

<b>Module Number</b> <b>5c</b>	<b>Title:</b> <b>Systems Neurosciences</b>		
<b>Module type:</b> compulsory elective	<b>Language:</b> English	<b>Group Size:</b> 8 students	
<b>Study semester:</b> 1	<b>Availability:</b> summer semester		<b>Duration:</b> 1 semester
<b>Workload:</b> 420 hrs	<b>Credits:</b> 14 CP	<b>Contact time:</b> 105 hrs	<b>Independent Study:</b> 315 hrs
<b>1</b>	<b>Courses</b> a) Lecture 3 PPW b) Practical course 6 PPW c) Seminar 2 PPW		
<b>2</b>	<b>Intended Learning Outcomes</b> The students are able to describe how behavioural states are organized on systemic, network-, cellular and molecular levels in relation to the daily circle. This includes sleep and waking, energy administration (temperature regulation, food intake and metabolism), and the release of hypothalamic hormones. The pathophysiology of these functions includes sleep disorders (e.g. narcolepsy, sleep apnoea), anorexia, obesity, central aspects of diabetes mellitus and neuroendocrine disorders. The students will be capable of observing behaviour, taking recordings from hypothalamic brain slices and primary cultures, performing neurotransmitter expression pattern analysis on brain sections, analysing receptor pharmacology and applying gene expression profiling. Students are capable to evaluate (data analysis), describe, interpret and document their experimental findings. They will demonstrate orally and in writing background, experimental approach, results and conclusions.		
<b>3</b>	<b>Content</b> <b>Lectures:</b> Starting from basics in physiology and endocrinology we will explain the daily organization of behaviour, physiology and pathophysiology of sleep-waking and consciousness and discuss new methods allowing identification of responsible neuronal groups and circuitries with new perspectives for therapy. Specific topics: clock genes, the various aspects of circadian rhythms, circadian and homeostatic regulation of behavioural state, wake- and/or sleep-active neurons, morphological and biochemical components of energy administration (temperature and body weight regulation, feeding). Neurotransmitters and modulators involved in these functions with their localisation, mainly in the hypothalamus, and signalling pathways (GABA, glutamate, biogenic amines and hypothalamic peptides), endogenous sleep-promoting agents (adenosine, melatonin). Mechanisms of action of general anaesthetics. Pathophysiology of sleep, neurodegenerative and metabolic diseases. <b>Practical course:</b> Students will perform the following methods: 1) (automatic) registration and analysis of behaviour (spontaneous locomotor activity). 2) preparation and use of primary cultures, recording with 60 channels in microelectrode arrays. 3) preparation of vital brain slices for electrophysiological recordings. 4) preparation of acutely isolated hypothalamic neurons, mRNA harvesting after patch-clamp recording, single-cell RT-PCR. 5) primer design, real-time RT-PCR 6) preparation of cryosections from mouse brains. Immunodetection of receptors and enzymes in neurons. Analysis of immunostainings with conventional and Laser Scanning Confocal Microscopy. In situ hybridization histochemistry including generation of digoxigenin-labeled riboprobes by in vitro transcription, hybridization and immunodetection followed by microscopic analysis. <b>Seminar:</b> Students give a presentation on selected seminal and recent papers of the field (oral presentation or e-poster presentation with projection). <b>Recommended reading:</b>		

	<p>Saper CB "Staying awake for dinner: hypothalamic integration of sleep, feeding, and circadian rhythms" Prog Brain Res. 2006;153:243-52.</p> <p>Lin JS, Anaclet C, Sergeeva OA, Haas HL. (2011) The waking brain: an update. Cell. Mol. Life Sci 68:2499-512</p>
<b>4</b>	<p><b>Teaching methods</b> Lecture/Seminar/Practical Course</p>
<b>5</b>	<p><b>Prerequisites</b> <b>Formal:</b> Successful completion of module 1. Bachelor in the natural sciences or engineering or a medical degree. The animal course would be advantageous. Proficiency in English level B2 of Common European Framework of Reference for Languages (CEFR). <b>With regards to content:</b> focus on neuroscience, knowledge of neurobiology, chemistry, physics, mathematics.</p>
<b>6</b>	<p><b>Examination types</b> Written examination</p>
<b>7</b>	<p><b>Requirements for award of credit points</b> Regular attendance in the practical course and the seminar Delivery of a protocol (in the style of a scientific manuscript) Delivery of a presentation in the seminar Passing written examination at the end of the module</p>
<b>8</b>	<p><b>Module applicability (in other study courses)</b> Master Biology (international) Master Biochemistry</p>
<b>9</b>	<p><b>Assessment</b> The mark given will contribute to the final grade in proper relation to its credits.</p>
<b>10</b>	<p><b>Module convenor and main lecturers</b> Prof. Dr. Olga A. Sergeeva, Dr. Heike Heuer, Dr. Wiebke Fleischer, Dr. Tatsiana Suvorava</p>
<b>11</b>	<p><b>Further information</b> The regular attendance at the lectures is strongly recommended. The content of the lectures is prerequisite for the practical course and the seminar.</p>