

Sunday March 21

3:00 pm Check-in

6:00 pm Reception

7:00 pm Dinner

8:00 pm Introduction and Welcome: Tobias Bonhoeffer

8:05 pm Session 1: Keynote Address
Dmitri Chklovskii, Janelia Farm Research Campus/HHMI
Does neuronal structure matter?

Monday March 22

- 7:30 am Breakfast
- 9:00 am Session 2: Development**
Chair: Yi Zuo
- 9:00 am **Hollis Cline**, The Scripps Research Institute
Combined in vivo time-lapse imaging and serial EM construction reveals the relation between branch dynamics and synapse dynamics in vivo
- 9:30 am **Jeff W. Lichtman**, Harvard University
Connectivity gradients in the developing neuromuscular system
- 10:00 am **Barbara Chapman**, University of California, Davis
The role of neuronal activity in the development of connections in the visual system
- 10:30 am Break and Group Photo
- 11:00 am Session 3: Imaging functional plasticity**
Chair: Josh Trachtenberg
- 11:00 am **David Fitzpatrick**, Duke University Medical Center
Experience-guided construction of cortical circuits: Visual motion and the development of direction selectivity
- 11:30 am **Michael P. Stryker**, University of California, San Francisco
Plasticity in layer 2/3 of developing visual cortex
- 12:00 pm **Axel Nimmerjahn**, Stanford University
Functional signaling and structural plasticity of glial networks
- 12:30 pm Lunch
- 1:00 pm Tour (optional)
- 2:15 pm Session 4: Structural plasticity and motor learning**
Chair: David Linden
- 2:15 pm **Wenbiao Gan**, New York University
Stably-maintained dendritic spines support lifelong memory storage
- 2:45 pm **Yi Zuo**, University of California, Santa Cruz
Rapid formation and selective stabilization of synapses for enduring motor memories

- 3:15 pm **David Linden**, The Johns Hopkins University
Axonal motility and its modulation by activity in the intact adult cerebellum
- 3:45 pm Break
- 4:15 pm Session 5: Simultaneous imaging of neuronal structure and function**
Chair: Karel Svoboda
- 4:15 pm **Henry Lütcke**, Brain Research Institute
*Repeated functional imaging of identified neuronal populations with Yellow
cameleon 3.60*
- 4:30 pm **Daniel Huber**, Janelia Farm Research Campus/HHMI
*Long-term imaging of cortical activity with genetically encoded calcium
indicators*
- 4:45 pm Open Discussion**
Chair: Karel Svoboda
- 5:30 pm Poster Reception 1
- 7:00 pm Dinner
- 8:00 pm Session 6: Ultrastructural analysis of neuronal structure**
Chair: Stephen Smith
- 8:00 pm **Kristen Harris**, University of Texas, Austin
Structural synaptic plasticity in hippocampus: LTP, before and beyond
- 8:30 pm **Graham Knott**, Ecole Polytechnique Federale de Lausanne (EPFL)
The growth of dendritic spines in the adult brain
- 9:00 pm Refreshments available at Bob's Pub

Tuesday March 23

7:30 am Breakfast

9:00 am Session 7: Mechanisms in reduced preparations
Chair: Tobias Bonhoeffer

9:00 am **Erin Schuman**, HHMI/California Institute of Technology
Approaches for labeling new synthesized proteins in identified neuronal circuits

9:30 am **Haruo Kasai**, University of Toyko
In vivo two-photon uncaging in the adult brain

10:00 am **Ryohei Yasuda**, Duke University Medical Center
Signaling pathways underlying structural and functional plasticity of dendritic spines

10:30 am Break

11:00 am Session 8: Visual system structural plasticity
Chair: Holly Cline

11:00 am **Mark Hübener**, Max Planck Institute of Neurobiology
Activity dependent loss of dendritic spines of inhibitory neurons in mouse visual cortex

11:30 am **Elly Nedivi**, Massachusetts Institute of Technology
Large volume imaging of interneuron dendritic arbors at high-resolution: costs and benefits

12:00 pm **Ania Majewska**, University of Rochester
Imaging synaptic re-organization in the visual cortex in vivo

12:30 pm Lunch

1:00 pm ScanImage Workshop (optional)
Vijay Iyer (Private Dining Room)

2:00 pm Session 9: Structural plasticity in nervous system dysfunction
Chair: Vincenzo De Paola

2:00 pm **Bradley Hyman**, Massachusetts General Hospital
In vivo imaging and Alzheimer disease models

2:30 pm **Tim Murphy**, University of British Columbia
Circuit and synapse level plasticity after stroke

- 3:00 pm **Carlos Portera-Cailliau**, University of California, Los Angeles
Chronic imaging of dendritic plasticity and local hemodynamics in peri-infarct cortex
- 3:30 pm Break
- 4:00 pm Break-out Sessions (rooms noted below)**
- Group 1:** Analysis of microstructural dynamics: How do we get at ground truth?
Chairs: Anthony Holtmaat and Holly Cline (**Photon Room**)
- Group 2:** Combining time-lapse imaging with retrospective ultrastructural analysis: How do we make this routine?
Chairs: Stephen Smith and Graham Knott (**Electron Room**)
- Group 3:** Learning-related plasticity: Are we looking at the relevant neurons and synapses and how will we know?
Chairs: Elly Nedivi and Michael Stryker (**Axon Room**)
- 5:00 pm Session 10: Reconvene in Seminar Room for summary and group presentations**
- 5:45 pm Poster Reception 2
- 7:00 pm Dinner
- 8:00 pm Session 11: Structural plasticity in birds and primates**
Chair: Karel Svoboda
- 8:00 pm **Stelios Smirnakis**, Baylor College of Medicine
Visual cortex plasticity in adulthood: Why consensus remains elusive
- 8:30 pm **Richard Mooney**, Duke University
Rapid structural and functional changes to synapses at the onset of behavioral learning
- 9:00 pm **Sally A. Marik**, The Rockefeller University
Axonal dynamics of excitatory and inhibitory neurons in somatosensory cortex
- 9:30 pm Refreshments available at Bob's Pub

Wednesday March 24

- 7:30 am Breakfast
- 9:00 am Session 12: Non-longitudinal experiments in deep brain structures**
Chair: Linda Wilbrecht
- 9:00 am **Pico Caroni**, Friedrich Miescher Institute for Biomedical Research (FMI)
Learning-related structural remodeling in feedforward inhibition circuits
- 9:30 am **Linnaea E. Ostroff**, New York University
Fear and safety learning differentially affect synapse size and dendritic translation in the lateral amygdala
- 9:45 am **Michael Ashby**, National Institutes of Health
Combined structural and functional analysis of experience-dependent development of layer 4 barrel cortex
- 10:00 am **Jason P. Lerch**, Hospital for Sick Children
MRI of structural plasticity in mice
- 10:30 am Break
- 11:00 am Session 13: Closing and Discussion**
Chair: The organizers
- 12:00 pm Lunch (To-go boxes available from servery for those on first shuttle) and Departure
- 12:30 pm First shuttle to Dulles
1:15 pm Second shuttle to Dulles
2:00 pm Last shuttle to Dulles

Topics for break-out groups - Tuesday 4:00 pm (rooms noted below)

Break-out groups should serve to discuss important issues in the field in a more intimate setting. Everyone is encouraged to attend. The group discussion and conclusions (if any) will be summarized in a joint session.

GROUP 1: Analysis of microstructural dynamics: How do we get at ground truth?
Anthony Holtmaat / Holly Cline (**Photon Room**)

Morphological changes of small synaptic structures reported in similar experiments, and using almost indistinguishable methods, are still all over the map. Substantial differences can creep in through subtle biases in analysis. Can measurement and reporting of morphological plasticity be improved? If so, how? Can we establish 'objective' criteria?

A related issue is: How do morphological changes relate to functional changes at synapses? Retrospective electron microscopy can provide a snapshot of what is going on, with a lot of hard work. Do we trust any fluorescent protein markers of synaptic plasticity? If so, what resolution is needed? Is conventional light microscopy good enough or do we need superresolution methods (STED, PALM, STORM, etc)? How about markers for filopodia vs spines? How might we use such markers? What kind of molecular tools do we need?

GROUP 2: Combining time-lapse imaging with retrospective ultrastructural analysis: How do we make this routine?
Stephen Smith / Graham Knott (**Electron Room**)

The combination of retrospective EM with long-term imaging is clearly very powerful, but very few groups have been able to do this successfully. Can recent developments in high-throughput, automated sectioning and imaging break this impasse and make ultrastructural analysis of imaged tissue routine? What are the bottlenecks? Is array tomography good enough to detect synapses?

GROUP 3: Learning-related plasticity: Are we looking at the relevant neurons and synapses and how will we know?
Elly Nedivi / Michael Stryker (**Axon Room**)

Numerous groups are measuring structural changes triggered by deprivation, activation, learning etc. Physiological studies of plasticity have revealed that learning occurs in specific synaptic pathways within well-defined circuits. How do we relate synaptic changes in single neurons to changes at the level of circuits? How do we know that we are looking at the relevant cells and synapses? What kind of molecular tools do we need to make progress?