

SCHEDULE OF EVENTS

8:00 a.m.

Registration & Continental Breakfast

Alumni Gallery, Room 1-65, W.T. Young Library

8:50 a.m.

Welcome

Dr. Lisa Cassis

Vice President for Research

UKAA Auditorium, room 1-62, W.T. Young Library

9:00 a.m.

Dr. Erin Calipari

Vanderbilt University

UKAA Auditorium, room 1-62, W.T. Young Library

“A novel mechanism for hormonal regulation of reward circuits in the brain contributes to addiction vulnerability in females”

There has been substantial effort focused on understanding the pathophysiology of addiction, where females represent a particularly vulnerable population. Here we identify and define a novel mechanism by which the sex steroid hormone estradiol regulates reward via direct actions on nicotinic acetylcholine receptors (nAChRs) in the nucleus accumbens – a brain region central to motivation and its dysregulation in drug addiction. We then define how these actions specifically alter dopamine neurotransmission. We find that estradiol increases dopamine release acutely through direct potentiation of $\alpha 4\beta 2^*$ nAChRs on dopamine terminals and following long-term exposure this alters the ability of these receptors to regulate dopamine function and behavior. In all, this work sheds light on the effects of non-classical sex steroid hormone-receptor interactions on dopamine neurotransmission which will be particularly important in informing better pharmacotherapeutic approaches for the treatment of addiction in women.

10:00 a.m.

Coffee Break & Refreshments

Alumni Gallery, Room 1-65, W.T. Young Library

10:30 a.m.

Dr. Tim Harris

Johns Hopkins University

UKAA Auditorium, room 1-62, W.T. Young Library

“High capacity electrophysiology: How we got here and where can we go”

Modern microelectronics is transforming electrophysiology research tools and results. Most prominent in this space are the Neuropixels probes (now more than 7000 probes in 600+ labs) and INTAN multiplexer chips, the core of nearly every other recording system. This talk will review the history of ephys, show the origin of Neuropixels and other technologies, discuss the data digestion logjam this new capacity has generated, and discuss the various new probes (for primates and, even smaller probes from NIH funded projects) emerging from this effort.

11:30 a.m.

Lunch & Break

1:00 p.m.

Dr. Elizabeth Hillman

Columbia University

UKAA Auditorium, room 1-62, W.T. Young Library

“Understanding the brain with high-speed 3D imaging of cell structure, function and identity”

A growing palette of multicolor fluorescent proteins, dyes and reporters of cellular function can label almost anything within a living organism. However, reading out these signals is limited by the slow 3D imaging speeds of conventional point-scanning microscopes. We developed swept confocally-aligned planar excitation (SCAPE) microscopy to enable 3D imaging of living samples at cellular resolution at up to 300 volumes per second, with high signal to noise and minimal photodamage. We have applied SCAPE microscopy to capturing calcium activity in neurons throughout freely moving *C. elegans* and fruit fly larvae, and across the brains of behaving fruit flies and zebrafish larvae. Multispectral implementations can resolve the function of different cell types, while single-photon, two-photon and meso-scale systems can capture 3D neuronal dynamics in the in-vivo mouse brain and olfactory epithelium. Additional versions

enable high-throughput and high-content imaging of fresh, fixed, cleared and expanded samples including the immunostained human brain.

2:00 p.m.

Break & Poster Session Set-Up

Alumni Gallery; Jacobs Science Building, Atrium

2:30 p.m.

Dr. Baljit Khakh

University of California, Los Angeles

UKAA Auditorium, room 1-62, W.T. Young Library

“Cells That Tile Your Brain: Astrocyte Roles in Neural Circuits”

Astrocytes tile the entire central nervous system, but their functions in neural circuits and their roles in mammalian behaviour and disease are incompletely defined. I will report data from my laboratory whereby we used state-of-the-art methods and new genetic approaches to reduce and activate striatal astrocyte signaling in vivo and also to assess their molecular mechanisms. Our data show that brain area specific astrocytes regulate neural circuits to shape behaviour and also contribute to phenotypes associated with psychiatric and neurodegenerative diseases.

3:30-5:00 p.m.

Poster Session

Jacobs Science Building, Atrium

— 47th — ANNUAL NAFF SYMPOSIUM

Innovation in Molecular Neuroscience

April 1, 2022

W.T. Young Library

chem.as.uky.edu/naff-symposium

 **College of Arts
and Sciences**
Department of Chemistry

47th Annual Naff Symposium

Innovation in Molecular Neuroscience

April 1, 2022

GUEST SPEAKERS



DR. ERIN CALIPARI
Vanderbilt University

Dr. Calipari received her PhD in Neuroscience in 2013 in the laboratory of Dr. Sara Jones at Wake Forest University School of Medicine where she studied how self-administered drugs altered dopaminergic function to drive addictive behaviors. She then went on to complete her postdoctoral training with Dr. Eric Nestler at Icahn School of Medicine at Mount Sinai, where she used circuit probing techniques to understand the temporally specific neural signals that underlie motivation and reward learning. She is currently an Assistant Professor at Vanderbilt University in the Department of Pharmacology. Her independent work seeks to characterize and modulate the precise circuits in the brain that underlie both adaptive and maladaptive processes in reward, motivation, and associative learning.



DR. TIM HARRIS
Johns Hopkins University

Timothy Harris is a research professor in the Department of Biomedical Engineering. He leads the Applied Physics and Instrumentation Group at the HHMI Janelia Research Campus, and is the originator of the project that produced the Neuropixels Si probe for extracellular recording in animals, mostly mice, and rats. He shares his time between Janelia and Johns Hopkins and is working on projects to enable recording 10-20,000 neurons in rodents and 30-50,000 neurons in non-human primates, as well as stimulate with high resolution. He received a BS in Chemistry at California Polytechnical State University, San Luis Obispo, and a PhD in Analytical Chemistry at Purdue University.



DR. ELIZABETH HILLMAN
Columbia University

Elizabeth Hillman is professor of biomedical engineering and radiology at Columbia University and a member of the Mortimer B. Zuckerman Mind Brain Behavior Institute and Kavli Institute for Brain Science at Columbia. Hillman received her undergraduate degree in physics and Ph.D. in medical physics and bioengineering at University College London and completed post-doctoral training at Massachusetts General Hospital/Harvard Medical School. In 2006, Hillman moved to Columbia University, founding the Laboratory for Functional Optical Imaging. Hillman's research program focuses on the development and application of optical imaging and microscopy technologies to capture functional dynamics in the living brain. Most recently, she developed swept confocally aligned planar excitation (SCAPE) microscopy, a technique capable of very high speed volumetric imaging of neural activity in behaving organisms such as adult and larval Drosophila, zebrafish, C. elegans and the rodent brain. Hillman's research program also includes exploring the interrelation between neural activity and blood flow in the brain, as the basis for signals detected by functional magnetic resonance imaging (fMRI). Hillman is a fellow of the Optical Society of America (OSA), the society of photo-optical instrumentation (SPIE) and the American Institute for Medical and Biological Engineering (AIMBE). She has received the OSA Adolf Lomb Medal for contributions to optics, as well as early career awards from the Wallace Coulter Foundation, National Science Foundation and Human Frontier Science Program.



DR. BALJIT KHAKH
University of California, Los Angeles

Baljit Khakh completed his Ph.D. at the University of Cambridge in the laboratory of Patrick A. Humphrey. He completed postdoctoral fellowships in the laboratory of Graeme Henderson at the University of Bristol, and then in the laboratory of Henry A. Lester and Norman Davidson at California Institute of Technology. In 2001, Khakh became Group Leader at the MRC Laboratory of Molecular Biology in Cambridge, and in 2006 he moved to the University of California, Los Angeles where he is Professor of Physiology and Neurobiology. Khakh's work has been recognized, including with the NIH Director's Pioneer Award, the Paul G. Allen Distinguished Investigator Award, and the Outstanding Investigator Award (R35) from NINDS.

2022 NAFF Committee Members:

Jason DeRouche (UKY Chemistry)

Lance Johnson (UKY Physiology)

Brandon Henderson (Marshall University)

 **College of Arts
and Sciences**
Department of Chemistry

For more information, contact Dr. Chris Richards at chris.richards@uky.edu.