ELECTRAIN
Extended Methods Course in Electrophysiology
May 2-13, 2022

Faculty:

Brett CARTER Synaptic Physiology and Plasticity, ENI Göttingen
Oliver DRAEGER Neurophysiology, University of Bielefeld
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Jutta KRETZBERG Computational Neuroscience, University of Oldenburg
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Annette NICKE Institute for Pharmacology and Toxicology, University of Munich
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Tina PANGRSIC Institute for Auditory Neuroscience, University Medical Center Göttingen
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Caspar SCHWIEDRZIK Neural Circuits and Cognition, ENI Göttingen
Dixon WOODBURY Cell Biology & Physiology, Brigham Young University, USA
Electrophysiology Training (ELECTRAIN)

Date: 02.05.2022 - 13.05.2022

Location: European Neuroscience Institute (ENI-G), Grisebachstr. 5, 37077 Göttingen

Participants: 16 for practical course (lectures are open for all PhD students)
(4 groups of 4 participants max. each, groups switch topics after 1st week,
participation for both weeks mandatory, topics will be assigned during the course)


TOPIC 1: Oocyte recordings with recombinant channels
(PARDO)

TOPIC 2: Invertebrate recordings
(FERBER)

TOPIC 3: Slice electrophysiology
(CARTER)

TOPIC 4: Channelrhodopsin photocurrent measurements and optogenetic stimulation of rat hippocampal neurons
(MAGER)
Practical Part

Week 1/2 Monday – Thursday from 13:30-18:00h ENI teaching labs

**Week 1** 02-06 May 2022 (Pardo)

*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

**Week 1** 02-06 May 2022 (Ferber)

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

*Techniques:* Single and double intracellular recording techniques; 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.

**Week 1/2** 02-06 May 2022 & 09-13 May 2022 (Carter)

*Topic:* Measurement of synaptic parameters in mouse hippocampal 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

**Week 2** 09-13 May 2022 (Mager)

*Topic:* Channelrhodopsin photocurrent measurements and optogenetic stimulation of rat hippocampal neurons

*Techniques:* Optogenetics, Patch-Clamp technique; Cell culture work; Data analysis; Adeno-associated virus mediated transduction; Photostimulation of rat hippocampal neurons

**Presentation of results & Cleaning-up:** Friday, ENI Lecture Hall & ENI Teaching Labs
## Lectures

**Week 1/2 Monday – Friday from 9:30h ENI lecture hall**

(open to all GGNB students)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Topic</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>Mon, 2 May 2022</td>
<td>09:30-11:00</td>
<td>Introduction to electrophysiological methods</td>
<td>Pardo</td>
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<tr>
<td>Mon, 2 May 2022</td>
<td>11:00-12:30</td>
<td>Heterologous expression and study of ion channels in oocytes</td>
<td>Pardo</td>
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<tr>
<td>Tue, 3 May 2022</td>
<td>11:00-12:30</td>
<td>Invertebrate model systems in neuroscience</td>
<td>Ferber</td>
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<tr>
<td>Wed, 4 May 2022</td>
<td>09:30-11:00</td>
<td>Basic electronics</td>
<td>Schliephacke</td>
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<tr>
<td>Wed, 4 May 2022</td>
<td>11:00-12:30</td>
<td>Sensory processing in leech</td>
<td>Kretzberg</td>
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<tr>
<td>Thu, 5 May 2022</td>
<td>09:30-11:00</td>
<td>Electrophysiological instrumentation</td>
<td>Schliephacke</td>
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<tr>
<td>Thu, 5 May 2022</td>
<td>11:00-12:30</td>
<td>Voltage gated ion channels</td>
<td>Pardo</td>
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<tr>
<td>Fri, 6 May 2022</td>
<td>09:30-11:00</td>
<td>Calcium imaging techniques</td>
<td>Milosevic, online</td>
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<tr>
<td>Fri, 6 May 2022</td>
<td>11:00-12:30</td>
<td>Ligand-gated channels</td>
<td>Nicke</td>
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<tr>
<td>Mon, 9 May 2022</td>
<td>09:30-11:00</td>
<td>Introduction to slice electrophysiology</td>
<td>Carter</td>
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<tr>
<td>Mon, 9 May 2022</td>
<td>11:00-12:30</td>
<td>Introduction to optogenetic techniques</td>
<td>Mager</td>
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<tr>
<td>Tue, 10 May 2022</td>
<td>09:30-11:00</td>
<td>Electrophysiology and imaging methods monitoring hair cell synapse</td>
<td>Pangrsic</td>
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<tr>
<td>Wed, 11 May 2022</td>
<td>09:30-11:15</td>
<td>Lipids, Fusion and Membrane Properties</td>
<td>Woodbury</td>
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<td>11:15-13:00</td>
<td>Data acquisition, noise, and the FFT</td>
<td>Woodbury</td>
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<td>Thu, 12 May 2022</td>
<td>09:30-11:00</td>
<td>Chronic implants and wireless electrophysiology in freely moving animals</td>
<td>Gall</td>
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<tr>
<td>Thu, 12 May 2022</td>
<td>11:00-12:30</td>
<td>Ion channels and perception</td>
<td>Draeger</td>
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<tr>
<td>Fri, 13 May 2022</td>
<td>09:30-11:00</td>
<td>fMRI guided in vivo electrophysiology</td>
<td>Schwiedrzik</td>
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