

CENTER for NEURORESTORATION & NEUROTECHNOLOGY



July 2019

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Important Dates:

July 2: CfNN Priority Funding Requests Due

July 4: Independence Day

September 2: Labor Day

September 30: Progress Report Deadline for CfNN Priorities Funding

November 26: CfNN Seed Application Deadline

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Investigators Awarded Career Development Funding

Amin Zand Vakili, MD, PhD, received a KL2 Mentored Research Award from the Brown University Advance-CTR for his project entitled “Machine Learning to Predict Clinical Response to Transcranial Magnetic Stimulation: A Resting State Electroencephalography Study.” His study aims to use machine learning and human electroencephalography (EEG) to predict transcranial magnetic stimulation (TMS) treatment response, as well as to study TMS’s mechanism of action (i.e., how it works in the brain). By using EEG to predict treatment outcome and understand TMS mechanisms, this study attempts to identify Veterans with mental health disorders for whom TMS is the most effective, ultimately with a future goal of refining and individualizing TMS treatment.



Young investigators, Amin Zand Vakili, MD, PhD (left) and Jennifer Barredo, PhD (right), awarded funding for CfNN research projects.

This \$275,022 KL2 includes two years of protected time for research within an individual training plan, and is mentored by CfNN Associate Director, Benjamin Greenberg MD, PhD, CfNN FA2 Director, Noah S. Philip MD, and Michael Frank PhD of Brown University.

Dr. Zand Vakili started with CfNN in 2016 through the R25 psychiatry resident research track. After completing his residency, he accepted a PVAMC position as a psychiatrist and researcher in July 2018.

Jennifer Barredo, PhD, recently received a five-year, \$1,019,270, Career Development Award (IK2 CX001824-01A1) from VA Clinical Science Research and Development (CSR&D), which will provide her support for additional research training and mentorship, as well as funding for her project entitled “Identification of Veterans at-risk for Suicide: a Multidisciplinary Approach.” This new study will use brain magnetic resonance imaging (MRI) and “big data” mathematical techniques to examine the biology of suicidal thoughts and behaviors in Veterans. Over the course of the project, Dr. Barredo will be mentored by researchers and clinicians from CfNN (Benjamin Greenberg MD, PhD, Noah S. Philip MD, and Jerome Sanes PhD), PVAMC (Jennifer Primack PhD), and Brown University (Michael Armev PhD, and Elizabeth C. Chen, PhD).

Dr. Barredo is a Research Health Scientist at PVAMC and an Assistant Professor (Research) at Brown University. She is committed to improving the mental and physical health of Veterans and has been with CfNN since 2015. Her early work at CfNN focused on how thinking and reasoning ability influenced the use of advanced prostheses with CfNN investigators Linda Resnik, PhD and Jerome Sanes, PhD. Her more recent work has used brain imaging to study mood and anxiety disorders, as well as suicide, in Veterans.

Veteran & CfNN Researcher: A. Nicole Dusang



The family and friends of Nicole Dusang (*pictured left*) were shocked when she joined ROTC in college. She had family members who had served, but she didn't come from a military family, and many that felt her personality would not mesh well with military expectations. Nicole was a "self-described hippy" and those closest to her would have described her as a free-spirit and nonconformist. Regardless, she was intrigued by the teamwork and camaraderie present in military culture, and understood that ideals of freedom and individualism, which she dearly cherished, had to be defended.

After earning her BS in electrical engineering, she served in the U.S. Air Force (USAF) for 11 years, separating as a Major in 2014. Nicole started as a Developmental Engineer and was later cross-trained into Civil Engineering (CE), where in her last seven years of service she served as an Explosive Ordnance Disposal (EOD) officer. She deployed four times while in the USAF—once to Iraq as a traditional CE officer, and three times to Afghanistan as an EOD officer.

Following her military service, Nicole decided to pursue a PhD in engineering. While researching programs, she learned about the novel developments in neural engineering and became fascinated with the therapeutic and rehabilitative applications.

Her time in the service influenced her to pursue this line of research. Many service members are affected by traumatic brain injuries, post traumatic-stress, and loss of mobility. She was excited that this line of research could be a way to give back to her military brothers and sisters. Brown University fostered groundbreaking research in this field, and it was the only place Nicole wanted to attend for her PhD. She is currently in her 4th year at Brown and is working to design and build an electroencephalogram (EEG) based arm orthosis for stroke rehabilitation. This project is a collaboration between CfNN at the Providence VAMC, Brown University, and Massachusetts General Hospital.

Thoughts from CfNN trainee, A. Nicole Dusang:

"The concept of service before self is highly indoctrinated in military personnel. I think it's important to emphasize to military members and Veterans that the need for self-care, whether that be medical treatment or simply a nap, isn't a weakness. Quite the opposite, recognizing the requirement, and addressing it, takes courage and discipline. A lesson I had to learn was that when I am my best self, I make better contributions to the team. I achieve those improved versions of myself by addressing my needs.

I highly encourage Veterans to get involved in research. I have been a participant, and now I have the opportunity to be a researcher as well. I love being on both sides of the table so to speak. Of course, I love pursuing my own research interests, but it's also nice to be a participant and experience how other researchers design their experiments and learn what their studying. I had this feeling when I first started that I wouldn't be good at research, since I didn't have a background in it, but the necessary skills can be developed. However, one essential prerequisite is the motivation to know and to master your area of study ... oh, and patience, loads and loads of patience."

Interested in our research?

Highlighted below are a selection of our studies that are actively recruiting and enrolling Veteran participants.

Feasibility of the BrainGate System for Veterans with ALS

PI: Leigh Hochberg, MD, PhD

Contact: Marguerite at 401-273-7100 ext. 6221

The overall goal of this research is to develop an effective communication and environmental control system for Veterans and other people with ALS. The specific goal of this project is to provide preliminary safety and feasibility testing of an intracortical neural interface system (NIS) for communication and environmental control in people with advanced ALS. Persons with limited hand use secondary to ALS, brainstem stroke or cervical spinal cord injury will be enrolled to evaluate this investigational; medical device, the BrainGate2 Neural Interface System (NIS). Using a small implanted sensor to record the brain's natural movement-related signals from motor related cortex (MRC), and using real-time decoded neural activity, participants will attempt to use the NIS to control a computer cursor simply by imagining or attempting movement of their own hand.

Neuroimaging Biomarker for Seizures

PI: William Curt LaFrance, MD, MPH

Contact: Krista at 401-273-7100 ext. 6229

This study will examine patients with epilepsy following head injury and posttraumatic psychogenic non-epileptic seizures and will compare them to patients with traumatic brain injury who do not have seizures. The research includes cognitive behavioral therapy for seizures, a manualized behavioral therapy program, (for the participants with seizures) and MRI. The aim is to investigate the differences in cerebral underpinnings of emotion and stress processing in these participants.

Closed-Loop Feedback Control for Transcranial Direct Current Stimulation

PI: Noah S. Philip, MD

Contact: Dr. Frank at 401-273-7100 ext. 6256

The aim of this study is to see if the use of a low-level electrical current to the head will improve attention and associated physiology in healthy participants that complete this study. The study involves computer tasks to assess participants ability to pay attention and then watch a monotonous virtual reality driving scenario while heart rate and brain activity, in the form of electroencephalography (EEG) and functional near infrared spectroscopy (fNIRS), are collected.

New studies are always starting up at CfNN. To learn more about the projects listed above as well as hear about other research opportunities, please visit us online at <https://www.providence.va.gov/research/CfNN/index.asp> or contact Marguerite Bowker by calling 401-273-7100 (ext. 6221).

Get to know the CfNN team



Focus Area 2 welcomed David Sorensen as a Senior Research Assistant in January 2019.

Prior to joining the CfNN team, David completed a Master of Science degree in Neuroscience at Brigham Young University in Provo, Utah. There, his research focused on implementing simultaneous electroencephalography and functional magnetic resonance imaging (EEG/fMRI) data acquisition methods, particularly in the field of auditory processing. He also collaborated with labs examining sleep, emotional processing, and speech therapy.

David's interest in various methods of examining neural function in the whole human brain led him to CfNN. He hopes to expand his EEG and MRI knowledge and skills, in addition to learning about neuromodulation through a variety of stimulation methods, including but not limited to, transcranial direct current stimulation (tDCS) and transcranial magnetic stimulation (TMS). In the future, David plans on continuing his education to pursue a PhD, and believes his experience at CfNN will be an invaluable step along his academic career path.

Welcome David!

Director's Remarks



I open my inbox this morning and find a link to another analysis (available for the low price of \$695) estimating that the U.S. market for neurotechnologies, or brain-computer interfaces, or neurorestoration technologies, will soon exceed \$1.2 billion annually, or maybe \$2.5 billion by 2023. The report, if purchased, would advise me of a long list of companies, most small, some no longer in existence, that have already developed, or are just about to develop, a breakthrough technology that will have a strong consumer sales angle based on a stronger intellectual property strategy that will eventually, maybe, be sufficiently tested to warrant being labeled to treat a medical condition. Thankfully, despite the hype, that email is flanked by others, from friends and colleagues who are deep in the details of planning and performing rigorous research all with the common goal of restoring function, to Veterans with injuries or illness of the nervous system.

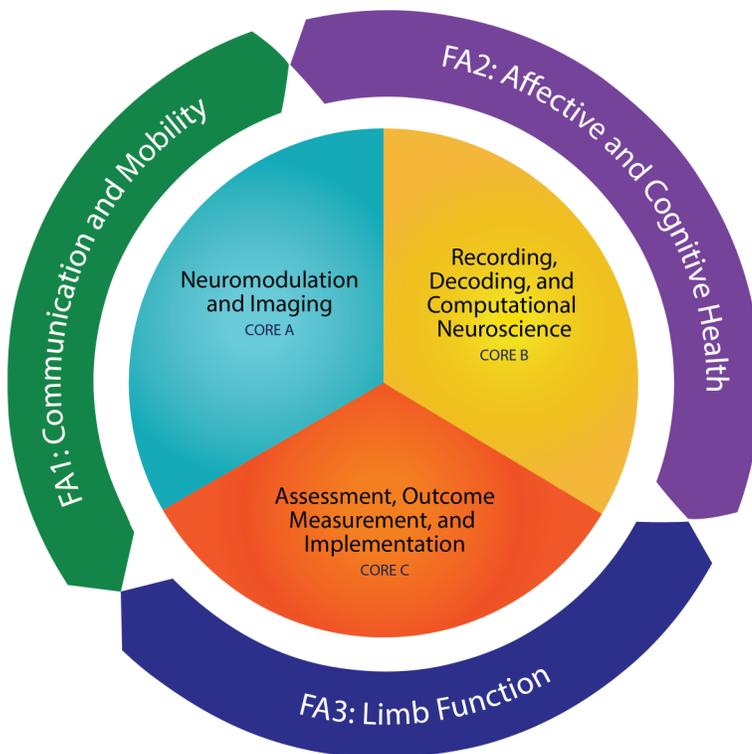
Over the past few months, our newly renewed Center has been launching new seed projects in neuromodulation for PTSD and in the use of artificial intelligence to restore vision. We're developing new portable technologies capable of conditioning and decoding thousands of neuronal signals, continuing on a path to a robust communication system for Veterans with ALS. A Veteran research trainee is working on novel BCI approaches to stroke rehabilitation. And we're learning how female Veterans with upper limb amputation report outcomes after using modern prostheses. With all of this, in addition to the many other active clinical research endeavors at CfNN, there's a lot to be proud of. And our role locally and among VA rehabilitation research centers across the US continues to expand.

We serve the Veteran community through our research. Additionally, we value Veterans' feedback about our research, the recruitment materials we use, and the methods we use to disseminate our research findings. In May, CfNN held the inaugural meeting of our Veterans Research Engagement Committee. Even in our initial discussions we're already receiving valuable guidance through what we hope will be a mutually beneficial effort. As a result of these meetings, our clinical research will become more efficient, and its impact will be that much greater.

I hope to use this newsletter to provide occasional updates on topics of interest to CfNN investigators and friends. The hard work of restoring communication, mobility, affective and cognitive health, and limb function often revolves around getting the details right, from planning through the performance and then the reporting of research, all en route to delivering new and better therapies. Please let CfNN staff know – early and often! – how we can help to advance both our research and collective mission.

Leigh Hochberg, MD, PhD

The VISION of the CfNN is to develop, test, and implement new therapies and technologies that restore function for Veterans with disorders affecting the nervous system.



Visit us online to learn more about CfNN and stay up-to-date with our offerings and progress!

<https://www.providence.va.gov/research/CfNN/>