Master internship project (Neurobiology) *Available from: 01.03.2019*

Magnetogenetics: Cell-type specific, remote control of neural activity in a magnetic field

Magnetic control of neural activity is an emergent technology that promises non-invasive brain stimulation. Because magnetic fields can penetrate the body largely undisturbed, magnetic stimulation can be performed without implanting a probe in the brain. Magnetic neural stimulation can be combined with optical and electrical methods for multimodal observation and control of neural circuits; it offers faster temporal resolution than other noninvasive brain stimulation techniques (e.g. ultrasound, transcranial magnetic stimulation). Therefore, molecular tools that provide cell-type specific neuromagnetic actuation have outstanding promise as novel neural interfaces.

In this project, we are developing the necessary molecular tools for rapid (in ms resolution), bidirectional (inhibition vs excitation) neuromagnetic actuation in a cell-targeted manner. There are two projects available for Master students:

Project #1 Construct design, vector preparation and gene delivery

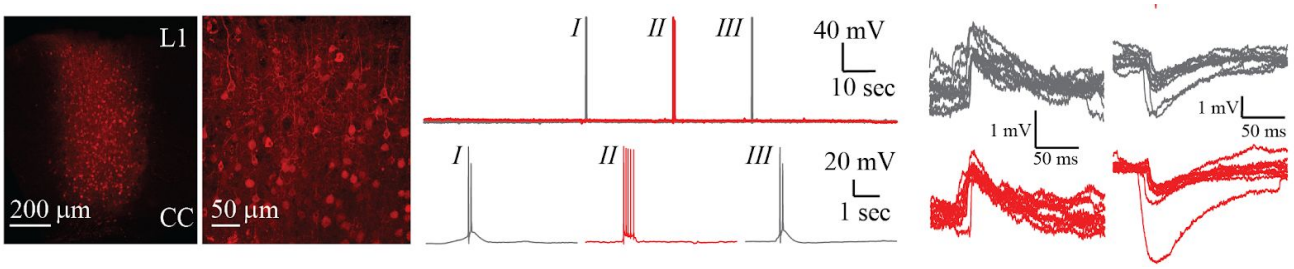
Ideally suited for students with a background and interest in molecular biology, genetics, virology

In this project, you will learn to engineer surface receptors, create viral vectors for gene delivery *in vivo* and perform quantitative molecular expression analysis *ex vivo*.

Project #2 Neural recordings

For students with a background and interest in synaptic and network physiology

You will learn to perform intracellular (whole-cell) recordings while stimulating neurons using miniature implantable electromagnets and perform data analysis (using custom in-house software). Potential expansion: For those students interested in advance computational methods, the project can be expanded to include predictive network modelling during (closed-loop) magnetic neural control which could also be combined with calcium imaging with genetically encoded indicators.



Basic experimental pipeline. Novel neuromagnetic actuators are virally transduced for in vivo gene delivery (Project #1) before intracellular recordings are performed to quantify sub- and suprathreshold dynamics (Project #2).

Internship location: Department of Neurophysiology, Science Faculty, Donders Institute

Applications should be addressed to Tansu Celikel (celikel@neurophysiology.nl). Applications should include a CV, a motivation letter and a half-page critique of a recent scientific paper (in any field) you read (please include the PMID of the paper in question in your critique).