

Symposia

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Public Symposium

In Celebration of Darwin: Evolution of Brain and Behavior

Chair: John G. Hildebrand, PhD

Co-chair: Harvey J. Karten, MD

Saturday, Oct. 17, 1:30–4 p.m.

McCormick Place: Room S100B

Support contributed by The Gatsby Charitable Foundation

The complexity of the brain challenges our abilities to understand its mechanisms of function. An evolutionary perspective provides a powerful means to clarify how the brain and behavior are both substrates and determinants of evolutionary change. Ultimately, every aspect of the brain can best be understood in evolutionary terms. How did higher functions and complexity arise? Are “simple” systems replaced by more complex ones? Does that change the basic neuronal algorithms for solving discrete tasks? Does behavior play a major role in natural selection?

Theme A: Development

The Molecular and Cellular Determinants of Cerebellar Development and Function CME

Chair: Daniel Goldowitz, PhD

Co-chair: Alexandra L. Joyner, PhD

Sunday, Oct. 18, 8:30–11 a.m.

McCormick Place: Room S100B

The cerebellum has played a unique role in helping us understand the cellular and genetic dynamics involved in the development and function of the mammalian brain. Four new approaches to understanding the molecular and cellular determinants of cerebellar development and function will be presented.

The New Molecular Genetics of Serotonin System Development and Physiology CME

Chair: George B. Richerson, MD, PhD

Sunday, Oct. 18, 1:30–4 p.m.

McCormick Place: Room S100B

Cutting-edge mouse genetic tools that have been used to study diverse aspects of the 5HT system will be discussed. Molecular, cellular, and systems level applications of these new technologies have identified mechanisms involved in development of 5HT neurons and redefined the role of 5HT neurons in behavior and physiological homeostasis. These

unique approaches have begun to elucidate serotonergic mechanisms underlying disorders as diverse as anxiety, aggression, and sudden infant death syndrome.

Origins and Evolution of Brain and Behavior CME

Chair: Seth G. N. Grant, MB, BS

Wednesday, Oct. 21, 8:30–11 a.m.

McCormick Place: Room S100A

In this bicentennial year of Charles Darwin's birth, the principles underlying the origins and evolution of nervous systems and their emergent behaviors remain poorly understood. This symposium brings together speakers addressing the origins of synapses (Grant) and neurons (Arendt) with studies of comparative cognition (Clayton) and evolution of Neanderthals and modern humans (Pääbo). The symposium is aimed at a broad audience interested in the origins and diversity of brain and behavior.

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

Calcium-Permeable AMPA Receptors in Synaptic Plasticity CME

Chair: R. Suzanne Zukin, PhD

Monday, Oct. 19, 1:30–4 p.m.

McCormick Place: Room S100A

This symposium highlights recent developments in the area of Ca²⁺-permeable AMPARs in synaptic plasticity and neuronal death. There have been groundbreaking discoveries in this area in the past two to three years including the finding that Ca²⁺-permeable AMPARs are critical to activity- and drug-dependent synaptic plasticity. These changes arise due to not only receptor trafficking but also local protein synthesis, RNA editing, and epigenetic remodeling of gene expression.

Nicotine-Induced Upregulation of Nicotinic Receptors CME

Chair: Susan J. Wonnacott, PhD

Tuesday, Oct. 20, 1:30–4 p.m.

McCormick Place: Room S100A

Chronic nicotine upregulates nicotinic receptors in human smokers and model systems. The function of upregulation is controversial, but it explains many aspects of nicotine addiction, from molecular interactions to circuit adaptations. Despite consensus that upregulation

results from post-translational changes, the specific mechanisms are debated. Presenters describe and discuss current research supporting or challenging several hypothetical mechanisms that could mediate nicotinic receptor upregulation.

New Insights in Biology of BDNF Synthesis and Release: Implications in CNS Function CME

Chair: Barbara L. Hempstead, MD, PhD

Tuesday, Oct. 20, 1:30–4 p.m.

McCormick Place: Room S100B

BDNF has pleiotropic effects on neuronal development and synaptic plasticity that underlie circuit formation and cognitive function. Recent breakthroughs reveal that neuronal activity regulates BDNF cell biology, including BDNF transcription, dendritic targeting and trafficking of BDNF mRNA and protein, and secretion and extracellular conversion of proBDNF to mature BDNF. Defects in these mechanisms contribute differentially to cognitive dysfunction, hyperphagia, and anxiety-like behaviors.

Regulatory Mechanisms Controlling Synapse Function CME

Chair: Matthias Kneussel, PhD

Co-chair: Stephan Sigrist, PhD

Wednesday, Oct. 21, 1:30–4 p.m.

McCormick Place: Room S100A

Synaptic function requires the precise control of molecular pathways at pre-, trans- and postsynaptic levels. This symposium integrates recent results on functional processes that control presynaptic neurotransmitter release, regulate specificity of synaptic wiring, and control intracellular transport underlying postsynaptic protein turnover.

Theme C: Disorders of the Nervous System

Alzheimer's Disease and Epilepsy: Converging Mechanisms and Therapeutic Opportunities CME

Chair: Lennart Mucke, MD

Co-chair: Jeffrey L. Noebels, MD, PhD

Saturday, Oct. 17, 1:30–4 p.m.

McCormick Place: Room S100A

Recent findings point to aberrant excitatory neuronal activity linking amyloid peptides and Alzheimer's disease (AD). Mucke will review AD and describe (mal) adaptive neural network remodeling in AD

models with epilepsy. Noebels will review nonconvulsive seizures in AD models and challenges in diagnosing human dysrhythmias. Konnerth will describe hyperactive neurons adjacent to amyloid plaques in AD models. Scharfman will review rearrangements in hippocampal circuit causing hyperexcitability and future areas for research and therapeutic intervention.

Nutrition, Brain Aging, and Neurodegenerative Diseases CME

Chair: James A. Joseph, PhD
Sunday, Oct. 18, 8:30–11 a.m.
McCormick Place: Room S406A

This symposium provides evidence that diet plays an important role in increasing “brain health span” and prevents or forestalls age-related neuronal deficits. The inclusion of fruits (e.g., berry fruit), beverages (e.g., red wine), and fish or walnuts containing compounds with antioxidant/anti-inflammatory properties may prevent neurodegenerative disease and promote healthy brain aging.

Role of Blood-Brain Barrier and Nonneuronal Cells in Neurodegeneration CME

Chair: Berislav V. Zlokovic, MD, PhD
Monday, Oct. 19, 8:30–11 a.m.
McCormick Place: Room S100B

This symposium integrates current knowledge of the role of blood-brain barrier (BBB) and nonneuronal cells in major human neurodegenerative disorders, including Alzheimer’s, multiple sclerosis, neuroinflammatory disease, and ALS. The symposium highlights new cellular and molecular mechanisms of CNS vascular dysfunction, BBB immune responses, and astrocytes and microglial roles in regulating risk for different forms of neurodegeneration and non-cell autonomous killing of neurons.

Oligodendrocyte Precursor Cells in Neurological Diseases CME

Chair: Wenbin Deng, PhD
Monday, Oct. 19, 8:30–11 a.m.
McCormick Place: Room S406A

Emerging evidence indicates that developing oligodendrocytes, the myelin-forming glial cells in the CNS, share with neurons a high vulnerability to excitotoxic, oxidative, and inflammatory forms of injury. This symposium discusses new findings on the regulation of oligodendrocyte development and the role of oligodendrocyte precursor cells in a variety of neurological diseases: from periventricular leukomalacia in the premature infant to multiple sclerosis in the adult.

Endocannabinoid Mechanisms in Brain Disease CME

Chair: Daniele Piomelli, PhD
Co-chair: Oliver Manzoni, PhD
Monday, Oct. 19, 1:30–4 p.m.
McCormick Place: Room S100B

The endocannabinoids are lipid compounds that activate the same receptors targeted by marijuana. They participate in multiple signaling processes in healthy and diseased brains. Symposium speakers will report findings that reveal unexpected roles for these substances in brain disorders including epilepsy, pain, depression, and Alzheimer’s disease. The speakers also will discuss how these discoveries might lead to the development of better drugs to treat these disorders.

Ubiquitin, Neurodevelopment, and Neurodegeneration CME

Chair: Jane Y. Wu, MD, PhD
Monday, Oct. 19, 8:30–11 a.m.
McCormick Place: Room S100A

Ubiquitin-mediated protein modification and degradation are crucial processes regulating gene expression and function. Accumulating evidence supports important roles of ubiquitin in the development, maintenance, and proper repair of the nervous system. Ubiquitin-positive protein aggregation is a prominent feature for a range of neurodegenerative diseases. This symposium addresses key questions in this area from genetics to biochemistry, from animal models to human diseases.

New Developments in the Genetics and Pathogenesis of ALS and ALS/Dementia CME

Chair: Hang-Xiang Deng, MD, PhD
Co-chair: Teepu Siddique, MD
Tuesday, Oct. 20, 8:30–11 a.m.
McCormick Place: Room S100B

Amyotrophic lateral sclerosis (ALS) is a paralytic disorder caused by degeneration of motor neurons in the brain and spinal cord. ALS also can be associated with dementia. The cause and pathogenesis of ALS and ALS/dementia are largely unknown. There is no effective treatment currently available. This symposium highlights recent findings in genetics and pathogenesis of ALS and ALS/dementia, and how these findings can be translated into development of therapy in ALS and ALS-related disorders.

Regeneration and Sprouting of Sensory Fibers in the Spinal Cord CME

Chair: Eric Frank, PhD
Tuesday, Oct. 20, 1:30–4 p.m.
McCormick Place: Room S406A

Recent studies of regeneration and sprouting of damaged sensory axons in the spinal cord demonstrate substantial recovery of function. Exogenous guidance cues can target regenerating sensory axons to appropriate regions of the cord, and these axons also can be guided by endogenous cues that persist in the adult cord. Spared axons can be induced to form functional connections with new targets, and root rhizotomies in primates lead to neurogenesis and modification of dorsal horn circuitry.

The β -secretase Enzyme BACE in Health and Alzheimer’s Disease: Regulation, Cell Biology, Function, and Therapeutic Potential CME

Chair: Robert Vassar, PhD
Wednesday, Oct. 21, 8:30–11 a.m.
McCormick Place: Room S406A

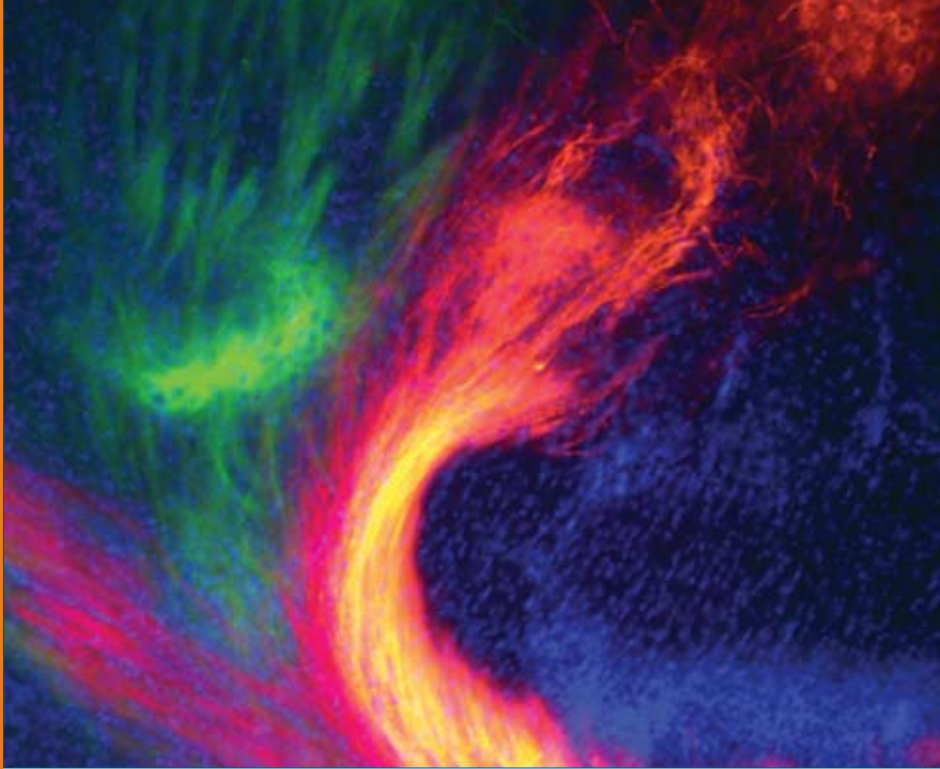
The β -secretase, β -site amyloid precursor protein cleaving enzyme (BACE), is the rate-limiting enzyme for A β production in Alzheimer’s disease (AD) and a prime drug target. Since its discovery 10 years ago, much has been learned about BACE. This symposium reviews BACE properties, describes BACE translation dysregulation in AD, and presents BACE physiological functions in sodium current, synaptic transmission, myelination, and schizophrenia. BACE therapeutic potential also will be discussed.

Theme D: Sensory and Motor Systems

The Control of Neural Activity by Complex Patterns of Synaptic Input: Using Dynamic Clamping In Vitro To Study Synaptic Integration In Vivo CME

Chair: Dieter Jaeger, PhD
Monday, Oct. 19, 1:30–4 p.m.
McCormick Place: Room S406A

The spiking activity of most neurons *in vivo* is controlled by thousands of synaptic inputs per second. The resulting high-conductance state significantly changes the intrinsic neural dynamics. Dynamic clamp application of synthetic synaptic and voltage-gated conductances allows a detailed analysis of this effect. This symposium shows how dynamic clamping can be used to unravel *in vivo* properties of synaptic integration, such as gain control and noise sensitivity using *in vitro* recordings.



***The Brain in Its Body: Motor Control and Sensing in a Biomechanical Context* CME**

Chair: Hillel J. Chiel, PhD

Wednesday, Oct. 21, 1:30–4 p.m.

McCormick Place: Room S100B

Brains work within complex bodies to generate flexible behavior. How do neural circuits and the periphery create different behaviors using the same structures? What are key control variables for rapid responses to unexpected perturbations? How do body mechanics and proprioceptive inputs shape motor behavior? How do the mechanics of sensory structures affect active sensing? Studies described in this symposium clarify the flexibility of motor decision making in goal directed behaviors.

Theme E: Homeostatic and Neuroendocrine Systems

***From Bench to Bedside: Long-Term Consequences of Early-Life Stress* CME**

Chair: Megan E. Libbey, PhD

Co-chair: Joan Kaufman, PhD

Tuesday, Oct. 20, 8:30–11 a.m.

McCormick Place: Room S100A

Early-life stress has been shown in preclinical and clinical studies to cause neuroendocrine, neuroanatomical, and biological alterations. These alterations, in turn, lead to disruptions in regulatory systems (e.g., emotional, metabolic, attentional) and a heightened risk for pathology. This symposium highlights ways in which preclinical basic research can help inform clinical interventions and vice versa. The speakers will present cross-cutting research that spans species and techniques.

Theme F: Cognition and Behavior

***The Role of the Dorsal Striatum in Reward, Reinforcement, and Addiction* CME**

Chair: David M. Lovinger, PhD

Co-chair: Dorit Ron, PhD

Sunday, Oct. 18, 1:30–4 p.m.

McCormick Place: Room S100A

The striatum, known for its role in movement, also is involved in cognitive processes and learning. This symposium discusses critical roles of the dorsal striatum in instrumental responding for reinforcement and reward, as well as cue-induced reward seeking. Signaling pathways involved in striatal-based behaviors also will be discussed. The symposium combines research on learning, memory, and addiction, and brings together molecular, cellular, and systems neuroscientists.

***Functional Neuroimaging Insights into Cognitive Development and Pediatric Neuropsychiatric Disorders* CME**

Chair: Bradley L. Schlaggar, MD, PhD

Wednesday, Oct. 21, 8:30–11 a.m.

McCormick Place: Room S100B

Impaired executive functioning is a core feature of developmental neuropsychiatric disorders such as Attention Deficit Hyperactivity Disorder and Tourette syndrome. Deep understanding of how executive functions develop typically, and how they go awry in pediatric patients, will guide early detection and remediation to provide insight into this critical aspect of cognition. The panel will highlight recent advances in typical and atypical development of control from fMRI and resting state functional connectivity MRI studies.

***Bridging Divergent Perspectives on Neural Mechanisms of Recognition* CME**

Chair: Joel L. Voss, PhD

Co-chair: Ken A. Paller, PhD

Wednesday, Oct. 21, 1:30–4 p.m.

McCormick Place: Room S406A

Two fundamental memory functions are to recognize objects and to recognize prior learning contexts. Identifying neural processes and structures that support item and context recognition has been highly controversial. This symposium features four prominent theoretical views, each developed from a combination of neurophysiological, neuropsychological, behavioral, and neuroimaging evidence. A unifying goal will be to uncover common ground and optimal strategies for future progress in this area.

Theme G: Novel Methods and Technology Development

***New Technologies for Probing Brain Disease with Light: From Super-Resolution and In Vivo Imaging to Optical Control of Circuits* CME**

Chair: Mark J. Schnitzer, PhD

Saturday, Oct. 17, 1:30–4 p.m.

McCormick Place: Room S406A

This symposium presents an overview of rapidly emerging optical technologies that are improving the ability to use light for the study of normal and diseased nervous systems. These technologies include optogenetics, microscopy in live and awake behaving animals, and super-resolution imaging. Speakers will discuss novel types of experiments enabled by cutting-edge techniques, emphasizing studies of a broad range of neuropsychiatric disorders and areas of potential clinical impact.

Theme H: History, Teaching, Public Awareness, and Societal Impacts in Neuroscience

Translational Neuroscience: From Bench to Classroom and Back

Chair: Samantha S. Gizerian, PhD

Co-chair: Thomas R. Insel, MD

Sunday, Oct. 18, 1:30–4 p.m.

McCormick Place: Room S406A

Neuroscience is an ideal field to spark interest in science among K-12 students, reinforce their knowledge across areas of study, and improve communication between scientists and the public. Presented data will highlight the real-world relevance of neuroscience, its accessibility via various learning modalities, and how translating neuroscience discovery into educational programming may bring good science back to the bench, as bright students are attracted to and retained in neuroscience careers.