

# Special Lectures

All featured lectures will be held at McCormick Place, Hall B1.

## THEME A: DEVELOPMENT

### Genetic Dissection of Neocortical Circuits CME



**Z. Josh Huang, PhD**  
*Cold Spring Harbor Laboratory*  
Sunday, Oct. 18, 8:30–9:40 a.m.

The computational power of the neocortex emerges from a basic neural architectural plan rooted in the genome and conserved across species. Whereas a set of glutamatergic projection neurons constitute inter-areal processing streams and cortical output channels, diverse GABAergic interneurons regulate the spatiotemporal configuration of neural ensembles. Systematic cell targeting and cell fate mapping provide entry points for integrating multiple approaches toward understanding the assembly and organization of cortical circuits. This lecture will discuss the progress and prospect on genetic targeting of glutamatergic and GABAergic neurons in the mouse, focusing on the construction and function of a chandelier cell-pyramidal cell module.

### Development and Reprogramming of Neuronal Diversity in the Central Nervous System CME



**Paola Ariotta, PhD**  
*Harvard University*  
Monday, Oct. 19, 11:30–12:40 p.m.

Support contributed by: Lilly USA, LLC

The mammalian central nervous system (CNS) contains an unparalleled diversity of neuronal subtypes, which are largely generated during embryonic development and maintained unchanged in the adult. This lecture will cover progress made in understanding the regulatory, molecular logic that shapes neuronal diversity in the embryo, consider its importance for CNS assembly and function, and discuss recent evidence for the unexpected capacity of central neurons to post-mitotically “reprogram” their class-specific features.

### The Genetic Logic of Synapse Formation and Axon Regeneration CME



**Yishi Jin, PhD**  
*Howard Hughes Medical Institute*  
*University of California, San Diego*  
Wednesday, Oct. 21, 8:30–9:40 a.m.

Genetic dissection in *C. elegans* has long been a powerful approach to discover the function of genes and to elucidate the molecular and cellular network underlying how synapses form and function. Recent technological innovation using laser surgery of single axons and *in vivo* imaging has also made *C. elegans* a new model for axon regeneration. Importantly, genes regulating synaptogenesis and axon regeneration are highly conserved in function across animal phyla. This lecture will focus on the key findings and discuss implications to human health.

### THEME B: NEURAL EXCITABILITY, SYNAPSES, AND GLIA: CELLULAR MECHANISMS From Spontaneous Neurotransmitter Release to Rapid Antidepressant Action CME



**Ege T. Kavalali, PhD**  
*University of Texas Southwestern*  
*Medical Center*  
Sunday, Oct. 18, 10–11:10 a.m.

Recent studies report a key role for spontaneous neurotransmission in regulation of synaptic plasticity, homeostasis, and behavior such as rapid antidepressant responses. There is also increasing evidence that the presynaptic basis of spontaneous neurotransmitter release events and their postsynaptic targets are segregated from those of evoked release, suggesting an autonomous role for spontaneous neurotransmission in neuronal signaling. This presentation will discuss these recent studies on the mechanisms and functions of spontaneous neurotransmitter release.

### Strange Synapses and Circuits of the Basal Ganglia CME



**Bernardo Sabatini, MD, PhD**  
*Harvard Medical School*  
Tuesday, Oct. 20, 8:30–9:40 a.m.

The basal ganglia are a phylogenetically old and evolutionarily conserved set of nuclei crucial for goal-oriented motor action. Nevertheless, many aspects

of their circuitry, function, and regulation remain mysterious. Sabatini will present recent work from his group revealing complex and unexpected interactions between nuclei of the basal ganglia. These include the surprisingly widespread use of multiple fast acting neurotransmitters by neuromodulatory systems. The results will be discussed in terms of action initiation and reinforcement.

### Inhibition and Excitation in the Cerebellar Nuclei CME



**Indira M. Raman, PhD**  
*Northwestern University*  
Tuesday, Oct. 20, 1–2:10 p.m.

Neurons in the cerebellar nuclei integrate high-frequency inhibition from convergent Purkinje cells with excitation from diverse mossy fibers to generate cerebellar outputs that lead to regulation of precise motor behaviors. This lecture will include a discussion of the synaptic and cellular specializations of Purkinje neurons, mossy fibers, and neurons of the cerebellar nuclei that contribute to information coding by the cerebellum in mice.

### THEME C: DISORDERS OF THE NERVOUS SYSTEM Clinical Neuroscience Lecture Neurotrophin Signaling and Epileptogenesis: Mechanistic and Therapeutic Insights CME



**James O. McNamara, MD**  
*Duke University Medical Center*  
Sunday, Oct. 18, 11:30 a.m.–12:40 p.m.

The lack of preventive treatments for common diseases of the nervous system is a glaring unmet medical need. Temporal lobe epilepsy is a common and devastating disease. An episode of prolonged seizures in an otherwise healthy individual is thought to cause severe temporal lobe epilepsy emerging years later. Recent discoveries have identified targets and therapies to prevent this disease in experimental animals. This presentation will review these discoveries and focus on the causal role of excessive neurotrophin signaling in development of temporal lobe epilepsy.

## Striatal Synaptic Dysfunction in Parkinson's and Huntington's Diseases CME



**D. James Surmeier, PhD**  
*Feinberg School of Medicine  
Northwestern University  
Medical School*

Wednesday, Oct. 21, 10–11:10 a.m.

Traditional models of basal ganglia disorders are grounded in the assumption that network dysfunction is driven by alterations in intrinsic excitability of striatal neurons. Recent work has challenged this assumption, showing that mouse models of Parkinson's disease have profound cell-specific alterations in striatal synaptic strength and connectivity. Cell-specific synaptic dysfunction also is being found in mouse models of Huntington's disease. This talk will summarize this work and link it to the motor symptoms of these two diseases.

### THEME D: SENSORY AND MOTOR SYSTEMS

#### Cortical Control of Arm Movements:

#### A Dynamical Systems Perspective CME



**Krishna V. Shenoy, PhD**  
*Stanford University*

Tuesday, Oct. 20, 11:30 a.m.–12:40 p.m.

Investigating the neural control of arm movements has involved, primarily, either attempts to account for single-neuron responses in terms of tuning for movement parameters or attempts to decode movement parameters from populations of tuned neurons. These have led to many seminal advances but have not produced an agreed-upon conceptual framework. This lecture will review how a dynamical systems perspective may help researchers understand why motor cortical activity evolves the way it does, how it relates to movement parameters, and how a unified conceptual framework may result.

### THEME E: INTEGRATIVE SYSTEMS:

#### NEUROENDOCRINOLOGY, NEUROIMMUNOLOGY, AND HOMEOSTATIC CHALLENGE

#### GPS Mechanisms of Migrating Monarch Butterflies CME



**Steven M. Reppert, MD**  
*University of Massachusetts  
Medical School*  
Monday, Oct. 19, 8:30–9:40 a.m.

This lecture will focus on the navigational mechanisms exploited by eastern North American monarch butterflies during their iconic fall migration. This includes use of a

time-compensated sun compass and of a light-dependent inclination magnetic compass. Genomic and genetic strategies have been developed to define the genetic underpinning of the migration. The monarch butterfly has emerged as a model system to study the neural, molecular, and genetic basis of long-distance animal migration.

#### Neurocircuitry Controlling Feeding and Drinking Behaviors in Mice CME



**Richard Palmiter, PhD**  
*University of Washington*  
Wednesday, Oct. 21, 1–2:10 p.m.

The development of genetic, viral, and optical technologies has revolutionized approaches for dissecting neuronal circuits that control basic behaviors and physiological process, including ingestion. Selective activation of specific neurons stimulates robust feeding or drinking, while activation of other neurons inhibits feeding or drinking. Deciphering the neuronal circuits engaged by these manipulations and the molecular phenotype of neurons involved is an ongoing endeavor.

### THEME F: COGNITION AND BEHAVIOR

#### Making, Breaking, and Linking Engrams CME



**Sheena A. Josselyn, PhD**  
*Hospital for Sick Children*  
Saturday, Oct. 17, 2–3:10 p.m.

A fundamental goal of neuroscience is to understand how information is encoded, stored, linked, and used in the brain. The physical or functional representation of a memory (the memory trace or “engram”) is thought to be sparsely encoded over a distributed memory network. However, identifying the precise neurons that make up a given engram has challenged scientists since Karl Lashley conceded defeat in his “search for the engram” in 1950. This lecture will discuss new insights into how engrams are formed, linked, and used.

#### Uncertainty, Choice, and Dopamine CME



**Stan B. Floresco, PhD**  
*University of British Columbia*  
Tuesday, Oct. 20, 10–11:10 a.m.

We routinely evaluate choices where decisions and actions may or may not yield different types of rewards. These situations trigger competitive decision biases that reflect interplay between different prefrontal cortical,

amygdalar, striatal, and habenular nodes within dopaminergic circuitry. This lecture will discuss some of the interactions between these circuits that shape decision biases and underlie conflicting urges when evaluating options that vary in terms of potential risks and rewards.

#### A Causal Analysis of the Attentional Network CME



**Robert Desimone, PhD**  
*McGovern Institute for Brain  
Research at MIT (Massachusetts  
Institute of Technology)*

Wednesday, Oct. 21, 11:30 a.m.–12:40 p.m.

The most behaviorally-relevant stimuli in scenes are selected for processing and control over behavior (“attention”). The effects of selection are widespread, making it difficult to distinguish cause from effect in the attentional network. However, the flow of control can be inferred through the analysis of timing and the use of “causal” methods such as pharmacological inactivation and optogenetics to establish the impact of one circuit on another. This lecture will explore the emerging new insights into the biological mechanism of attention.

### THEME G: NOVEL METHODS AND TECHNOLOGY DEVELOPMENT

#### Nanoscopy With Focused Light: Principles and Applications CME



**Stefan W. Hell, PhD**  
*Max Planck Institute for  
Biophysical Chemistry*  
Sunday, Oct. 18, 1–2:10 p.m.

Throughout the 20<sup>th</sup> century, it was well accepted that lens-based light microscopy cannot discern details that are finer than half the wavelength of light (>200 nm). However, in the 1990s, it was discovered that this barrier can be effectively overcome such that fluorescent features can be resolved virtually down to molecular dimensions. This lecture will discuss the simple yet powerful physical principles that allowed researchers to overcome the diffraction limit with a special emphasis on STED and RESOLFT microscopy relating these nanoscopy “techniques to the neurosciences.”