

BASIC NEUROSCIENCE
2° YEAR STUDENTS
UNIVERSITY OF SPLIT SCHOOL OF MEDICINE

All data are valid for the academic year 2025/2026

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→ Neuroscience is one of the basic medical sciences studying morphology and function of a healthy nervous system, with an emphasis on the mechanisms responsible for achieving its role as a central organism control and management system. This course will introduce students to and enable them to approach problems in this area using scientific methods. The aim of the Basic neuroscience course is to teach a student how to use the acquired knowledge on physics, chemistry, biochemistry, biology, anatomy, histology and physiology in acquiring knowledge on the normal function of the nervous system to the extent necessary for further successful studying.

- ☐ The Basic neuroscience course lectures are held in the second year of study, with a total duration of 103 hours.
- ☐ Neuroscience is tested in the form of written exam that consists of 100 multiple answer questions with only one answer being correct. Each correct answer carries one point.
- ☐ Topics to be covered through lectures, seminars and practical lessons, including an indication of the prescribed literature, will be announced on the beginning of the course. Attendance of all forms of instruction is MANDATORY (except the attendance of individual consultations), and all students are obligated to study the prescribed material IN ADVANCE for seminars and practical lessons, using the main textbook and/or the additional literature.

→ The course Basic neuroscience is consisted of:

•LECTURES • SEMINARS • PRACTICALS

CURRICULUM - The course content is divided into five units:

A Neuroanatomy

LECTURES

CNS research methods. Development of the CNS.
Peripheral nervous system and the spinal cord
Diencephalon and telencephalon

SEMINARS

The structure of gray and white matter of the spinal cord, brainstem and cerebellum, diencephalon and telencephalon
Neuroanatomy, summary

PRACTICAL WORK

Review of the CNS structures
Appearance and distribution of gray and white matter of the spinal cord and brainstem
Clinical-anatomic syndromes of the spinal cord

B Basics of neuron electrophysiology

LECTURES

Neuron is a basic structural-functional unit of CNS
The biophysical basics of excitability
Neurotransmitters in health and disease
Serotonin

SEMINARS

The cell membrane, ion channels, passive and active neuron properties
Structure and function of the synapse and the cellular basis of behavior (neuron sequences, pathways, circles, networks, systems)
Neurotransmitters, neuropeptides and their receptors
Electrophysiology of neurons, summary

PRACTICAL WORK

Resting, action, and synaptic potentials
Signalization

C Sensory system

LECTURES

General organization of the sensory systems. Taste and smell
Physiology of the eye and phototransduction

SEMINARS

Pain, heat and cold – anterolateral sensory system. Touch, pressure, and kinesthesia - the dorsal column system
Ear - organ of hearing and balance. Auditory and vestibular system
Organization of the retina, primary visual pathway and primary visual cortex
Perception of colours, shapes, depth and movement; and the organization of the associative visual fields
Sensory system, summary

PRACTICAL WORK

Physiology of sensation

D Motor system

LECTURES

General structure of the motor systems

SEMINARS

Role of motor cortex in voluntary movements. Eye movement and eye gaze direction system

Spinal motor mechanisms and reflexes

Role of the descending pathways from the brainstem in maintaining posture and muscle tone; spinal shock

Motor functions of the cerebellum and the basal ganglia

Motor system, summary

PRACTICAL WORK

Muscle and electromyography

E General brain functions

LECTURES

General brain function and sleep

Control of breathing during wakefulness and during sleep

Brain lateralization

Basic research and clinical importance

SEMINARS

Neuroanatomy and psychology of speech and language

General brain functions; EEG, evoked potentials

Stages of wakefulness and alertness; sleep

Organization and structure functions of the limbic system

Neurobiology of emotion and sexuality

Neurobiology of attention and associative functions of the prefrontal and posterior parietal cortex

Anatomy and psychology of learning and memory

Cellular mechanisms of learning and memory

General brain function, summary

Clinical seminar

PRACTICAL WORK

TMS

EEG and evoked potential

Polysomnography

Polysomnography report

Reflexes and reaction time

Animal neurophysiological research *in vivo*

• LECTURES:

Lecture program for the academic year 2025/2026

<i>Lecture</i>	<i>Topic</i>	<i>Hours</i>
P-1	Introductory lecture	1
P-2	Neuron is a basic structural-functional unit of the CNS	2
P-3	Development of the CNS and processes of development reorganization and plasticity	1
P-4	Biophysical basics of excitability	2
P-5	Neurotransmitters in health and disease	2
P-6	Serotonin	2
P-7	General organization of the sensory systems (Ch 15, 18). Taste and smell	2
P-8	Physiology of the eye and phototransduction	1
P-9	General structure of the motor systems	1
P-10	Motor cortex and voluntary movements	1
P-11	Brain lateralization	1
P-12	Control of breathing during wakefulness and during sleep. Sleep medicine	2
P-13	General brain function	2
TOTAL:		20 hours

Seminar program for the academic year 2025/2026

<i>Seminar</i>	<i>Subject</i>	<i>Hours</i>
S1	The structure of gray and white matter of the spinal cord (Ch 8)	(2 hours)
S2	The structure of gray and white matter of the brainstem and cerebellum (Ch 9, 10, 11, 13)	(2 hours)
S3	The structure of gray and white matter of the diencephalon (Ch 12)	(2 hours)
S4	Telencephalon (Ch 12, 24)	(2 hours)
S5	Neuroanatomy, summary	(2 hours)
S6	Cell membrane, ion channels, passive and active neuron properties (Ch 5)	(2 hours)
S7	Structure and function of the synapse and the cellular basis of behavior (neuron sequences, pathways, circles, networks, systems) (Ch 6)	(2 hours)
S8	Neurotransmitters, neuropeptides and their receptor (Ch 7)	(2 hours)
S9	Electrophysiology of neurons, summary (Ch 5-7)	(2 hours)
S10	Pain, heat and cold – anterolateral sensory system Touch, pressure, and kinesthesia - the dorsal column system (Ch 14)	(2 hours)
S11	Ear - organ of hearing and balance. Auditory and vestibular system (Ch 16)	(2 hours)
S12	Organization of the retina, primary visual pathway and primary visual cortex (Ch 15)	(2 hours)
S13	Eye movement and the organization of associative visual fields	(2 hours)
S14	Sensory system, summary	(2 hours)
S15	Spinal motor mechanisms and reflexes (Ch 8) (2 hours)	
S16	Spinal motor mechanisms and reflexes (Ch 8) .	
	Role of the descending pathways from the brainstem in maintaining posture and muscle tone; spinal shock (Ch 8, 9, 16:p329, 18:p364-5, 25:p525-7)	(2 hours)
S16	Motor functions of the cerebellum and the basal ganglia (Ch 19, 20)	(2 hours)
S17	Organization and structure functions of the limbic system (Ch 24)	(2 hours)
S18	Motor system, Summary	(2 hours)
S19	Neurobiology of emotion and sexuality	(2 hours)
S20	Anatomy and psychology of learning and memory)	(2 hours)
S21	Hypothalamus; autonomic and endocrine control	(2 hours)

S22	Clinical seminar	(2 hours)
S23	General brain functions; EEG, evoked potentials	(3 hours)
S24	Stages of wakefulness and alertness; sleep	(3 hours)
S25	Neurobiology of attention and associative functions of the prefrontal and posterior parietal cortex	(3 hours)
S26	Cellular mechanisms of learning and memory	(3 hours)

TOTAL:

56 hours

The prescribed material must be studied in advance.

The materials are chapters of the textbook by

- Allan Siegel and Hreday N. Sapru: Essential Neuroscience, 4th Edition.

The text for exercise is an Interactive Tutorial by John Huguenard and David A. McCormick:

Electrophysiology of the Neuron, Windows Version

All absences and minuses have to be compensated through a colloquium at least 2 days before the exam.

Students not taking the exam in the first examination period, to compensate their absences and minuses, have to take a colloquium in a 10 days period after the end of the Basic neuroscience course.

• PRACTICAL LESSONS:

Program of the practical laboratory work for the academic year 2025/2026

Practical Hours Title

Neuroanatomy

V1	2	Appearance and distribution of gray and white matter of the spinal cord
V2	2	Appearance and distribution of gray and white matter of the brainstem
V3	2	Clinical-anatomic syndromes of the spinal cord

Neuron electrophysiology

V4	2	Resting potential
V5	2	Action potential
V6	2	Postsynaptic potential
V7	2	Signalization

Motor and Sensory system

V8	2	CRD: Reflexes and reaction time
V9	3	Physiology of sensation
V10	2	Muscle and electromyography

General brain functions

V11	2	EEG and evoked potential
V12	2	<i>SleepLab</i> Polysomnography

TOTAL: 24 hours

OBLIGATORY TEXTBOOK AND PRACTICUM FOR PRACTICAL LESSONS

- Siegel, A. and Sapru, H.: ESSENTIAL NEUROSCIENCE, 4th Edition, Wolters Kluwer/ Lippincott Williams & Wilkins
- John Huguenard and David A. McCormick: **Electrophysiology of the Neuron**, Windows Version, A Companion to *Neurobiology* by Gordon Shepard

ADDITIONAL LITERATURE

- Purves et al Neuroscience 5th edition published by Sinauer Associates
- Kandel, E.R., Schwartz, J.H. and Jessel, T.M.: PRINCIPLES OF NEURAL SCIENCE, 4th edition, McGraw-Hill; New York, SAD, 2000.
- Zigmond, MJ et al.: Fundamental Neuroscience, Academic Press; San Diego, SAD, 1999.
- Guyton, A.C. and Hall: MEDICAL PHYSIOLOGY, 11th edition. 2006.
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The exam is written and is administered in the form of a test (100 questions, circle the only correct answer from five options).

Registration for the exam is conducted in the usual manner. Only students who are attending the IV semester this academic year and have not missed seminars or have justified and made up for their absences with a colloquium have the right to take the exam. The requirement for exam registration is both signatures.

Students who have re-enrolled in the second year (i.e., have subjects re-enrolled in their index) are required to regularly attend seminars and lectures for the parts of the material they have not yet passed. They are not required to retake the exercises.