



E 03 - GGNB Extended Methods Course

Electrophysiology

ELECTRAIN
(07 - 18 May 2018)

European Neuroscience Institute Göttingen
ENI-G

supported by
FEDERATION OF EUROPEAN NEUROSCIENCE
SOCIETIES (FENS)

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E 03 - GGNB Extended Methods Course 2018

ENI Electrophysiology Training (ENI-ELECTRAIN)

Date: 07 – 18 May 2018
Location: European Neuroscience Institute (ENI-G), Grisebachstr. 5, 37077 Göttingen
Participants: 12 for practical course (lectures are open for all PhD students)
(3 groups A+B+C of 4 participants each, groups switch topics after 1st week, participation for both weeks mandatory, topics will be assigned during the course)

TOPIC 1: *In vitro* Electrophysiology of Expressed Ion Channels
in *Xenopus laevis* oocytes (PARDO + NN)
(4 participants)

TOPIC 2: *In vivo* Electrophysiology of Identified Neurons
in *Hirudo medicinalis* (HÖRNER + FERBER)
(4 participants)

TOPIC 3: Measurement of synaptic parameters in mouse hippocampal
organotypic slices (SCHLÜTER + NN)
(4 participants)

TOPIC 4: Calcium measurements in cultured neurons and mouse brain slices
(MILOSEVIC + NN)
(4 participants)

Week 1/2 (07 – 11 May 2018 and 14 – 18 May 2018) ENI Lecture Hall, ENI Teaching Labs

Topic: Expression and electrophysiological characterization of different ion-channels in the *Xenopus* oocyte expression system

Techniques: cDNA expression techniques in *Xenopus* oocytes, Two-electrode voltage clamp configuration and measurements, Quantitative evaluation and statistical analysis of different ion channels/conductances

Lectures: see separate schedule from 9-11h, ENI Lecture Hall (open to all GGNB students)

Practical Training: Monday through Friday from 13-18h, ENI Teaching Labs

Presentation of results: Friday, ENI Lecture Hall, Friday afternoon: Cleaning-up

Week 1/2 (07 – 11 May 2018 and 14 – 18 May 2018) ENI Lecture Hall, ENI Teaching Labs

Topic: In-vivo electrophysiology of identified neurons in *Hirudo medicinalis*

Techniques: Single and double intracellular recording techniques, single cell fluorescent labeling and 3d-imaging, Characterization of spontaneous and stimulus-evoked electrical activity patterns in identified neurons, Analysis of synaptic connectivity and network properties, Pharmacological characterization of different electrical conductances.

Lectures: see separate schedule, ENI Lecture Hall (open to all GGNB students)

Practical Training: Monday through Friday from 13-18h, ENI Teaching Labs

Presentation of results: Friday afternoon, ENI Lecture Hall, Friday afternoon: Cleaning-up

Week 1/2 (07 – 11 May 2018 and 14 – 18 May 2018) ENI Lecture Hall, ENI Teaching Labs

Topic: Measurement of synaptic parameters in mouse hippocampal organotypic slices

Techniques: Miniature EPSC recording of CA1 pyramidal cells, evoked AMPA receptor and NMDA receptor mediated synaptic transmission of Schaffer collateral CA1 pyramidal cell synapses, lentiviral-mediated molecular manipulation of CA1 pyramidal cells

Lectures: see separate schedule, ENI Lecture Hall (open to all GGNB students)

Practical Training: Monday through Thursday from 13-18h, ENI Teaching Labs

Presentation of results: Friday afternoon, ENI Lecture Hall, Friday afternoon: Cleaning-up

Week 1/2 (07 – 11 May 2018 and 14 – 18 May 2018) ENI Lecture Hall, ENI Teaching Labs

Topic: Calcium measurements in cultured cells (HeLa, primary cortical and hippocampal neurons) and mouse brain slices

Techniques: preparation of samples (cultured cells and mouse brain slices); ratiometric calcium imaging in cultured HeLa cells; calcium imaging in cultured cortical and hippocampal neurons; calcium imaging in mouse brain slices; quantitative evaluation of data

Lecture: Calcium measurements in cultured neurons and brain slices

ENI Lecture Hall (open to all GGNB students)

Practical Training: Mon-Fri from 13-18h, ENI Teaching Labs

Presentation of results: Friday afternoon, ENI Lecture Hall, Friday afternoon: Cleaning-up

SELECTED LITERATURE:

TOPIC 1: *In vitro* Electrophysiology of Expressed Ion Channels in *Xenopus laevis* oocytes

Stühmer, W. (1998) Electrophysiological recordings from *Xenopus* oocytes.
Methods in Enzymol. 293, 280-300.

TOPIC 2: *In vivo* Electrophysiology of Identified Neurons in *Hirudo medicinalis*

Carretta, M. (1988) The Retzius Cells in the Leech: A Review of their Properties and Synaptic Connections.
Comp. Biochem. Physiol. 91A, 3: 405-413

De-Miguel FF, Leon-Pinzon C, Noguez P, Mendez B. (2015) Serotonin release from the neuronal cell body and its long-lasting effects on the nervous system. *Philos Trans R Soc Lond B Biol Sci.* 2015 Jul 5;370(1672). pii: 20140196. doi: 10.1098/rstb.2014.0196.

Gaudry, Q., Kristan, W.B. (2009) Behavioral choice by presynaptic inhibition of tactile sensory terminals.
Nature Neuroscience. 2009;12(11): 1450-57; doi:10.1038/nn.2400

Moshtagh-Khorasani, M., Miller, E.W., Torre, V. (2013) The spontaneous electrical activity of neurons in leech ganglia. *Physiological Reports Published 28 October 2013 Vol. 1 no. e00089 DOI: 10.1002/phy2.89*

Nicholls, J.G., van Essen, D. (1974): The nervous system of the leech. *Sci. American*, 230: 38-48

Rose, T, Gras, H, Hörner, M (2006) Activity-dependent suppression of spontaneous spike generation in the Retzius neurons of the leech, *Hirudo medicinalis* L..
Invertebrate Neuroscience 6: 169-176 (DOI 10.1007/s10158-006-0030-2)

TOPIC 3: Measurement of synaptic parameters in mouse hippocampal organotypic slices

Stein, V., House, D.R.C., Bredt, D.S., Nicoll, R.A. (2003): Postsynaptic Density-95 Mimics and Occludes Hippocampal Long-Term Potentiation and Enhances Long-Term Depression.
J. Neuroscience, July 2, 2003 • 23(13):5503–5506 • 5503

TOPIC 4: Calcium measurements in cultured neurons and mouse brain slices

Dawitz J, Kroon T, Hjorth J, Meredith RM (2011) Functional Calcium imaging in developing cortical networks.
J Vis Exp 56, e3550, doi:10.3791/3550

Grienberger C, Konnerth A. (2012) Imaging calcium in neurons. *Neuron* 73(5):862-85.