Special Lectures

All lectures will take place in Ballroom 20 of the San Diego Convention Center. Overflow seating will be available in Hall A.

THEME A: DEVELOPMENT

Genetic Specification of Neuronal Identity CME

Oliver Hobert, PhD / Columbia University / Tuesday, Nov. 6, 1–2:10 p.m.

How is the enormous diversity of cell types in a nervous system genetically specified? The answer to this question lies in defining the gene regulatory mechanisms that control the expression of neuron type-specific gene batteries. In this lecture, studies on the genetic specification of many different neuronal cell types in the nematode *C. elegans* that have led to the discovery of some commonly used strategies, by which diverse neuronal identities are instructed, will be discussed.

THEME B: NEURAL EXCITABILITY, SYNAPSES, AND GLIA

Neuronal Diversity Within the Ventral Tegmental Area and Co-Release of Neurotransmitters CME

Marisela Morales, PhD / National Institute on Drug Abuse, NIH
Tuesday, Nov. 6, 11:30 a.m.–12:40 p.m.

The release of several neurotransmitters from a single neuron has been recognized for decades. Emerging evidence has shown that the adult brain has subpopulations of neurons with the capability to accumulate vesicular glutamate and GABA for their synaptic release. This lecture will focus on the key findings and proposed molecular and cellular models for the co-release of glutamate and GABA and discuss its implications for human health.

Biochemical Computation in Postsynaptic Compartments: Implications for Synaptic Plasticity, Learning, and Memory CME

Ryohei Yasuda, PhD / Max Planck Florida Institute for Neuroscience
Wednesday, Nov. 7, 8:30–9:40 a.m.

Dendritic spines are postsynaptic compartments that contain biochemical signaling cascades important for synaptic plasticity, learning, and memory. Signaling events in dendritic spines are mediated by molecular networks composed of hundreds of signaling proteins. This lecture will discuss how the spatiotemporal dynamics of these networks play roles in transforming rapid Ca2+ pulses into long-lasting protein activity, which is coordinated throughout different subcellular compartments, necessary for the induction of synaptic plasticity.

THEME C: NEURODEGENERATIVE DISORDERS AND INJURY

CLINICAL NEUROSCIENCE LECTURE: From Axon Regeneration to Functional Recovery After CNS Injury CME

Zhigang He, PhD / Boston Children's Hospital / Sunday, Nov. 4, 1–2:10 p.m.

In the adult mammalian CNS, the inability of injured axons to regenerate contributes to unrecoverable functional deficits. This lecture will present recently uncovered cellular and molecular mechanisms regulating the processes of neuronal injury responses and axon regeneration. Further discussion will focus on the progress in developing effective strategies to promote axon regeneration and functional recovery in experimental injury models *in vivo*, such as spinal cord injuries and optic nerve crush.

Understanding Regeneration of Complex Body Parts CME

Elly M. Tanaka, PhD / Research Institute of Molecular Pathology
Tuesday, Nov. 6, 8:30–9:40 a.m.

Regeneration of the nervous system and complex body structures, while minimal in humans, is observed in many animals, including vertebrates. How does injury trigger replacement of the missing portion of an organ? Recent advances in imaging and gene editing technologies have allowed us to identify molecular programs that control regeneration and the cells that execute these programs. This lecture will describe how the time-, space- and tissue-dependent responses to organ injury choreograph a molecular program that induces the regeneration of missing body structures.

Sensorimotor Circuits for Social Communication CME

Mala Murthy, PhD / Princeton University / Sunday, Nov. 4, 11:30 a.m.–12:40 p.m.

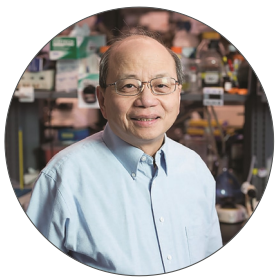
Social interactions require continually adjusting behavior in response to sensory feedback from a partner. This lecture will focus on the computations and neural mechanisms that underlie the processing of dynamic sensory information to flexibly guide social behaviors. In particular, this lecture will highlight recent discoveries using the acoustic communication system of *Drosophila* to characterize sensorimotor circuits for both song production and perception and will put these discoveries in the broader context of research on social communication across model systems.

THEME D: SENSORY SYSTEMS

A Genetic Roadmap to Understanding Auditory Perception Mechanisms CME

Christine Petit, MD, PhD / Institut Pasteur, Collège de France / Wednesday, Nov. 7, 10–11:10 a.m.

The molecular mechanisms underlying auditory system development and function remained unknown until they were unlocked by genetic dissection. This lecture will show how the hundreds of causal genes for deafness have revealed the molecular basis of sound detection and processing in the cochlea. Recent results extend genetic dissection to the identity and functional connectivity of auditory cortex neuronal populations. How pleiotropic functions of deafness genes are likely to affect future treatments and shed light on the evolution of this sensory system will be discussed.



Light Detection in the Eye: The Big Picture CME

King-Wai Yau, PhD / Johns Hopkins University School of Medicine
Wednesday, Nov. 7, 1–2:10 p.m.

This lecture will discuss multiple photoreceptor cell-types existing in the eye. Retinal rods and cones serve predominantly image-forming vision, using a cGMP signaling cascade for phototransduction. A few percent of retinal ganglion cells express the pigment melanopsin and are bona fide photoreceptors. They serve mostly, but not exclusively, non-image-forming vision. They use a combination of cGMP signaling and phospholipase-C signaling for phototransduction, with some using both signaling pathways in the same cell. Still other ocular photoreceptor cells exist both inside and outside the retina.

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THEME E: MOTOR SYSTEMS

Bidirectional Interactions Between the Brain and Implantable Computers CME

Eberhard E. Fetz, PhD / University of Washington / Sunday, Nov. 4, 8:30–9:40 a.m.

Closed-loop interactions between the brain and implantable computers open new opportunities for brain research and clinical applications. This lecture will review the use of bidirectional brain-computer interfaces to bridge lost physiological connections, strengthen synaptic connections via Hebbian plasticity, and reinforce neural activity with intracranial stimulation. Closed-loop activity-dependent stimulation has numerous applications, depending on the recorded signals, the computed transforms, and the stimulated targets.

THEME F: INTEGRATIVE PHYSIOLOGY AND BEHAVIOR

The Genetics, Neurobiology, and Evolution of Natural Behavior CME

Hopi E. Hoekstra, PhD / Harvard University, Howard Hughes Medical Institute / Tuesday, Nov. 6, 10–11:10 a.m.

New tools — from genomic analyses to automated behavioral assays — have enabled the discovery of specific genes that contribute to variation in behavior. This lecture will focus on the genetic and neurobiological mechanisms responsible for the evolution of natural behavior. It will highlight recent discoveries from diverse organisms that demonstrate how genetic changes, through neural circuits, give rise to variation in behavior, and how these findings in nonmodel species in turn shed light onto variation in human behavior.

THEME G: MOTIVATION AND EMOTION

Reward Processing by the Dorsal Raphe CME

Minmin Luo, PhD / National Institute of Biological Sciences, Beijing
Wednesday, Nov. 7, 11:30 a.m.–12:40 p.m.

Rewards fundamentally influence animal survival and well-being. The dorsal raphe nucleus (DRN) in the midbrain is a major center for serotonin neurons. The questions of whether and how the DRN and the serotonin system process reward signals have remained controversial. This lecture will present recent evidence to argue that DRN serotonin neurons likely encode “beneficialness,” or how much potential benefit the current state might bring to an individual. This simple theory may explain the diverse roles of serotonin in modulating behaviors and intervening in psychiatric disorders.

THEME H: COGNITION

Neural Dynamics of the Primate Attention Network CME

Sabine Kastner, MD / Princeton University / Saturday, Nov. 3, 2–3:10 p.m.

The selection of information from cluttered sensory environments is one of the most fundamental cognitive operations performed by the primate brain. This process engages a large-scale network that consists of multiple nodes, distributed across cortical and subcortical regions. This lecture will focus on temporal dynamics within this network that shape both the sampling of and responses to our environment, with an emphasis on thalamo-cortical interactions. The lecture will also discuss the importance of comparative electrophysiology and neuroimaging in human and monkey brains.

New Computational Perspectives on Serotonin Function CME

Zachary F. Mainen, PhD / Champalimaud Institute, Portugal
Monday, Nov. 5, 11:30 a.m.–12:40 p.m.

Serotonin is an important target of psychoactive drugs whose endogenous neuromodulatory functions remain enigmatic. Data indicate that serotonin neurons are activated by surprising events and that consequent serotonin release facilitates neural plasticity and biases decision-making. This lecture will discuss these data from a computational perspective in which serotonin is seen as reporting uncertainty in the brain's internal models of the world and helping to modify them accordingly.

THEME I: TECHNIQUES

Neural Data Science: Accelerating the Experiment-Analysis-Theory Cycle in Large-Scale Neuroscience CME

Liam Paninski, PhD / Columbia University / Sunday, Nov. 4, 10–11:10 a.m.

Modern multineuronal recordings produce single-cell-resolution data on a large scale. "Neural data science" aims to extract meaning from the resulting huge new streams of data. This lecture will review recent progress and current challenges in this rapidly growing field, where new methods for network analysis, dimensionality reduction, and optimal control — developed in lockstep with advances in experimental neurotechnology — promise breakthroughs in multiple fundamental neuroscience problems.

Organelle Structure and Dynamics: What High-Resolution Imaging Is Uncovering CME

Jennifer Lippincott-Schwartz, PhD / Janelia Research Campus / Monday, Nov. 5, 8:30–9:40 a.m.

Powerful new ways to image the internal structures and complex dynamics of cells are revolutionizing cell biology and biomedical research. This lecture will focus on how emerging imaging technologies are increasing spatiotemporal resolution dramatically, permitting simultaneous multispectral imaging of multiple cellular components. Using these tools, it is now possible to begin describing the interrelationships of different cellular organelles as they carry out critical functions.