NEURAL ENGINEERING RESEARCH SYMPOSIUM

April 2 and 3, 2018
Lois Pope Life Science Center
University of Miami
1095 NW 14th Terrace Miami, FL 33136

Contact Information:
Dr. Suhrud M. Rajguru
Associate Professor
s.rajguru@miami.edu

Program Committee:
Suhrud M. Rajguru, Julia Dallman, Abhishek Prasad, Monica Perez and W. Dalton Dietrich
Institute for Neural Engineering at the University of Miami
MEETING AGENDA

Monday April 2, 2018

7:00 - 8:00 AM  Registration and Continental Breakfast

8:00 - 8:10 AM  Welcome and Opening Remarks by Provost Jeffrey Duerk, University of Miami

8:15 – 9:15 AM  Keynote: Daofen Chen, PhD, NINDS (Introduction by Suhrud M. Rajguru, PhD)

9:15 - 10:45 AM Restoring Mobility After Injury: Challenges and Emerging Approaches
Chair: Julia Dallman, PhD
Speakers:
- Lee Miller, PhD
- Gregorio Valdez, PhD
- Monica Perez, PhD

10:45 - 11:00 AM  Coffee Break

11:00 - 12:30 PM Neural interfaces and Models in Motor Control Neuroscience
Chair: Suhrud M. Rajguru, PhD
Speakers:
- Ranu Jung, PhD
- Jose Contreras-Vidal, PhD
- Abhishek Prasad, PhD

12:30 - 2:00 PM  Lunch

2:00 - 2:30 PM  Keynote: Sheyum Syed, PhD (Welcome back and introduction by Julia Dallman, PhD)

2:30 - 4:00 PM New Frontiers in Neuro-technology Development
Chair: Suhrud M. Rajguru, PhD
Speakers:
- Jay Rubinstein, PhD
- Jack Judy, PhD
- Crystal Noller, PhD

4:00 - 7:00 PM  Poster session and Reception
Tuesday April 3, 2018

9:00 - 9:30 AM  Registration and Continental Breakfast

9:30 - 11:30 AM  SEEDS: Finding Your Niche in Science and Society

*Chair:* Julia Dallman, PhD  
*Co-Chair:* Suhrud M. Rajguru, PhD

*Speakers:*
- Gennaro D’Urso, PhD
- April Mann, MA
- Audra Van Wart, PhD
- Daofen Chen, PhD

11:30 - 1:00 PM  Lunch and networking reception
2018 KEYNOTE SPEAKERS

Daofen Chen, PhD  
Program Director, Systems and Cognitive Neuroscience  
National Institute of Neurological Stroke and Disorders  

Dr. Daofen Chen joined the NINDS as a Program Director in 2001. He currently oversees research grant portfolios and programs in the areas of motor systems, focusing on basic, translational, and clinical sciences of sensorimotor control and integration, neurorehabilitation, and related neurotechnologies. Dr. Chen began his graduate training in neurophysiology at the Chinese Academy of Sciences, studied subsequently at University of Fribourg as an IBRO fellow, and received his Ph.D. in Physiology and Biophysics from University of Washington. He was an NIH NRSA postdoctoral fellow at the Northwestern University Medical School and the Rehabilitation Institute of Chicago, where he also completed his clinical training in movement/rehabilitation science. Prior to joining NINDS, Dr. Chen served on the faculty at the University of Kansas Medical Center. His research career focused on the cortical and spinal mechanisms of motor control and associated neural circuit properties and plasticity.

Sheyum Syed, PhD  
Assistant Professor  
University of Miami  

Sheyum Syed is currently an assistant professor of physics at UM. He did his doctoral work at Columbia, looking at how electrons move in semiconductors under extreme temperatures and magnetic fields. Through a sequence of unexplained neural events leading up to his postdoctoral work, he decided to switch to movements in biological systems. In his first postdoctoral stint, Sheyum conducted single-molecule fluorescence studies on molecular motors at the University of Illinois. To learn biology from biologists, he then went to Rockefeller University for additional postdoctoral research, this time focusing on movements of fruit fly. There he learned about circadian clocks and how they shape animal behavioral patterns in time. At UM, Sheyum’s group uses the fruit fly to gain basic insights into regulatory mechanisms of sleep, color preference and grooming, combining genetics and molecular biology with statistical physics and hardware design.
Lee Miller, PhD
Professor
Northwestern University

*Development of a continuously active, wireless brain computer interface to restore mobility in spinal cord injury*

Although the technology of existing Brain Computer Interfaces (BCIs), is remarkable, the vast majority require the user to be wired to stationary equipment and allow only intermittent control of a computer cursor or a disembodied robotic limb. The associated control algorithms must be regularly recalibrated to compensate for the changing neurons recorded by the chronically implanted microelectrode arrays. We have built upon new methods capable of extracting low-dimensional “latent signals” from wireless neural recordings to develop a novel BCI, stable over month-long periods, that we anticipate will ultimately restore voluntary hand use to patients with spinal cord injury (SCI).

Gregorio Valdez, PhD
Assistant Professor
Virginia Tech Carilion

*Failure to communicate: The contribution of synapses and associated molecules to motor dysfunction*

The ability to initiate and control all voluntary movements requires neurons to communicate with each other and with skeletal muscles. In this talk, I will show that synapses in the spinal cord and in skeletal muscles degenerate early and progressively with advancing age and progression of diseases. I will then present evidence supporting important roles for a growth factor modulating protein in preserving the integrity of synapses during aging and progression of amyotrophic lateral sclerosis, an age-related motor disease.

Monica Perez, PT, PhD
Associate Professor
University of Miami

*Emerging Noninvasive Approaches to Promote Recovery in Humans with Spinal Cord Injury*

Spinal cord injury (SCI) impairs sensorimotor function in muscles below the level of the lesion. Non-invasive approaches suggest that the corticospinal tract represents a target to maximize residual motor output following chronic incomplete SCI. We have used transcranial magnetic stimulation (TMS) over the primary motor cortex to reinforce spinal function using principles of spike-timing dependent plasticity and to mimic the periodicity of descending volleys in the corticospinal tract in humans with and without SCI. Acute intermittent hypoxia changes corticospinal excitability and spike-timing dependent plasticity in humans, opening another avenue to target the corticospinal tract after SCI.

Ranu Jung, PhD
Professor
Florida International University

*Bionic Interfaces: Targeting the Restoration of Lost Neural Function*

The nervous system functions by generating patterns of neural activity which underlie sensation and perception as well as control of movement, cardiovascular, endocrine, immune and other systems. By accessing the appropriate peripheral nerve tissue or end organs, activating it in a focal targeted manner, and utilizing neuromorphic control, bionic interfaces offer targeted restoration of function lost to neurotrauma. This talk will discuss our work in advancing bionic interfaces to enhance ventilatory control after spinal cord injury or restore sensation to upper-limb amputees with a neural-enabled prosthetic hand system.

Jose Contreras-Vidal, PhD
Professor
University of Houston

*Context-aware Mobile Neurotechnologies to Understand the Dynamic Brain in Action and in Context*

In this talk, I will review the state-of-the-art of mobile brain-body imaging (MoBI) technologies to measure and understand the brain response and other data in free behaving individuals acting in complex natural settings. I will review the challenges and advantages of using the museum as a laboratory, which offers an ideal setting to record multimodal data from tens of thousands of participants with rich demographics. I will also review advances in MoBI-based brain-machine interfaces to control wearable robots for restoring motor function to people with disabilities and summarize some of the challenges that next-generation BMI technology have to overcome. I will end my talk by discussing some of the technical and societal impacts of research at the interface of art, science and engineering.
Abhishek Prasad, PhD  
**Assistant Professor**  
University of Miami  
**A New Model for Behavioral Motor Neuroscience Research**

There are currently 282,000 cases of spinal cord injury (SCI) in the United States (US) alone, with about 17,000 new cases occurring each year. During SCI, the descending fibers in the spinal cord are damaged and therefore, they lose their connections with the lower motor neurons that control the skeletal muscles. If the injury is at the cervical level, it results in quadriplegia with little or no function remaining in the four limbs. This patient population can benefit from neural prosthetics to restore movement. Here, I will describe efforts to construct a neural interface by utilizing descending signals in the intact regions of the spinal cord above the point of injury. I will present new results on the feasibility, long-term stability, and decoding of signals recorded from a marmoset spinal cord.

Sheyum Syed, PhD  
**Assistant Professor**  
University of Miami  
**Towards Understanding Sleep with Help from the Fruit Fly**

How does our body know when we are sleep-deprived? Sleep deficit or excess is monitored by a sophisticated biochemical system called the sleep homeostat. Based on the duration of the last adequate sleep episode, the homeostat generates the appropriate propensity for future sleep. But despite its indispensable role in sleep regulation, the architecture and operational principles of the homeostat remain mysterious. In this talk, I will discuss our efforts in dissecting the inner workings of the homeostat through studies of sleep patterns in the fruit fly, a model organism with over a 100 years of history in basic neuroscience.

Jay Rubinstein, MD, PhD  
**Professor**  
University of Washington  
**Challenges, promise and discovery in the development of a vestibular prosthesis**

The UW team is currently implanting a second generation vestibular neurostimulator in human subjects. The device is a modified cochlear implant, originally implanted in non-human primates, then studied chronically in both monkeys and humans. Based on the data obtained, a new device design was fabricated and implanted in non-human primates. These results led to human studies of the new design. Results of both device iterations in both humans and monkeys will be reviewed. Remaining challenges to routine clinical use as well as physiological discoveries obtained with the devices will be discussed.

Jack Judy, PhD  
**Professor**  
University of Florida  
**Revolutionizing Nerve Interfaces for the Control of Advanced Prosthetic Limbs with Microfabricated Electrode Arrays in Tissue-Engineered Scaffolds**

Microfabricated electrodes are often implanted into the brain, spinal cord, or nerves in order to record or stimulate neural activity. The goal of such work is typically to advance neuroscientific understanding or to develop new therapies or solutions for nervous-systems diseases or injuries. For example, nerves are a promising target for neural interfaces used to control sophisticated robotic limbs. However, to provide robust, rapid, and precise prosthesis control and to elicit high-resolution prosthesis-related sensory percepts, a nerve interface needs many reliable and independent motor and sensory channels.

Crystal Noller, PhD  
**Postdoctoral Associate**  
University of Miami  
**Vagal Nerve Stimulation after Spinal Cord Injury**

Vagal Nerve Stimulation (VNS) is an FDA-approved neuromodulation technique currently used to treat neuropsychiatric disorders (e.g., epilepsy and depression). In addition to neuropsychiatric conditions, extensive research has shown that VNS can be used for other indications, such as activating the body’s “cholinergic anti-inflammatory pathway.” This talk will review the use of VNS in conditions characterized by elevated inflammation. The presentation will also discuss our current work examining the use of VNS to modulate inflammation after acute and chronic spinal cord injury.
On April 3, between 9:30AM - noon, at Lois Pope 7th Floor Auditorium, supported by SEEDS at the University of Miami and the Institute for Neural Engineering, Drs. Julia Dallman and Suhrud M. Rajguru will also lead a training workshop for students, postdoctoral scientists and early-career investigators. As the biomedical workforce expands and diversifies, more trainees are seeking jobs outside of academia. In this workshop, four speakers from diverse backgrounds and career paths, Audra Van Wart, Daofen Chen, April Mann, and Gennaro D'Urso, will discuss strategies for making the most of your scientific training by building communication skills and considering diverse career pursuits.
POSTERS


8. **Localized Therapeutic Hypothermia Mitigates Noise-Induced Hearing Loss.** Samantha Rincon, Rachele Sangaletti, Ilmar Tamames, Anne Feliciano, Curtis King and Suhrud M. Rajguru. University of Miami.


10. **Characterizing neural control of precision and power grip tasks using motor unit coherence.** Changki Kim, Monica Perez, Laura M. McPherson. Florida International University.


18. Multi-electrode arrays for simultaneous recording, deep brain stimulation, optogenetics and/or electrochemistry in large animals. Ioan Opris, Stephano Chang, Francisco J Sanchez, Luz M Villamil, Andrea J Santamaria, Juan P Solano, Yohjans Nunez, James D Guest and Brian R Noga. University of Miami.


21. Tissue Engineering Approaches to Improve Schwann Cell Transplantation. Susana R. Cerqueira, Yee-Shuan Lee, Robert C Cornelison, Michaela M Mertz, Rebecca A Wachs, Christine E Schmidt, Mary Bartlett Bunge. University of Miami.


27. Encoding of direction in spiking and local field potentials (LFP) in the primary motor cortex (MI) of the common marmoset (Callithrix jacchus). Ramanamurthy Mylavarapu, Noeline Prins, Shubham Debnath, Shijia Geng, Eric Pohlmeyer, Justin Sanchez, Abhishek Prasad. University of Miami.


THE DEPARTMENT OF
BIOMEDICAL ENGINEERING

UNIVERSITY OF MIAMI
COLLEGE of ENGINEERING

WWW.BME.MIAMI.EDU