

4IT420 ZÁKLADY NEUROVĚD

Course code	4IT420
Course title in language of instruction	Základy neurověd
Course title in Czech	Základy neurověd
Course title in English	Foundations of Neurosciences
Mode of completion and number of credits	Exam ECTS (3 credits) One ECTS credit corresponds to 26 hours of workload for an average student.
Type of course	Daily attendance: 2/0 (hours of lectures per week / hours of seminars per week)
Language of instruction	Czech
Level of course and year of study	master: 4; master continuing: 1
Semester	Sklad FIS – FIS
Name of lecturer	MUDr. Robert Rusina, PhD.
Prerequisites	none

Aims of the course

Basic knowledge of neurophysiology and neuropsychology will be discussed with regard to the cognitive-computational orientation of participating students.

A) Students will be confronted to principal directions and trends in neurosciences with a particular impact on cognitive framework

B) Basic literature and relevant information sources will be submitted and critical lecture and discussions initiated

C) Background issues in the domains of neuro-informatics, neuro-economics and neuro-politics will be presented and discussed

Learning outcomes and competences

Upon successful completion of this course, students will become oriented in the relationship between brain structure and its function, with a particular impact on emotions, planning, decision making and reward and selection principles. They will be able to understand and critically comment contemporary literature. The essay will place the acquired knowledge into a large context and verify the understanding of basic items and their relationships.

Course contents

1) Cell membrane – structure and function (principles of transmembrane potentials and conduction, action potentials, myelin and its role, alterations of signal processing – epileptic discharges)

2) Ionic channels and pumps (voltage gated channels, mechanisms of blocking and inactivation, restitution of resting potential – ionic pumps)

3) Synaptic transmission – (synaptic structure, principal neurotransmitters; the role of calcium in synaptic transmission – second messengers and related modifications in function and shape of neurons and dendrites)

4) Pain and sensibility; (tactile perception and conduction, signal modulation at different levels from the spinal cord to the thalamus, cortical integration – modules, pain modulation, phantom pain)

5) Movements (different aspects of motor functions – principles of regulation, the passage from initiation to realization of a movement, modulation of an ongoing movement – the role of the cerebellum)

6) Brain development, formation of neuronal connections; synaptic and neuronal plasticity (critical periods, growth factors, signal proteins, synaptic plasticity, long term potentiation and learning)

7) Cognition – general aspects, language and communication (primary and secondary brain areas, associative cortex, language and its localization)

8) Memory and amnesia (different subtypes of memory, the key role of hippocampus in declarative memory, procedural memory, amnesias, mechanisms of learning, the aging brain)

9) Lateralization, emotions, visual perception (the dominant and non-dominant hemispheres, visuo-spatial perception, emotions and the limbic system, amygdala emotional behavior)

10) Vigilance and consciousness, awakesness and sleep (brain stem functions, attention, subconsciousness, circadian rhythms, sleep stages and pathology)

11) Frontal functions, the social brain (planning and decision making, voluntary acting, social behavior, personality, intelligence)

12) Interaction between the nervous system and other systems (immunity, hormones, homeostasis) (feedback circuits, integrity of the organism and physiological interactions, brain and sexuality)

13) Introduction to neuro-economics (behavior and decision making under economical aspects, marketing and neurobiology of emotions)

Teaching methods and student workload

Type of teaching method	Hours of workload
	daily attendance
Participation in lectures	26
Preparation for lectures	13
Preparation for final oral exam	39
Total	78

Assessment methods

Requirement type	Weight
	daily attendance
Final oral exam	100 %
Total	100 %
Special requirements and details: none	

Recommended reading

Type*	Author	Title	Published in	Publisher	Year	ISBN
R	RUSINA, R.	Základy neurovědy (v přípravě)			2008	
R	GLIMCHER, P. W.	Decisions, uncertainty, and the brain : the science of neuroeconomics	Cambridge	MIT Press	2003	0-262-07244-0
R	KOUKOLÍK, F.	Sociální mozek	Praha	Karolinum	2006	80-246-1242-9
R	ROBERTS, J. L. – BYRNE, J. H.	From molecules to networks : an introduction to cellular and molecular neuroscience	Amsterdam	Elsevier Academic Press	2004	0-12-148660-5
R	KANDEL, E. R.	In search of memory : the emergence of a new science of mind	New York	W.W. Norton & Company	2006	0-393-32937-2
R	DARUNA, J. H.	Introduction to psychoneuroimmunology	Boston	Elsevier Academic Press	2004	0-12-203456-2
R	KULIŠŤÁK, P.	Neuropsychologie	Praha	Portál	2003	80-7178-554-7
R	KOUKOLÍK, F.	Já : o vztahu mozku, vědomí a sebeuvědomování	Praha	Karolinum	2003	80-246-0736-0
R	STERNBERG, R. J.	Kognitivní psychologie	Praha	Portál	2002	80-7178-376-5

* R – required reading, A – additional reading