autonomic tone, basic principles of the autonomic reflexes, main actions of the ANS on body functions, pharmacological and non-pharmacological manipulation of the autonomic functions

5. Neuromuscular transmission

Functional morphology of the neuromuscular junction (motor end plate), functional properties of motoneurons, biochemistry and pharmacology of the cholinergic transmission, end plate potential, excitation-contraction coupling, regulation of the muscle contraction and force generation

We would like to draw the attention of students to the fact that the given textbook (Purves et al. Neuroscience) is the source textbook for Medical Neuroscience (Instructor L.E.White, Duke University, USA) on-line course, which is available for free on the Coursera platform with a subscription from SZTE. We warmly recommend this online course to interested students! More information:

https://www.coursera.org/learn/medical-neuroscience The extracts of the lectures and seminars are shared in the Coospace scene “documents” library.
Supporting methods to achieve learning outcomes: Teaching methods: Besides giving theoretical background, we give practical examples based on medical, biological research papers to show the application of the methods in practice. During some lectures, students actually present will get homework on the lectures to get bonus points on the final.
Evaluation of the acquisition of expected learning outcomes: **Requirements:** **Examination requirements** At the end of the semester, students take an oral exam by presenting an independent 2-3-page paper (essay) on a previously agreed topic from the field of cellular neurophysiology. The examination committee recognizes the completion of the course with a grade of 5 based on the paper and the discussion.
Mandatory reading list: Purves et al.: Neuroscience 2nd ed. (or later) (https://www.ncbi.nlm.nih.gov/books/NBK10799/?term=Pruves)
Recommended reading list: Kandel, Schwartz, Jessel: Principles of Neural Science

Course description

Informing students on course requirements

Program**: PhD full-time training, mandatory subjects**
Course: **Neurophysiology 2**
Course code: **EODI-NEUSC-02**
Academic year/Semester: 2025/26 – 2. semester
Educator and contact details (e-mail): santha.peter@med.u-szeged.hu

Type of course: lecture/seminar/practice/laboratory
Weekly hours of the course: 2 hours
Credit vale of the course: 6
Type of examination: **final exam at the end of semester**, practice exam, other:……..
Preliminary requirements (preliminary academic performance or completed course required to fulfill the purposes and requirements of the course): none
Purpose of course: The Neurophysiology 2nd course is a mandatory course for postgraduate (PhD) students, which deals with the main theoretical (and in part practical research and medical/clinical) concepts of Neurophysiology.
Outcome requirements of the course (specific academic results to be established by the course): see below
Topics: see below
Supporting methods to achieve learning outcomes: Teaching methods: Besides giving theoretical background, we give practical examples based on medical, biological research papers to show the application of the methods in practice.
Evaluation of the acquisition of expected learning outcomes: **Requirements:** **Examination requirements** At the end of the semester, students take an oral exam by presenting an independent 2-3-page paper (essay) on a previously agreed topic from the field of system neurophysiology. The examination committee recognizes the completion of the course with a grade of 5 based on the paper and the discussion.
Mandatory reading list: Purves et al.: Neuroscience 2nd ed. (or later) (https://www.ncbi.nlm.nih.gov/books/NBK10799/?term=Pruves)
Recommended reading list: Kandel, Schwartz, Jessel: Principles of Neural Science

Course description

Informing students on course requirements

Program	PhD full-time training, obligatory course
Subject area:	Neuroscience
Course name:	**Neuroanatomy**
Course code:	EODI-NEUSC-03
Name of department:	University of Szeged, Department of Anatomy, Histology and Embriology
Coordinator:	Prof. Antal Nogradi
Course requirement:	none
Course announcement (Fall or Spring semester)	2025/26 – 1st semester
Suggested course registration:	1st semester or 3d semester
Number of classes weekly:	2
Total number of classes:	28
Credits:	6
Evaluation:	five-scale report
Maximal number of course registrations:	1
Course announcing department:	Department of Anatomy, Histology and Embriology
Type of course:	theoratical
Type of exam:	oral
Lecturers of the course:	Prof. Dr. Antal Nógrádi, Prof. Dr. András Mihály, Dr. Krisztián Payer nogradi.antal@med.u-szeged.hu mihaly.andras@med.u-szeged.hu payer.krisztian@med.u-szeged.hu
Topics of the course:	Concepts regarding the structure and function of the nervous system: historical overview Methods of examining the nervous system: clinical and pathological observations, experimental approaches, neuroanatomical and neurobiological examination methods The development of the central and peripheral nervous systems The organization of the nervous system, macroscopic anatomy of the central nervous system (parts of the CNS, structure of the meninges, formation, circulation, and absorption of cerebrospinal fluid, cerebral blood supply) Microscopic structure of the nervous system. Parts of neurons, structure under light and electron microscopy. The neuron as a unit, the theories of continuitas and contiguitas. The role and morphology of glial cells.

	Degeneration and regeneration in the nervous system, the concept of nervous system plasticity. Types of nervous system injuries, possibilities for nervous system reconstruction, tissue transplantation. Macroscopic anatomy of the spinal cord, spinal cord membranes (concept and significance of dura mater and epidural space), structure of spinal segments, concept of segments and dermatomes. Cytoarchitecture of the spinal cord, Rexed's layers, spinal cord cell types, structure of spinal reflexes Diencephalon, thalamus, thalamic nuclei and their connections Cerebrum, structure of the cerebral cortex, connections of the cerebral cortex Cerebellum, structure of the cerebellar cortex, afferent and efferent pathways of the cerebellum The organization of the motor system, pyramidal tract The somatosensory system, protopathic and epicritical modality pathways, plasticity in the sensory system Hypothalamus, hypothalamic-pituitary system, neurosecretion
Required reading:	Szentágothai-Réthelyi: Functional Anatomy, Volume III