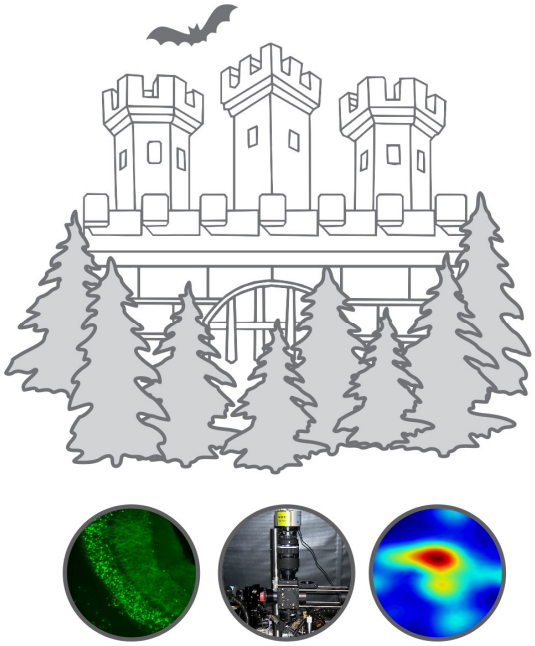

Transylvanian Experimental Neuroscience

Summer School (TENSS 2012)

www.tenss.ro

June 1-15, 2012, Pike Lake, Romania

Final program

Friday – June the 1st

7:30 – 8:30 [Breakfast]

8:30 – 09:15
[Introduction and logistics]
Why have this course and what we hope to achieve, overview of what will follow and what are the expectations (Adam Kampff, Florin Albeanu & Raul Mureşan).

09:15 – 11:15
[Lecture] Basic Optics. Nature of light, optical elements – lenses and mirrors, image formation, diffraction and resolution (Florin Albeanu).

11:15 – 11:30 [Tea/Coffee break]

11:30 – 12:30
[Lab session] Lenses. Convex and concave lenses. How to determine focal length of a lens? Forming real and virtual images with one lens (Students divide into 4 groups).

12:30 – 14:00 [Lunch]

14:00 – 16:00
[Lab session] Simple microscopes. Image formation with two lenses – finite and infinite conjugate systems. Telescopes - Beam expanders. Combination of lenses - doublets and composite optical elements.

16:00 – 18:00
[Lecture] Basic microscopy – Illumination systems and objectives. Introduction to microscopes. Critical vs. Koehler illumination. Numerical aperture, resolution and depth of field (Priyanka).

18:00 – 18:15 [Tea/Coffee break]

18:15 – 21:00
[Lab session] Koehler illumination. Building a Koehler illumination based microscope – Image your favorite sample. Modulating Numerical Aperture – effects on depth of field and resolution.

21:00 – 22:00 [Dinner]

22:00 – 22:45
[Round up] Image of the day.

22:45 – 24:00
[Lecture] Advanced light microscopy techniques - Phase contrast and Differential Interference Contrast microscopy (Priyanka).

Saturday – June 2nd

7:30 – 9:00 [Breakfast]

9:00 – 11:15
[Lecture] Fluorescence microscopy. Fluorescence, excitation/emission, FRAP, FLIM, FRET, photoactivation, photoconversion. Light sources – lamps, LEDs. Point spread function and resolution (Florin Albeanu).

11:15 – 11:30 [Tea/Coffee break]

11:30 – 12:30
[Lecture] Detectors. Photodiodes, cameras and PMTs (Adam Kampff)

12:30 – 14:00 [Lunch]

14:00 – 16:00
[Lab session] How to build a fluorescence microscope? Converting Koehler illumination setups to fluorescence microscopes.

16:00 – 17:15
[Lecture] Noise in images. Shot noise, dark noise, read out noise (Adam Kampff).

17:15 – 17:30 [Tea/Coffee break]

17:30 – 19:30
[Lab session] Noise measurements, Fluorescence measurements with beads - PSF. Resolution – check different objectives of different magnification/NA.

19:30 – 21:00
[Lecture] Image analysis with ImageJ (Ashesh Dhawale).

21:00 – 22:00 [Dinner]

22:00 – 22:45
[Round up] Image of the day.

22:45 – 24:00
[Lecture] Fluorescent probes – GFP and GFP variants, functional integrators – organic calcium dyes, voltage dyes, synaptopHluorin, ratiometric indicators (Juan Burrone & Florin Albeanu).

Sunday – June 3rd

7:00 – 7:45 [Breakfast]

8:00 – 21:00
[Off] Trip through Transylvania – Salt mine in Turda, Roşia Montană

21:00 – late evening
[Dinner & discussions]

Monday – June 4th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Synapses - Physiology of the synapse, release modes, vesicle pools (Venki Murthy)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] Synaptic plasticity - Hebbian plasticity, LTP, LTD, short term plasticity, homeostasis, pre- and postsynaptic mechanisms (Juan Burrone)

12:30 – 14:00 [Lunch]

14:00 – 15:00
[Lecture] Fun with electronics – Designing amplifiers and filters (Mehrab Modi).

15:00 – 15:30
[Lecture] Dye loading in brain slices (Mehrab Modi).

15:30 – 18:30
[Lab session] Monitoring Local field potentials – electrophysiology and calcium imaging. Recording LFPs in brain slices via extracellular electrodes and SpH/calcium imaging. Plasticity protocols demo – LTP and LTD .

18:30 – 18:45 [Tea/Coffee break]

18:45 – 20:00
[Lecture] Making sense of fluorescence. df/f, dynamic range, background subtraction, ratiometric analysis, bleaching subtraction, spatial filtering, deconvolution (Ashesh Dhawale).

20:00 – 21:00
[Research Lecture] Synaptic maturation and balancing mechanisms (Juan Burrone)

21:00 – 22:00 [Dinner]

22:00 – 22:45
[Round up] Fluorescence movies.

22:45 – 24:00
[Lecture] Debates at the synapse: pre- vs. postsynaptic processes; different modes of vesicle release (Juan Burrone & Venki Murthy)

Tuesday – June 5th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Intrinsic optical Imaging (Mark Hubener)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] Structural plasticity – visual cortex – using both intrinsic and 2p imaging in tandem (Mark Hubener)

12:30 – 14:00 [Lunch]

14:00 – 18:00
[Lab session] Wide field fluorescence microscopy and intrinsic imaging. Assemble custom microscopes for intrinsic and fluorescence imaging. Monitor odor evoked signals in the olfactory bulb using the two techniques and compare results.

18:00 – 19:30
[Presentation] National Instruments (Vlad Zileriu)

19:30 – 21:00
[Lecture] Mapping the auditory cortex – structural and functional plasticity. Intrinsic Optical Imaging and two-photon imaging (Simon Rumpel)

21:00 – 22:00 [Dinner]

22:00 – 22:45
[Round up] Comparison of fluorescence and intrinsic optical signals.

22:45 – late evening
[Continuation of afternoon lab session, drinks, discussions]

Wednesday – June 6th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Light activated channels – PX2 channel, Chr2 and its variants, Halo/Arch, new developments (Venki Murthy)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] Optogenetic methods to dissect neuronal circuits – a few interesting examples – PINP, CRACM, etc. (Venki Murthy).

12:30 – 14:00 [Lunch]

14:00 – 15:00
[Lecture] Basics of electrophysiology. Electrodes – impedence and dipoles (Adam Kampff).

15:00 – 19:30
[Lab session] Electrophysiology in a dish and optogenetics with a projector.

1. Build custom photo-stimulation setups using a DLP projector.
2. Understand basic principles of extracellular recordings and make tetrodes.
3. Demonstration: photo-stimulation and extracellular tetrode recordings.

19:30 – 21:00
[Lecture] Viral methods of labeling, monitoring, altering, tracing – AAV, lenti, pseudo rabies, rabies viruses (Botond Roska)

21:00 – 22:00 [Dinner]

22:00 – late evening
[Continuation of afternoon lab session, drinks, discussions]

Thursday – June 7th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Scanning Microscopy – Confocal, 2p, lasers (Florian Engert)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30

[Lecture] Building 2pm microscope theory (Florian Engert)

12:30 – 14:00 [Lunch]

14:00 – 19:15
[Lab session] 2p microscopy, electrophysiology and photostimulation

- **Group A,B:** Build a custom 2-photon microscope
- **Group C:** Single unit tetrode recordings with photo-stimulation using a DLP projector
- **Group D:** Single unit tetrode recordings in different brain regions

19:15 – 19:30 [Tea/Coffee break]

19:30 – 21:00
[Lecture] Neuronal connectomics – Imaging approaches – Brainbow, viral approaches, electron microscopy, electro-physiology approaches (Simon Rumpel & Tom Mrsic-Flogel)

21:00 – 22:00 [Dinner]

22:00 – late evening
[Continuation of afternoon lab session, drinks, discussions]

Friday – June 8th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Neuronal circuits and behavior in the zebra fish – 2p imaging and optogenetic manipulations (Florian Engert)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] 2p in vivo imaging – calcium indicators (Tom Mrsic-Flogel)

12:30 – 14:00 [Lunch]

14:00 – 18:00
[Lab session] 2p microscopy, electrophysiology and photostimulation

- **Group A,B:** Imaging using the custom and commercial 2p microscopes
- **Group C:** Single unit tetrode recordings in different brain regions
- **Group D:** Single unit tetrode recordings with photo-stimulation using a DLP projector

18:00 – 19:30
[Lecture] Coding Strategies (Rate versus Synchrony – temporal coding) (Wolf Singer)

19:30 – 21:00
[Lecture] Molecules at the synapse (Hannah Monyer)

21:00 – 22:00
[Dinner]

22:00 – 23:30
[Lecture] Introduction to Labview and hardware control (Adam Kampff)

Saturday – June 9th

7:00 – 7:40
[Breakfast]

8:00 – 21:00
[Off] Trip through Transylvania – Sighişoara, Biertan, Moşna, Mediaş

21:00 – late evening
[Dinner & discussions]

Sunday – June 10th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Patch Clamp – In vivo patching in anesthetized and awake head-fixed rodents (Tomas Hromadka)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] Electrophysiology – Cat setup, anesthesia, multielectrode probes, filtering spikes and LFPs, single units, field recordings (Danko Nikolić)

12:30 – 14:00 [Lunch]

14:00 – 19:30
[Lab session] In vivo patching and continuation of 2p microscopy, electrophysiology and photostimulation.

Group A: In vivo patching demo and single unit recordings in different brain regions
Group B: In vivo patching demo and single unit recordings with photo-stimulation using a DLP
Group C,D: Build a custom 2-photon microscope

19:30 – 21:00
[Lecture] Electrode arrays and silicon probes: from 1 to 64 to 10,000 channels; applications (Adam Kampff)

21:00 – 22:00 [Dinner]

22:00 – late evening
[Continuation of afternoon lab session, drinks, discussions]

Monday – June 11th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Electrophysiology analysis 1 (spike sorting, PSTH, CCH – examples of analyses) (Danko Nikolić)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] Advances in neural ensemble recording and functional connectomics. Current and future developments in *in vivo* neural ensemble recording technologies and also the use of neural-activity dependent immediate-early genes combined with retrograde and transsynaptic tracing for functional connectomics (Bruce McNaughton)

12:30 – 14:00 [Lunch]

14:00 – 19:30
[Lab session] Continuation of In vivo patching, 2p microscopy, electrophysiology and photostimulation.

- **Group A:** Single unit recordings with photo-stimulation using a DLP
- **Group B:** Single unit recordings in different brain regions
- **Group C,D:** In vivo patching demo and Imaging using the custom and commercial 2p microscopes

19:30 – 21:00
[Lecture] "Doughnuts in the brain". The toroidal attractor model for cognitive mapping in MEC, the entorhinal origin of attractor dynamics in CA3 (i.e., CA3 is not a general purpose autoassociator), hippocampal neocortical interactions and the extraction of knowledge from memory (Bruce McNaughton)

21:00 – 22:00 [Dinner]

22:00 – 23:00
[Round up] 2p microscopy

23:00 – late evening
[Open lab session, drinks, discussions]

Tuesday – June 12th

7:30 – 9:00 [Breakfast]

9:00 – 10:30
[Lecture] Electrophysiology analysis 2 (rate codes, multineuron patterns, spectral techniques) (Raul Mureşan)

10:30 – 10:45 [Coffee break]

10:45 – 11:30
[Lecture] Electrophysiology analysis 3 (scaled correlation) (Danko Nikolić)

11:30 – 13:00 [Lunch]

13:00 – 21:00
[Off] Afternoon trip to Cluj-Napoca and surroundings

21:00 – 22:00
[Dinner]

22:00 – late evening
[Open lab session, drinks, discussions]

Wednesday – June 13th

7:30 – 9:00 [Breakfast]

9:00 – 10:45
[Lecture] Neuronal oscillations – general issues, definition, properties (György Buzsáki)

10:45 – 11:00 [Tea/Coffee break]

11:00 – 12:30
[Lecture] Functional role of neuronal oscillations (György Buzsáki)

12:30 – 14:00 [Lunch]

14:00 – 18:30
[Lab session] Continue analsysis – ephys data; Data pertaining to oscillations, lfp signals.

18:30 – 21:00
[Lecture] Thalamocortical oscillations and sleep – a view from within neurons, glia and blood vessels (Florin Amzica)

21:00 – 22:00 [Dinner]

22:00 – late evening
[Open lab session, drinks, discussions]

Thursday – June 14th

7:30 – 9:00 [Breakfast]

9:00 – 10:30
[Demo] Record your brain waves – EEG signals (Ioana Țincaş & Vlad Moca)

10:30 – 10:45 [Tea/Coffee break]

10:45 – 12:30
[Lecture] Neurocognitive problems and related data concerning visual selective attention (Leonardo Chelazzi)

12:30 – 14:30 [Lunch]

14:30 – 21:00
[Lab session] Students will revisit one topic/technique that they got very interested in/got very confused about and will explore it in more depth with help from the instructors and TAs

21:00 – 22:00
[Dinner]

22:00 – late evening
[Open lab session, drinks, discussions]

Friday – June 15th

7:30 – 9:00 [Breakfast]

9:00 – 11:30
[Round table discussion] What was confusing, what was interesting, what did you learn?

11:30 – 13:00 [Lunch]

13:00 – 21:00
[Packing up - Course materials and equipment]

21:00 – 22:00 [Dinner]