Spatially Precise Optogenetics at Depth Incubator Meeting

Cracking Neural Circuits with Structured Illumination & Ultrafast Imaging in the Intact Brain

8-10 December 2013 ● OSA Headquarters ● Washington, D.C.

HOSTS: Hillel Adesnik, University of California, Berkeley, United States
Laura Waller, University of California, Berkeley, United States
Shy Shoham, Technion – Israel Institute of Technology, Israel

Exploring the role of optics in the BRAIN Initiative

Brain Research through Advancing Innovative Neurotechnologies

AGENDA

Sunday, 8 December 2013

18:30 Welcome Dinner
Ezme, 2016 P Street, NW

Monday, 9 December 2013

8:00 Breakfast
OSA Headquarters, 2010 Massachusetts, Ave., NW

8:30 Welcome & Opening Remarks
Elizabeth Rogan, Chief Executive Officer, OSA, United States
Hillel Adesnik, University of California, Berkeley, United States
Laura Waller, University of California, Berkeley, United States
Shy Shoham, Technion – Israel Institute of Technology, Israel

Session 1: Large Scale/High Speed Imaging and Photo-Stimulation in the Brain

8:50 Large-Scale High-Throughput Optical Imaging and Stimulation
Peter Saggau, Baylor College of Medicine, United States

9:20 Towards a Dynamic Map of Neuronal Circuits
Alipasha Vaziri, University of Vienna, Austria

9:40 Rapid 3D Optical Microscopic Imaging
Guoqiang Li, Ohio State University, United States

10:00 Depth and Speed: What are the Limits?
Elizabeth Hillman, Columbia University, United States

10:20 Coffee Break

10:40 Rapid Distributed Photo-stimulation and Imaging Using Holography and Temporal Focusing
Shy Shoham, Technion – Israel Institute of Technology, Israel

11:10 Multi-photon 3D Imaging and Control of Neurons
Darcy Peterka, Columbia University, United States

11:30 Optical Probing of Brain Circuits with Naturalistic Patterns of Neuronal Activation
Serena Bovetti, Italian Institute of Technology, Italy

11:50 Using Digital Holography for Stimulation of Multiple Neurons Distributed in 3D with Cellular Resolution and Physiological Timescales
Karl Kilborn, Inelligent Imaging Innovations, Inc. United States

12:10 Generalized Phase Contrast and Matched Filtering for Speckle-free Patterned Illumination
Darwin Palima, DTU Fotonik, Denmark

12:30 Lunch

Session 2: Imaging and Photo-stimulating Deep in Scattering Tissue

13:20 Deep, Fast Multiphoton Imaging
Chris Xu, Cornell University, United States

13:50 Patterning Light in 3D and through Scattering Media: Then and Now
Rafael Piestun, University of Colorado, Boulder, United States

14:10 Deep Tissue Molecular Imaging in Complex Biological Systems
Meng Cui, Howard Hughes Medical Institute, Janelia Farm, United States

14:30 Two-photon Microscopy with SLM-based Coherent Control for Deep Imaging in Scattering Tissue
Thomas Bifano, Boston University, United States

14:50 Ultrafast Time and Space Shaped Laser Pulses for Adaptive Functional Depth-resolved Imaging
Marcos Dantus, Michigan State University, United States

15:10 Coffee Break

15:30 Group Discussion

The need for speed:
Rapid scanning vs. planar imaging vs. parallel sparse illumination
How deep can we see and stimulate with light?
Are multi-modality methods the future?
Combining depth, speed and wide areas.

Session 3: New Imaging Tools / New Imaging Modalities

16:20 Neuron-based Screening for Improved Red Fluorescent Genetically-encoded Calcium Indicators

Hod Dana, Howard Hughes Medical Institute, Janelia Farm, United States

16:40 3D Optical Waveguide Arrays for In-vivo Optogenetics: Development and Application

Anthony Zorzos, Massachusetts Institute of Technology, United States

17:00 Micron-scale LED Probes for In-vivo Spatiotemporal Optogenetic Activation of Neural Circuits

Keith Matheison, University of Strathclyde, United Kingdom

17:20 Flexible, Cellular-Scale Optoelectronics for Wireless Optogenetics

Jordan McCall, Washington University School of Medicine, United States

17:40 Waveguide Spatial Light Modulators

Daniel Smalley, Brigham Young University, United States

18:00 Break-out Group Discussion

Benchmarking imaging and stimulation systems; how to choose among a diversity of illumination geometries & devices.
What is more appropriate for the field: brain observatories or a distributed observation model?

19:10 Dinner

Bistro Bistro, 1727 Connecticut Ave, NW

Tuesday, 10 December 2013

8:30 Breakfast
OSA Headquarters, 2010 Massachusetts, Ave., NW

Session 4: Applications & Analysis of Big Imaging Data Sets

9:00 Initial Attempts at Imaging Network Learning in Frontal Cortex
Joshua Trachtenberg, University of California, Los Angeles, United States

9:25 A Cellular-resolution, Functional Map of Mouse Barrel Cortex
Simon Peron, Howard Hughes Medical Institute, Janelia Farm, United States

9:50 Measuring Network Activity with 3D Random Access Two-Photon Imaging
James Cotton, Baylor College of Medicine, United States

10:15 Morpho-functionality of Intact Neural Networks: From Single Cell to Whole Organ
Francesco Pavone, European Laboratory for Non-Linear Spectroscopy, Italy

10:40 Coffee Break

11:00 Break-out Group Discussions
What are the major challenges for deep brain imaging/photo-stimulation and how can they be solved?
Next steps in radically new applications associated computational tools.

12:20 Break-out Groups Reports
Hillel Adesnik, University of California, Berkeley, United States
Laura Waller, University of California, Berkeley, United States
Shy Shoham, Technion – Israel Institute of Technology, Israel

12:50 Summary, Conclusion & Next Steps
Hillel Adesnik, University of California, Berkeley, United States

13:00 Lunch/Adjourn