

**Theme A: Development*****Axon Guidance and Local RNA-Based Mechanisms of Directional Steering* CME**

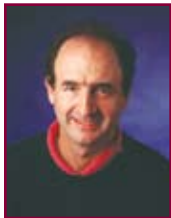
Speaker: Christine E. Holt, PhD  
University of Cambridge



Synaptic connections between distant neurons are first established by the navigation of axons along specific pathways. Early pathways are divided into molecularly distinct segments, and axons are guided from one segment to the next by successive encounters with guidance cues. Cues, such as netrin and semaphorin, induce rapid mRNA translation and protein degradation in growth cones. This lecture will focus on an RNA-based mechanism of directional steering in *Xenopus* retinal axons with particular consideration of the role of spatially localized translation.

***Chemospecificity, Cell Recognition, and Wiring the Brain* CME**

Speaker: Stephen L. Zipursky, PhD  
University of California, Los Angeles/HHMI



The cellular recognition mechanisms by which the intricate and highly specific pattern of synaptic connections emerge during development remain poorly understood. Long-range secreted signals promote directional outgrowth of axons and dendrites. Short-range signals displayed on the surface of cells mediate interactions between developing neurites during axon guidance, target recognition, and synaptic specification. This lecture will focus on the molecular strategies underlying short-range interactions which have evolved to assemble neural circuits.

**Theme B: Neural Excitability, Synapses, and Glia: Cellular Mechanisms*****Dendrites Become Active: Colorful Wings of the Mysterious Butterflies* CME**

Speaker: Daniel Johnston, PhD  
University of Texas at Austin



Cajal referred to neurons as the “mysterious butterflies of the soul.” The wings of these butterflies, or their dendrites, were originally thought to be passive integrators of synaptic input. During the past 30 years, through the efforts of many investigators, neuronal dendrites have been shown to be “colorful,” that is to be endowed with a plethora of voltage-gated ion channels, with each family of butterflies made of distinct mosaic patterns of hues and shades. These patterns also undergo activity-dependent plasticity leading to an almost chameleonic adaptability for the neuron.

***Synaptic Plasticity: The Control of Inhibitory Circuits* CME**

Speaker: Julie A. Kauer, PhD  
Brown University



LTP and LTD are well-established cellular mechanisms to control synaptic strength, and contribute to learning, development, and other activity-dependent neuroadaptations to environmental stimuli. The great majority of studies have described synaptic plasticity at excitatory synapses on excitatory neurons, but recent work has begun to identify novel molecular mechanisms underlying synaptic plasticity of GABAergic synapses and at excitatory synapses impinging on GABAergic interneurons. This talk will use hippocampal and ventral tegmental area synapses as examples.

**Theme C: Disorders of the Nervous System*****Vulnerability in the Newborn Brain* CME**

Speaker: Donna M. Ferriero, MD  
University of California, San Francisco



Why do cells in the CNS respond differently to different stressors, and why is this response so age-dependent? In the immature brain, there are regions of selective vulnerability that are predictable and depend on the age when the insult occurs and the severity of the insult. This damage is both region and cell population specific. Both signaling and metabolic pathway maturation determine these patterns. Advanced imaging techniques have shown us these patterns, and have allowed us to ask new questions about how the injury evolves and how the newborn brain adapts and repairs itself.

***Prophylaxis of Post-Traumatic Epilepsy: Waiting for Translation* CME**

Speaker: David A. Prince, MD  
Stanford University Medical Center



Traumatic brain injury can initiate maladaptive processes that lead to recurrent epileptic seizures. The latent period between trauma and the onset of epilepsy provides an opportunity for prophylactic intervention, once the critical underlying pathophysiological processes are identified. This lecture will review anatomical and electrophysiological data focused on two key epileptogenic mechanisms that follow cortical injury and describe promising experimental results, suggesting that these aberrant processes may be modified to prevent post-traumatic epilepsy.



## Theme D: Sensory and Motor Systems

### *The Mirror Neuron System in Monkeys and Humans* CME

Speaker: Giacomo Rizzolatti, MD

University of Parma



This lecture consists of three parts. The first part will describe the properties of mirror neurons of the monkey. It will show that, while individual mirror neurons code the “what” of a given motor act (grasping), their “chained” organization enables the observer to infer the “why” of that motor act (grasping for eating). The second part of my talk will cover

the human mirror system focusing on its differential organization in the premotor and parietal cortex. It will conclude by discussing the relation between mirror mechanism and autism.

### *The Neurobiology of Decision Making: A Window on Cognition* CME

Speaker: Michael N. Shadlen, MD, PhD

University of Washington/HHMI



A decision is a deliberative process that leads to a commitment to a categorical proposition or plan of action. For example, a jury takes time to weigh evidence for alternative interpretations before settling on a verdict. This lecture will evaluate the advances in our understanding of how simple perceptual deliberation is implemented in the brain. The

fundamental insights which have emerged have begun to expose the neural basis of reasoning, including the kinds of flexible and nuanced decisions that are a hallmark of higher cognition.

## Theme E: Homeostatic and Neuroendocrine Systems

### *Imaging Selective Motor Plasticity in Spinal Cord and Brainstem: Implications for Spinal Cord Injury, ALS, and Sleep Apnea* CME

Speaker: Gordon S. Mitchell, PhD

University of Wisconsin



Intermittent serotonin receptor activation induces plasticity in motor neurons, including those that convey respiratory activity. Serotonin-dependent long-term facilitation of phrenic motor output requires new synthesis of brain derived neurotrophic factor and ROS-dependent suppression of protein phosphatase activity. Insights from cellular/synaptic mechanisms that underlie phrenic long-term facilitation suggest novel

therapeutic strategies for diverse neurological disorders, including cervical spinal injury, motor neuron disease, and sleep apnea.

### *Molecular Basis of Sleep/Wake Cycles* CME

Speaker: Amita Sehgal, PhD

University of Pennsylvania Medical School/HHMI



Using the fruit fly, *Drosophila melanogaster*, as a model system, we are investigating the molecular basis of sleep/wake cycles. The 24-hour rhythm of these cycles is driven by a circadian system, while the basic need for sleep derives from homeostatic control. This lecture will focus on both of these regulatory systems. It will include a description of the

molecular mechanisms of the circadian clock, and recent studies on the cellular and genetic analysis of homeostatic regulation.

## Theme F: Cognition and Behavior

### *A New Perspective on the Role of Orbitofrontal Cortex in Decision-Making, Judgment, and Adaptive Behavior* CME

Speaker: Geoffrey Schoenbaum, MD, PhD

University of Maryland School of Medicine



Damage to the orbital area of the frontal lobe disrupts adaptive, flexible behavior. These deficits have been attributed to impairments in response inhibition and/or to the idea that orbitofrontal cortex is a rapidly-flexible associative learning area. Yet, recent data contradict these accounts. This lecture will discuss an alternate account, whereby orbitofrontal cortex

supports flexible responding due to its more recently described role in signaling information about expected outcomes.

### *Neural Mechanisms of Cortical Dysfunction in Addiction: Consequence or Cause of Compulsive Behavior* CME

Speaker: Jane R. Taylor, PhD

Yale University School of Medicine



The neural mechanisms underlying the progression to compulsive drug use in addiction are unknown. Altered plasticity in limbic-striatal regions affect reward-related learning and memory processes. This lecture will review evidence linking drug-induced neuroadaptations in regions of frontal cortex that coordinate limbic-striatal function in the transition from flexible

goal-directed to habitual and stimulus-driven behavior. A comprehensive view of compulsive aspects of addiction must integrate the contributions of drug-induced and pre-existing cortical dysfunction.

## Theme G: Novel Methods and Technology Developments

### *Recovery of Consciousness after Severe Brain Injury* CME

Speaker: Nicholas D. Schiff, MD

Weill Medical College of Cornell University



This lecture will focus on mechanisms of recovery of consciousness after severe brain injury, and will examine the surprising degree of uncertainty presented by patients with very limited behavioral responsiveness. Recent studies that identify the potential for late recovery of cognition will be discussed in the context of possible “circuit-level” mechanisms underlying recovery of consciousness. This lecture will

discuss the clinical and scientific background, and results of a study of central thalamic brain stimulation to improve chronically impaired consciousness in a single human subject.