Technische Universität München

Module Description

WZ2682: Sensory and Behavioral Neurogenetics

Assistant Professorship of Neuronal Control of Metabolism (Prof. Grunwald-Kadow)

Module level:	Language:	Module duration:	Occurrence:
Master	German/English	one semester	summer semester

Credits*:	Total number of hours:	Self-study hours:	Contact hours:
5	150	88	62

* The number of credits can vary depending on the corresponding SPO version. The valid number is always indicated on the Transcript of Records or the Performance Record.

Description of achievement and assessment methods:
The module examination consists of a written exam (90 min), where students are expected to remember and reproduce topics that were covered in the lecture (theories of behavioral analysis, methods, examples etc.) without additional aids. The exam will consist of multiple choice, free formulations, tables to be completed and interpretations of schemes etc. In addition, students will write a protocol covering the exercises of the practical course. The module is passed, when the protocol is successfully completed and the grade of the written exam is at least 4,0.

Exam type:	Exam duration (min.):	Possibility of re-taking:	Homework:
written	not specified	In the next semester: Yes At the end of the semester: No	No

Lecture:	Conversation:	Written paper:
No	No	No

(Recommended) requirements:
Basic knowledge of neurobiology and genetics are obligatory.

Contents:
LECTURE: once a week during the semester for two hours including a break, the lecture will cover the following topics:

• general introduction, deepening of knowledge in form, function, and networks of synaptic connections and nervous systems.
• the role of model animal systems in neuroscience
• illustration and deeper understanding of neuroscience research on the example of sample publications covering model system (including genetic models) such as worm, fly, fish, mouse, monkey, primate.
• Analysis and explanation of model specific methods such as automated behavioral analysis, in vivo imaging, electrophysiology, multiphoton microscopy, live microscopy, modeling
• Examples describing the role of internal state and behavioral context including the role of neuromodulation
• translation and general meaning of results obtained in model organisms
• evolution of neuronal networks and their translational meaning

EXERCISE: The exercise will take place in parallel or after the lecture in one block

• performance of experiments that were covered during the lecture using the olfactory and gustatory system of Drosophila melanogaster (with the help of computer programs and analysis: CTraxx/Matlab und ImageJ)
• histological preparations and dissections of fly brain in order to analyze olfactory sensory neurons as well as higher brain centers using GFP and other genetic marker proteins.
• acquisition of pictures using fluorescence stereo and confocal microscopy
• Image analysis using ImageJ software
• extracellular recordings in sensory neurons in the fly
• use of optogenetics to direct fly larvae in behavioral experiments
• use of gustatory and olfactory receptor mutants in behavioral experiments
• statistical analysis and graph generation using Graphpad, Photoshop und Powerpoint
• discussion of results and expectations and comparison to published data; discussion on possible errors and improvements

Study goals:
Students who have successfully completed this module should: • know important definitions and methods in neurogenetics and behavioral analysis, and why and how they are used in model organisms.
• understand the terms optogenetics, chemogenetics, calcium imaging, connectomics, system neuroscience, neuronal networks, phsychophysics, neuromodulation and can explain them.
• in particular the methods studied in the exercise on the example of the chemosensory system of Drosophila melanogaster (extracellular electrophysiology, computer-based behavioral analysis, optogenetics, mutants) can be explained methodologically and can be carried out at least in part independently.
• be able to interpret, analyse and develop results obtained in behavioral studies, neurophysiology and neuroanatomy. They have basic knowledge of programs such as Matlab, ImageJ, GraphPad und understand when these programs can be used and for which applications. They also grasp how to plan, carry out, interpret, and present experiments.

Teaching and learning methods:
LECTURE: In the lecture material will be presented in a powerpoint presentation, which features many examples, pictures, schemes, videos. In addition, at the beginning of each lecture the content of the previous lecture will be summarized and open questions will be discussed. At the end of each lecture, a list of 'take home messages' will be given. EXERCISE: depending on the availability of students, exercises will run in parallel or as a block just after the lecture or just before the winter semester. Students will work in groups of 3-4 persons and will use the fruitfly model to practice some of the methods introduced in the lecture. A combination of practical, experimental work and computer analysis will be carried out. Computer programs include Ctraxx, GraphPad, Excel, ImageJ.

Media formats:
not specified

Literature:
Standard textbook: Eric Kandel (editor), Principles of Neural Sciences; various journal articles (list will be made available in class)

Responsible for the module:
Grunwald, Ilona; Prof. Dr. rer. nat.: ilona.grunwald@tum.de

Courses (Type, SH) Lecturer:

0000003369 Sensory Neurogenetics and Behavior (3SWS L, SS 2016/17) [BF]
Grunwald I [L], Grunwald I

0000004004 Sensory Neurogenetics and Behavior (2SWS P, SS 2016/17) [BF]
Grunwald I

For further information about this module and its allocation to the curriculum see:
https://campus.tum.de/tumonline/wbModHb.wbShowMHBReadOnly?pKnotenNr=1340934

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