Each of these modules yields 9 ECTS, students have to choose three out of these presently seven modules

Introductory week (obligatory) yields 3 ECTS

Neuro- and Electrophysiology
Module 406 (A. Kreiter, D. Wegener)

In this module you will be systematically introduced into the methods of neurophysiological recordings in the mammalian cortex. You will learn to understand the electro-technical and neurobiological basics of different neurophysiological recording techniques and exercise how to perform the necessary preparatory steps including stereotactic approaches. After building up a recording apparatus, learning how to eliminate sources of artifacts and noise as well as planning your own recording experiment you will perform your own neurophysiological recording experiment in an anesthetized rat. Furthermore, you will learn how to perform behavioral training and neuronal recordings in awake, behaving animals and to analyze your data with state-of-the-art methods. Finally, you will present your data and critically discuss them in written and oral presentations.

Neuropharmacology
Behavioral Pharmacology
Module 407 (M. Koch)

This practical course includes behavioural pharmacology experiments focusing on the role of dopamine in reward-related learning. You will learn to perform stereotaxic surgery on rats how to administer systemic and intracranial drugs and conduct various behavioural tests. Finally, you will learn standard histology as well as statistical data analysis. Critical interpretation and discussion of your findings, writing a protocol (according to scientific standards) and an oral defence complete this module.

Experimental Neuroanatomy and Behavioural Physiology
Module 408 (O. Masseck, Janine Kirstein)

(a) Optogenetics and beyond (O. Masseck)
In this module students will learn basic techniques for the development of optogenetic tools and acquire the knowledge to plan, perform and analyse optogenetic experiments. You will learn
(1) Molecular biology techniques to design and construct optogenetic tools
(2) Cell culture techniques to express and analyse proteins in heterologous expression systems via Calcium Imaging and Patch Clamp
(3) Stereotactic surgery to inject optical tools and implant optical fibers in mice. Follow up on this you will perform behavioural tests in conjunction with optogenetic stimulation. Histology and immunhistochemical stanings will complement your knowledge.
Finally, you will interpret your result and discuss them in a written protocol.

(b) Molecular methods in Neuroscience (J. Kirstein)
In this module, students will get introduced to the model system *Caenorhabditis elegans* and how it can be employed to address neurobiological questions with a particular emphasis on neurodegenerative diseases. The students will utilize different *C. elegans* strains that express human disease proteins such as $A\beta_{1-42}$ and Huntingtin (HTT) and will characterize these animals for physiological fitness and neuronal activity. The following experiments will be performed:

(1) Lifespan and development analyses

(2) Chemotaxis, motility and fecundity analyses

(3) Genetic crosses of the disease models with e.g. reporter constructs or strains overexpressing a molecular chaperone

(4) RNA interference studies

The students will learn to plan the experimental outline and will perform the experiments with guidance, yet will also be trained to work independently. The obtained data will be analysed and presented to the lab in an oral presentation as well as in a written protocol. The students will also review and extract data and methods from publications that are closely related to their research questions.

Experimental Neuropsychology
Approaches and research strategies in experimental neuropsychology, imaging techniques and electrophysiology
Module 410 (M. Herrmann, T. Fehr)

Based on lectures, lab teaching, computer simulations, and hands-on studies you will get an introduction into the experimental basics (transfer of hypotheses into study designs) of cognitive neuroscientific research. This module focuses on the appropriate translation of neuropsychological research ideas into human EEG and fMRI studies as well as the methodological basics of combining both research approaches.

Structural and Functional Neuroimaging
Basics of functional magnetic resonance imaging
Module 412 (M. Herrmann, E. Küstermann)

In the first part of this module you will get an introduction into the tomographical or cross-sectional depiction (MRI and CAT scans) of brain lesions. This lecture will also be used for a brief summary of human brain anatomy based on slice topography. Within the more comprehensive functional magnetic resonance imaging (fMRI) part of the module we will employ lectures, lab teaching, computer simulations, and hands-on studies for introducing both the physical and methodological basics of fMRI as well as data pre- and post-processing, and the handling of an fMRI scanner.

Neurophysics
Theoretical neurosciences, data analysis and modelling
Module 413 (K. Pawelzik, Udo Ernst)

Based on the lecture and the computer course, this module delves into neuronal network modeling and data analysis. Problems selected from the fields of neuronal coding, neuronal decoding, data analysis and small neuronal networks will be treated in small projects. The focus lies on the development of simple, yet viable models and the performance of computer simulations required for obtaining significant results.