DEPARTMENT OF NEUROSCIENCE

C4F2624 Brain Circuits, 1.5 credits (hec)

Hjärnans nätverk, 1,5 högskolepoäng

Third-cycle level / Forskarnivå

Approval

This syllabus is approved by the The Committee for Doctoral Education on 2023-10-31, and is valid from Spring semester 2024.

Responsible department
Department of neuroscience, Faculty of Medicine

Prerequisite courses, or equivalent

Knowledge of neuron function and brain anatomy is required.

Intended learning outcomes

Purpose

The purpose of the course is to provide doctoral students in the field of neuroscience with an overview of current state-of-the art approaches, technologies and concepts used for understanding of the brain's circuits and functions in animal models. There is a very strong emphasis on research in mice. All invited speakers have made seminal contributions to how we currently study and understand the brain, and there will be ample opportunities for the students to interact with the speakers, and discuss aspects relevant to their own work.

Intended learning outcomes

By the end of the course the student shall be able to:
- explain the structure and function of the main brain circuits,
- describe the principles for excitatory and inhibitory networks, including receptors and neurotransmitters, as well as the action of different chemical neuromodulators,
- describe principles, use and readout of optogenetics and recording technologies,
- describe principles and methods to define the structure (neuroanatomy) of brain circuits,
- explain how dysfunctions of networks can manifest as neuropsychiatric disorders,
- describe animal behavior tests probing specific networks and network functions.

Course content

The course will cover the organization and function of main circuits in the brain, including the interaction and participation of different cell types, the interplay between excitation and inhibition, and how circuit output results in behavior. Different techniques for recording, labeling and manipulation of neuronal circuits in animal models will be discussed, including electrophysiology, molecular targeting, optogenetics and viral tracing. The connection between deficient circuit functions and neuropsychiatric disorders will be included, as well as animal behavior tests probing specific circuits and circuit (dys)functions. Specific emphasis will be put into describing the technologies currently used in the neuroscience field.

Forms of teaching and learning

Lectures by invited experts and group exercises.

Language of instruction
The course is given in English.

Grading scale

Pass (G) /Fail (U)

Compulsory components & forms of assessment

Compulsory components

The seminar presentations are obligatory, and so are all lectures. Any absence has to be compensated for in accordance with the instructions of the course director.

Forms of assessment

The student should in discussions and a seminar presentation demonstrate the ability to critically evaluate original research papers on the topics covered and be able to show that the intended learning outcomes for the course are reached.

Course literature

Original research and review papers provided by the course organizers.