COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Neurochemistry	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Prof. dr. Valentina Vengelienė	Department of Neurobiology and Biophysics, Institute of Biosciences, Life Sciences Center, Vilnius University

Study cycle	Type of the course unit (module)
Second	Compulsory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face-to-face/remote	2nd (spring) semester	Lithuanian/English

Requirements for students	
Prerequisites: At least the basic knowledge of chemistry/biochemistry, neurophysiology and neuroanatomy. Good English comprehension.	**Additional requirements (if any):** The basic knowledge of signal transduction.

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	133	48	85

Purpose of the course unit (module): programme competences to be developed		
The student will be taught: 1. Specific functional aspects of neurochemical systems 2. Classification and distribution of chemical neurotransmitters and neuroreceptors 3. Structure and synthesis of neurotransmitters 4. Pharmacokinetics and pharmacodynamics of neurotransmission 4. Types of synaptic plasticity 5. A neurochemical mechanism of mental and neurological diseases, and their pharmacological treatment.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
The student will learn how "communication" between the environment and the nervous system occurs; how the information is transmitted between neurons, between different areas of the nervous system; between the nervous system and other organs; how adaptation to the changing environment occurs; why failure in this "communication" result in mental and neurological disorders and how they are treated; what methods are used in the neurochemistry research.	Lectures, seminars	Exam, seminar presentation
The student will learn to search for new or missing information in various databases, to analyze and systemize information.	Seminars, self-study (selected reading from the current literature available on the MEDLINE database)	Presentation of acquired information in written form (essay), seminar presentation
The student will be able to present collected information orally in a systemic, clear way.	Lectures, self-study (selected reading from the current literature available on the MEDLINE database), face-to-face discussions during seminars	Presentation of acquired information orally (ppt presentation)

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	**Contact hours**	**Self-study hours**	**Assignments**
1. Introduction: neuronal and synaptic anatomy, principles of neurotransmission (synthesis, release, transport, etc.), cell-surface receptors.	6						**6**	**18**	Preparing for the exam
2. Distribution, structure, transport, synthesis, degradation and receptors of small-molecule neurotransmitters (acetylcholine, monoamines, cannabinoids, amino acid transmitters) and neuropeptides (e.g., opioids).	14						**14**	**22**	Preparing for the exam
3. Mental and neurodegenerative disorders (e.g., addiction, OCD, Parkinson's disease) – neurochemical mechanism of occurrence and treatment.	10						**10**	**22**	Preparing a presentation in a written (essay)and oral form; Preparing for the exam
4. Seminars for getting acquainted with methods used for neurochemical research.			18				**18**	**23**	Oral presentation
Total	**30**		**18**				**48**	**85**	

Assessment strategy	Weight,%	Deadline	Assessment criteria
Seminar	20%	Mid-semester	The student is evaluated by his/her ability to present information orally, to find complete and validated information; to find reliable and comprehensive information sources and to achieve the overall goal of the neurochemistry seminar. Evaluation is carried out using a 0-2 point system (worst-best)
Essay	10%	Mid-semester	The student is expected to give a thorough analysis of a psychiatric/neurological disorder (and its pharmacological treatment) of his/her choice from the neurochemical perspective. Evaluation is carried out using a 0-1 point system (worst-best)
Exam	70%	End of semester	3 questions (open essay): 1 – general principles of neurochemistry of the nervous system (2 points); 2 – information on a specific neurotransmitter (3 points): 3 – neurochemical basis of diseases (2 points). The student is evaluated according to the depth of his/her knowledge. Sum evaluation is 0-7 points (worst-best).

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
Eds. Siegel GJ, Albers RW, Brady ST, Price DL	2006	Basic Neurochemistry: Molecular, Cellular and Medical Aspects, 7th edition		Elsevier

van den Pol AN	2012	Neuropeptide transmission in brain circuits.	76:98-115	Neuron
Vizi ES, Fekete A, Karoly R, Mike A	2010	Non-synaptic receptors and transporters involved in brain functions and targets of drug treatment.	160:785-809	British Journal of Pharmacology
Le Merrer J, Becker JA, Befort K, Kieffer BL	2009	Reward processing by the opioid system in the brain.	89:1379-1412	Physiological reviews
Kano M, Ohno-Shosaku T, Hashimotodani Y, et al.	2009	Endocannabinoid-mediated control of synaptic transmission.	89:309-380	Physiological reviews
Bjorklund A, Dunnett SB	2007	Dopamine neuron systems in the brain: an update	30:194-202	TRENDS in Neurosciences
Bowery NG, Smart TG	2006	GABA and glycine as neurotransmitters: a brief history.	147S: 109-119	British Journal of Pharmacology
Nedergaard M, Takano T, Hansen AJ	2002	Beyond the role of glutamate as a neurotransmitter.	3:748-755	Nature reviews. Neuroscience
Optional reading				
Eds. Johnstone EC, Owens DC, Lawrie SM, et al.	2010	Companion to psychiatric studies, 8th edition		Elsevier
Eds. Cooper J, Bloom FE, Roth RH	2003	The Biochemical Basis of Neuropharmacology, 8th edition.		Oxford University Press
Ferraguti F, Shigemoto R	2006	Metabotropic glutamate receptors.	326:483-504	Cell and tissue research
Hyman SE, Malenka RC, Nestler EJ	2006	Neural mechanisms of addiction: the role of reward-related learning and memory.	29:565-598	Annual review of neuroscience
Wise RA	2004	Dopamine, learning and motivation.	5:483-494	Nature reviews. Neuroscience
Waldhoer M, Bartlett SE, Whistler JL	2004	Opioid receptors	73:953-990	Annual review of biochemistry
Pralong E, Magistretti P, Stoop R	2002	Cellular perspectives on the glutamate–monoamine interactions in limbic lobe structures and their relevance for some psychiatric disorders.	67:173–202	Progress in Neurobiology
Langer SZ	1997	25 years since the discovery of presynaptic receptors: present knowledge and future perspectives.	18:95-99	Trends in pharmacological sciences
Malosio ML, Marquèze-Pouey B, Kuhse J, Betz H	1991	Widespread expression of glycine receptor subunit mRNAs in the adult and developing rat brain.	10:2401-2409	The EMBO journal