Special Lectures

THEME A: Development

Building a Synapse Through Nuclear Export of Large RNA Granules and Exosomes CME

Vivian Budnik, PhD
University of Massachusetts Medical School

Studies in *Drosophila* are uncovering novel conserved mechanisms for synapse development and plasticity. These include signaling pathways from the membrane to the nucleus, promoting the nuclear assembly and export of ribonucleoprotein granules and their synaptic localization. In addition, pre- and postsynaptic compartments are shaped through transsynaptic transmission of exosomes carrying transmembrane proteins and RNA. This lecture shares lessons from the study of viruses and Wnt signaling that led to these discoveries and highlights their importance in disease.

THEME B: Neural Excitability, Synapses, and Glia: Cellular Mechanisms

Exocytosis of Synaptic Vesicles — A Molecular Perspective CME

Reinhard Jahn, PhD
Max Planck Institute for Biophysical Chemistry

Neurotransmitter release from neurons is mediated by Ca^{2+}-dependent exocytosis of synaptic vesicles. The molecular machinery involves SNARE proteins that carry out membrane fusion together with other conserved proteins such as SM and CATCHR. Furthermore, specialized proteins such as synaptotagmins and complexins convey Ca^{2+} regulation. Jahn will discuss new insight on the mechanisms by which these proteins mediate membrane fusion at the synapse.

How Do You Feel? The Role of Mechanically Activated Ion Channels in Touch, Pain, Hearing, and Beyond CME

Ardem Patapoutian, PhD
The Scripps Research Institute, Howard Hughes Medical Institute

Mechanosensation is perhaps the last sensory modality not understood at the molecular level. Ion channels that sense mechanical force are postulated to play critical roles in sensing touch/pain (somatosensation), sound (hearing), sheer stress (cardiovascular tone), etc. However, the identity of ion channels involved in sensing mechanical force has remained elusive. This lecture focuses on the identification, using functional genomics approaches, and characterization of novel mechanically activated channels including Piezo1 and 2.

THEME C: Disorders of the Nervous System

Genes and Environment Interaction During Development: Redox Imbalance in Schizophrenia CME

Kim Quang Do, PhD
Center for Psychiatric Neuroscience, Lausanne University Hospital

Understanding how the interaction of genes and environmental risk factors during neurodevelopment leads to cognitive, affective, and social impairment is a central challenge in psychiatric neuroscience. This lecture discusses the case of schizophrenia where these risk factors converge on a hub made of NMDAR hypofunction, neuroinflammation and redox imbalance/oxidative stress, affecting parvalbumine neurons and myelination that leads to structural and functional dysconnectivity. A translational approach toward prevention attempts to modify the disease course by redox modulators.

The Glymphatic System and Its Possible Roles in CNS Diseases CME

Maiken Nedergaard, MD, DMSc
University of Rochester

Past work has focused on cellular recycling of proteins involved in neurodegeneration. This lecture expands the traditional framework to include a macroscopic clearance system — the glymphatic system — by which the brain exports waste products of neural metabolism. Glymphatic clearance is driven by convective CSF influx and is especially active during sleep. Macromolecules, such as amyloid beta, are literally swept out of CNS for ultimate degradation in the liver. As such, the glymphatic system represents a novel and unexplored target for treatment of neurological diseases.

Persistent Cocaine-Induced Plasticity and Synaptic Targets for Its Reversal CME

Marina E. Wolf, PhD
Rosalind Franklin University of Medicine and Science

Cocaine addicts remain vulnerable to cue-induced craving and relapse even after long periods of abstinence. In a rat model of this phenomenon, cue-induced cocaine craving increases during withdrawal and remains high for months. This relies on strengthening of glutamate synapses in the nucleus accumbens, a brain region that translates motivation into action. This lecture will focus on mechanisms that maintain this plasticity, as well as strategies for reversing it and thus reducing craving. Potential targets include group I metabotropic glutamate receptors and protein translation.

THEME D: Sensory and Motor Systems

Learning and Relearning Movement CME

Amy J. Bastian, PhD
Kennedy Krieger Institute, Johns Hopkins University School of Medicine

Human motor learning depends on a suite of brain mechanisms that are driven by different signals and operate on timescales ranging from minutes to years. Understanding these processes requires identifying how new movement patterns are normally acquired, retained, and generalized, as well as the effects of distinct brain lesions. The lecture focuses on normal and abnormal motor learning and how we can use this information to improve rehabilitation for individuals with neurological damage.

The Sensory Neurons of Touch CME

David D. Ginty, PhD
Harvard Medical School, Howard Hughes Medical Institute

The somatosensory system endows us with enormous capacity for object recognition, texture discrimination, sensory-motor feedback, and social exchange. Innocuous touch of the skin is detected by physiologically distinct low-threshold mechanosensory neurons (LTMRs). Ginty's research team has amassed a genetic toolbox that enables interrogation of the physiology, morphology, and function of LTMR subtypes and their synaptic target neurons in the spinal cord. Ginty will discuss morphological and physiological features of LTMRs and the organizational logic of LTMR projections and circuits in the central nervous system.

CME This activity has been approved for *AMA PRA Category 1 Credit.*™ For details, see page 5 and visit SfN.org/cme.

The Brain Is Needed to Cure Spinal Cord Injury CME

Tadashi Isa, MD, PhD
National Institute for Physiological Sciences

Recovery after neuronal damage is learned by the spared neural systems. Isa's research team is studying the mechanism of recovery of hand dexterity after partial spinal cord injury using nonhuman primate models by combining multidisciplinary approaches such as kinetic analysis, electrophysiology, brain imaging, neuroanatomy, and genetic manipulation with viral vectors. Isa will talk about the large-scale circuit reorganization that occurs through training and is critical for recovery, spanning over the spinal cord, motor cortices, and even the limbic structures.

THEME E: Integrative Systems: Neuroendocrinology, Neuroimmunology, and Homeostatic Challenge

Surprising Origins of Sex Differences in the Brain CME

Margaret M. McCarthy, PhD
University of Maryland School of Medicine

Brain sex differences are established early by genes, hormones, environment, and experience. Animal models reveal multiple endpoints modified by steroid hormones in a region-specific manner and that these changes underlie sex differences in adult behavior. This talk reviews the cellular and molecular mechanisms mediating masculinization involving inflammatory molecules, immune signaling, endocannabinoids, and epigenetic changes. Illuminating the biological origins of brain and behavior sex differences is essential for enhancing health and preventing disease.

What Drives Sleep — Wake Cycles: Identification of Molecules and Circuits in *Drosophila* CME

Amita Sehgal, PhD
Perelman School of Medicine at the University of Pennsylvania, Howard Hughes Medical Institute

This lecture will focus on the cellular and molecular mechanisms that regulate sleep. The 24-hour rhythm of sleep is driven by a circadian clock, while the need to sleep comes from a homeostatic system, which ensures adequate sleep levels. The lecture will show how the use of *Drosophila* has led to the identification of mechanisms that generate a circadian clock and to some of the downstream circuitry required for circadian timing of behavior. It will also highlight recent developments in identifying molecular components and cellular circuits that underlie homeostatic regulation.

THEME F: Cognition and Behavior

Affective Neuroscience of Reward: Limbic Modules for Liking and Wanting CME

Kent C. Berridge, PhD
University of Michigan, Ann Arbor

Reward involves several different psychological components. "Wanting" a reward is generated by robust mesolimbic circuitry, whereas "liking" the same reward is generated by hedonic-hotspot circuitry that is neuroanatomically and neurochemically more restricted. This wanting-liking difference has implications for addiction disorders. Yet surprisingly, forms of positive wanting and negative fear share some of the same brain mechanisms. New insight on the generation of these intense "liking," "wanting," and other emotion states are emerging in affective neuroscience.

Generating and Shaping Novel Action Repertoires CME

Rui M. Costa, DVM, PhD
Champalimaud Foundation

Many actions are learned anew throughout life, likely through a process of trial and selection. Researchers investigated how novel self-paced actions are generated and how actions that lead to particular outcomes are then selected. Research found that dopamine is critical for the initiation of novel actions and that plasticity in cortico-basal ganglia circuits is essential for action selection. With iteration, actions become organized in modules, and neural substrates of chunking emerge in these circuits.

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

For most of the 20th century, scientists believed that lens-based light microscopy could not discern details finer than half the wavelength of light (>200 nm). In the 1990s, this barrier was overcome when it was discovered that fluorescent features can be resolved virtually down to molecular dimensions. This lecture discusses the simple, yet powerful, physical principles that allowed researchers to overcome the diffraction limit, with special emphasis on STED and RESOLFT microscopy. The lecturer will exemplify the relevance of these nanoscopy techniques to neuroscience.

Find the latest session information at **SfN.org/speciallectures.**

Continuing Medical Education (CME)

Physicians: Improve Competencies While Earning CME Credit

The Society for Neuroscience annual meeting is a forum for educating physicians in neuroscience. By attending lectures, symposia, and minisymposia, the physician will receive both a broad overview of the field and information about the most recent, detailed research on specific topics. Abstracts for each plenary session contain brief descriptions of the material to be presented. Participation in these activities reinforces foundational concepts clinicians need as a part of their practice.

Statement of Need

It is important that physicians comprehend the basic science that underlies clinical medicine. SfN's annual meeting is the premier venue for this educational opportunity. Physicians learn about the most up-to-date, cutting-edge discoveries of the brain and nervous system.

Global Learning Objective

Physicians will integrate the most up-to-date information and research on the mechanism, treatment, and diagnosis of conditions related to neurological and psychiatric disorders into their diagnostic and therapeutic modalities of practice to determine the best treatment for the patient.

Accreditation

SfN is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

CME Registration

CME registration must be completed before or during the annual meeting. Those who do not register before the conclusion of the meeting will not be able to request CME credits. CME registrants will receive via email two weeks before the meeting the CME Supplemental Program, which contains important information regarding the CME program, including disclosure information and instructions for obtaining CME credits.

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