Neuroscience Seminar Series schedule

All seminars are currently scheduled from 4-5 pm mountain time (this may have to change for some of our speakers on the East Coast presenting via Zoom meeting!). Many of our local speakers will provide in-person seminars, while our out-of-state guests will most likely join via Zoom Meeting.

Fall 2021

September 7, 2021 – Dr. Fred Hoerndli (in person)
Assistant Professor, Department of Biomedical Sciences, Colorado State University

Title: **Local mechanisms of glutamate receptor transport regulation necessary for synaptic distribution and plasticity.**

Abstract: Glutamate release and binding to receptors at neuronal connections or synapses is critical for cognition, learning and memory. The number and type of glutamate receptors at synapses in particular, are known to be essential for synaptic plasticity and memory. Although there is a good understanding of how local "synaptic" mechanisms regulate glutamate receptor numbers to strengthen or weaken synaptic transmission, how receptors actually are delivered or removed from local synaptic pools is poorly understood. My previous research has shown that molecular motor such as Kinesin are important for delivery, removal and redistribution of glutamate receptors to synapses and that this function is essential for synaptic plasticity. In my talk, I will present recent research from my lab exploring the role of synaptic signaling in regulating the transport of glutamate receptors and how the composition of the transport complex contributes to this regulation. I will also show that what happens at the molecular level to glutamate receptors transport matters as it affects associative learning and memory. Most of the data I will present is based on direct observation of transport and synaptic signaling in intact *C. elegans* animals, allowing a glimpse of molecular processes at work in an intact nervous system.

September 21, 2021 – Dr. Sondra Bland (in person)
Associate Professor, Department of Psychology, University of Colorado Denver, CO

Title: **Social influences on reward, fear, and the development of emotional behavior.**

Abstract: Social experience during adolescence profoundly impacts the development of social and aggressive behaviors, and can alter the effects of drugs of abuse such as cocaine on reward and neurochemistry. Work in my laboratory uses behavioral assays of social interaction, reward, fear, and anxiety, in addition to immunohistochemistry and in vivo microdialysis/HPLC to assess the impact of acute and chronic social experiences on brain and behavior during both rewarding and stressful challenges in male and female rats.

October 5, 2021 – Dr. Hongkui Zeng (Zoom meeting)
Executive vice-president and Director, Allen Institute for Brain Science, Seattle, WA

Title: **Understanding Brain Cell Type Diversity**

Abstract: To understand the function of the brain and how its dysfunction leads to brain diseases, it is essential to uncover the cell type composition of the brain, how the cell types are connected with each other and what their roles are in circuit function. At the Allen Institute, we have built multiple platforms, including single-cell transcriptomics, spatial transcriptomics, single and multi-patching electrophysiology, 3D reconstruction of neuronal morphology, and high throughput brain-wide connectivity mapping, to characterize the transcriptomic, physiological, morphological, and connectional properties of brain cell types in a systematic manner, towards a multi-modal cell atlas for the mouse and human brain. These studies reveal extraordinary cellular diversity and underlying rules of brain organization and lay the foundation for unraveling mechanisms of circuit function.

Towards the goal of creating a cell atlas for the entire mouse brain, we have generated single-cell transcriptomes from many parts of the mouse brain. A comprehensive transcriptomic cell type taxonomy across the mouse isocortex and hippocampal formation reveals a parallel cell type and circuit organization between these two major brain structures and large-scale continuous gradient distribution of cell types in multiple dimensions in both structures, suggesting evolutionary and developmental underpinnings of the adult-stage cell type landscape.

To better understand the relationship between cell types' transcriptomic profiles and other structural and functional properties, we used Patch-seq to characterize the transcriptomic, physiological and morphological properties of mouse cortical GABAergic interneurons and complete morphology reconstruction of molecularly defined long-range projection neurons from various brain regions. These studies reveal concordant phenotypic variations at major cell type level as well as differential variations at more fine-grained subtype and individual cell levels, suggesting an interplay of genetic programming and network interaction in shaping the cellular diversity in the brain.

October 19, 2021 – Dr. Andrew Tan (in person)

Assistant Professor, Department of Integrative Physiology, University of Colorado Boulder, CO

Title: **Low oxygen therapy: shaping plasticity to enhance motor recovery in persons with incomplete spinal cord injury.**

Abstract: Spinal cord injury (SCI) disrupts motor and sensory pathways, leading to chronic mobility impairments and loss of functional independence. Spontaneous plasticity in spared neural pathways contributes to some motor recovery but is often quite limited. Thus, there remains a need for new treatments that strengthen these spared connections and subsequently elicit motor recovery in persons with SCI. Mild breathing bouts of low oxygen (acute intermittent hypoxia, AIH) is a promising intervention that induces neural plasticity leading to improvements in breathing and locomotion in rats with SCI. Translational work from our group and others demonstrated that AIH improves walking ability and ankle strength in humans with SCI. However, the neuromechanical changes underlying these functional improvements remain unclear. This presentation will examine the evidence showing the efficacy of AIH as an approach to improving motor recovery as well as highlight our current understanding of the neural mechanisms of AIH-induced plasticity. Emphasis will be given to recent efforts to parse gains in downstream motor output resulting from plasticity in pathways affecting both motor facilitation and inhibitory transmission.

November 2, 2021 – Dr. Keren Haroush (Zoom meeting)
Assistant Professor, Department of Neurobiology, Stanford University, CA

Title: **Social Representations in the Primate Brain**

Abstract: A cornerstone of human interaction is the ability to build internal models of other individuals in our environment, based on our past interactions, which in turn enable assessing and predicting another individual's current hidden state of mind, for example, what other individuals are thinking or feeling. Such predictions are key for successful social engagement, mutual reciprocity and cooperative behavior, the glue that holds together our societies. Yet, despite their importance, how social prediction computations are implemented at the single-neuronal and population level, and their causal underpinnings have remained a mystery. This presents a major roadblock to the development of neural circuit-based therapies for an array of neurological and psychiatric disorders in which social interaction deficits are a debilitating factor. Key to our unique approach for rendering the complex psychological problem of predicting another's hidden state of mind a biologically tractable question is using game theory to provide a mathematically driven, well-controlled encapsulation of real-world interactions. Specifically, we adapted the canonical iterated Prisoner's Dilemma (iPD) game in which each agent can choose to cooperate or defect on each trial. Critically, as one's outcome depends on the other's decision in a series of repeating encounters, anticipating the other's intention and upcoming choice is key to one's success. Using this framework we dissect the neuronal signals in the dorsal anterior cingulate cortex that predict the other's yet unknown decision from one's own concurrent choice. To complement our non-human primate results, we investigate the representation of the other in humans. We will discuss our work recording single neuronal activity in intraoperative patients and using deep brain stimulation to further dissect how interconnected brain regions such as the dorsolateral prefrontal cortex and the periaqueductal gray take part in building the internal subjective representation of other agents. Together, this body of work begins to delineate the brain-wide neuronal foundation of social prediction.

December 7, 2021 – Dr. David Arciniegas (TBA)

Clinical Professor, Department of Neurology, University of Colorado Anschutz Medical Campus, Denver, CO, and
Professor and Senior Research neuropsychiatrist, Department of Psychiatry and Behavioral Sciences, University of New Mexico School of Medicine, NM

Title: **Cognition and Cholinergic Function after Traumatic Brain Injury: Lessons in Translational Neuroscience.**

Abstract: Effective treatment of cognitive impairments after traumatic brain injury (TBI) requires a clear understanding of the neuroanatomic and neurochemical bases of those impairments. Toward that end, this presentation will briefly review the structure and function of the acetylcholinergic systems in the brain and their role in cognition. Next, the short- and long-term effects of TBI on acetylcholinergic systems in the brain will be presented. That presentation will integrate findings from basic (e.g., experimental injury studies) and clinical (e.g., neuroimaging, electrophysiology, cerebrospinal fluid, and neuropathology) studies. Those findings and their translation to clinical care, including multicenter clinical trials of medications for persistent cognitive impairments among persons with TBI, then will be reviewed, with particular attention given to the results and clinical implications of three multicenter randomized clinical trials of acetylcholine-enhancing medications for persistent posttraumatic cognitive impairments performed by Dr. Arciniegas and colleagues. Future directions in this area of clinical neuroscience research and lessons learned from studies performed to-date then will be discussed.