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MESSAGE FROM THE DIRECTOR

The past year saw the unanticipated challenge of the COVID-19 pandemic, where the adaptability and innovation of MRRRI were demonstrated. Individual staff acted quickly to ensure the safety of each other and research participants, while pivoting from in-person experimental work and recruiting, to remote work such as data analysis, manuscript writing, and grant preparation. Despite its challenges, 2020 saw a buzz of activity, with MRRRI scientists continuing their outstanding record of scholarship, contributing to over 40 research publications, presenting at virtual conferences, and serving as committee members and leaders for professional organizations and meetings.



Despite the clear health and socioeconomic impacts caused by the pandemic to society, efficiencies and methods have been developed that will carry forward in a post-COVID era. The work of our clinical colleagues at MossRehab and Einstein Healthcare Network was remarkable, continuing to deliver first-rate clinical care, while remaining a top workplace for employees. MRRRI continues to be a vibrant and supportive environment that is conducive to ongoing high-quality translational research, allowing our scientists the intellectual freedom to pursue their programmatic research goals in support of the mission of MRRRI. As Director, I am proud of how we've responded to the challenges of the past year, and look forward to our continued success in 2021.



Dylan Edwards, PhD

RESEARCH PARTICIPANT SPOTLIGHT

Letter from an MRRRI Study Volunteer

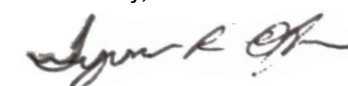
After I had my stroke in 2008, I was diagnosed with aphasia which made it hard for me to talk to people. I had many months of therapy at MossRehab, and when I was approached about a research study, I decided to volunteer. It was easy because they were able to provide transportation and help me through every step. Everyone that I worked with at the research institute was kind and understanding.

I enjoyed my time in the study so much that I still choose to volunteer often, almost 13 years later.

I wanted to do it again because it's a good purpose – helping people with speech problems. My aunt had a stroke a little over a year ago, and I recommended that she volunteer for research at MRRRI too. I've been in a lot of different kinds of studies, and I wanted somebody else to know that if I can do it, someone else can too. I'm happy to be able to help other people with aphasia while also enjoying the research and the people at MRRRI.

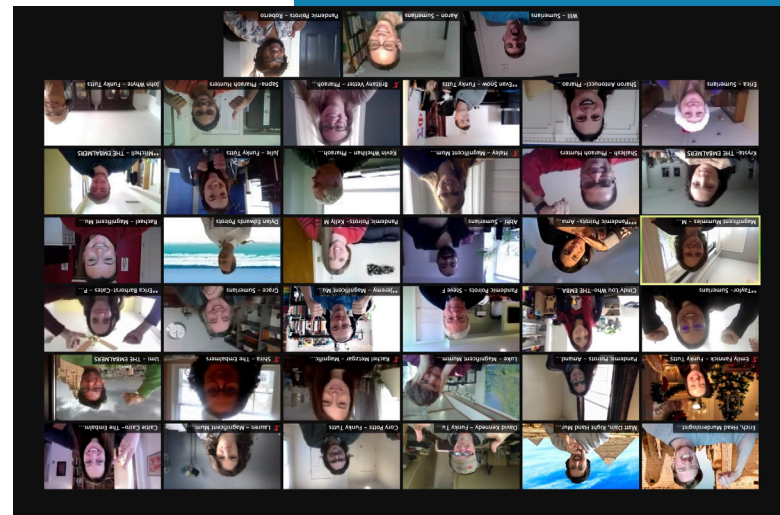


Sincerely,



Tyrone Ogburn

2020 was a year that presented profound challenges. The COVID-19 pandemic upended life for the entire global community with devastating personal, social, and economic effects that are still continuing to unfold. The ability to adapt to change has been strikingly apparent here at MRRRI, as our staff have continued their dedicated pursuit of our core mission, improving the lives of individuals with neurological disabilities through research.



In 2020, MossRehab was again ranked among the top rehabilitation providers in the nation by U.S. News & World Report magazine.

CONTINUED DEDICATION TO OUR MISSION DURING COVID-19

MOVEMENT SCIENCE AND MOBILITY REHABILITATION

Imitation and Tool Use in Limb Apraxia

Imitating movements and using tools are two important abilities that allow us to efficiently learn new behaviors and manipulate our environments. Both may be impaired in limb apraxia, a clinical disorder in which individuals with left-hemisphere stroke or other neurological disorders have trouble performing skilled, purposeful movement. Imitation and tool-use deficits can occur even with the “unaffected” arm without any other underlying movement deficits. This suggests that something is going awry with cognitive processing – though it remains unclear exactly what is impaired.



Recently, Drs. Aaron Wong and Laurel Buxbaum of MRRI, with Dr. John Krakauer of Johns Hopkins Medicine, were awarded a grant from the NIH to develop a novel theory of how neurotypical individuals imitate and use tools, and how those processes are disrupted in limb apraxia. By bringing together expertise in cognitive neuroscience, neuropsychology, and motor neuroscience as well as employing state-of-the-art techniques, this team hopes to shed light on a disorder that has puzzled clinicians and scientists for over a century.

The project will explore how task goals guide the choice between two different approaches. Some actions are best performed by specifying how the body and tool should be configured; for example, ballet dancers learn to perform beautiful dances by rehearsing sequences of well-learned positions. In contrast, other actions are best performed by specifying how the body part and tool should move; for example, planning the winding path the hand should follow when reaching around an obstacle. This project will describe how and under what circumstances these two approaches support imitation and tool use. Results will not only advance our current understanding of apraxia, highlighting pathways that might be targeted for rehabilitation treatment, but they will also serve as a model for studying cognitive-motor interactions more broadly.

COGNITIVE NEUROSCIENCE AND COGNITIVE REHABILITATION

Assessing Navigation Difficulties After Stroke



The combination of walking, maintaining balance, and turning while also attending to one’s surroundings and remembering locations make real-world navigation a particularly complex daily activity. Even though nearly a third of people who have had a stroke report difficulties with navigation, this is rarely assessed during rehabilitation. MRRI postdoctoral fellow Dr. Erica Barhorst-Cates, along with Drs. Laurel Buxbaum and Aaron Wong, recently received a grant from the Albert Einstein Society to study spatial navigation deficits in individuals after stroke.

The team will test the navigation abilities of individuals who have had a stroke as well as a group of neurotypical individuals in a real-world environment. Participants will perform the navigation task in three different conditions: walking, being pushed in a wheelchair, and watching a video. Our scientists expect neurotypical individuals to perform best when walking, because they will be able to make use of all the information they receive from their own body movements to remember where they are and where they have been. In contrast, participants with stroke may perform best in the video condition, wherein they are able to focus completely on remembering locations and routes.

The researchers will also examine how stroke location and individual differences in movement and cognitive abilities relate to performance on the navigation task. This project will improve our understanding of navigation deficits after stroke and the characteristics of individuals who might have difficulties with spatial navigation.

Research is an important part of treatment, often leading the way to new advances and innovations in medical rehabilitation.

To support our research at MRRI, visit the donation page of our website: <http://mrrri.org/donate-now/>

We highlight some of MRRI’s exciting research, as well as recent presentations and workshops in videos on our YouTube channel (youtube.com/user/MossRehabResearch).

Get connected with us!

To stay up to date on our latest announcements and activities:

Visit our website MRRI.org

Follow us on Twitter at [@mossresearch](https://twitter.com/mossresearch)

Subscribe to our YouTube channel at <https://www.youtube.com/user/MossRehabResearch>

Like and follow Moss Rehabilitation Research Institute - MRRI on Facebook

EARLY CAREER TRAINING AT MRRI

MRRI is Dedicated to Preparing the Next Generation of Rehabilitation Researchers

MRRI provides exceptional training opportunities for early-career scientists through a postdoctoral research program funded by a National Institutes of Health T32 training grant in translational neurorehabilitation research. Marja-Liisa Mailend, Ph.D., and Frank Garcea, Ph.D., are two scientists who recently completed postdoctoral fellowships at MRRI.

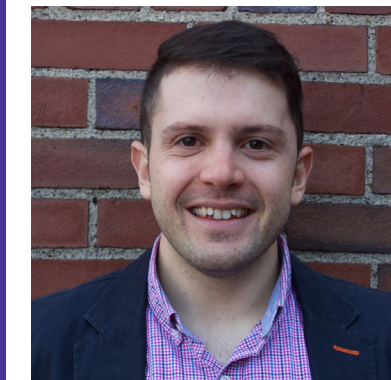
Dr. Mailend reflects on her time at MRRI:

“I was drawn to MRRI by the outstanding and highly impactful aphasia research developed here, exceptional mentors, interest in experiencing a different setting apart from a university, integration with a world-class rehabilitation hospital at MossRehab, excellent resources, and so much more.”



In my time at Moss, I gained a very rich experience for launching a career in rehabilitation, as well as friends and colleagues within my profession. One of my most memorable moments was seeing my first participant with aphasia in the first experiment that I set up at MRRI. I work on a phenomenon called speech entrainment, which refers to the act of speaking in synchrony with another person. It was fascinating to witness that phenomenon for the first time in person.

The research I conducted at MRRI has shown that while motor programs are largely intact in people with apraxia of speech and aphasia, the process of accessing them is impaired. This finding is important clinically because most current treatment approaches assume that the motor programs are not intact and must be reestablished in the context of treatment. My research suggests that effective treatments should focus instead or in addition on the process of accessing and selecting the intended motor programs.”



Dr. Garcea reflects on his experience:

“The environment at MRRI is unique in that postdocs have a great deal of face-time with our primary mentors and with other Institute Scientists and visiting scholars.”

During my fellowship, I partook in seminars and training workshops; and I got opportunities to learn new research skills, publish papers, and write grant proposals. Of the many great experiences I had during my fellowship, publishing my first scientific paper was particularly memorable. I was thrilled when the neuroimaging project that I spearheaded was published, as it symbolized hard work and effort, and the new pathway I had forged for myself in pursuing my postdoctoral research goals. It was also the first (of many) great accomplishment that I’ve shared with my mentor Dr. Buxbaum.

The research I conducted at MRRI examined how different brain networks interact when performing tasks like using objects. Moving forward, I would like to understand the necessity of neural connectivity by testing individuals who have reduced or degraded network connectivity, due to stroke or brain tumor. Investigating connectivity loss provides us with a unique opportunity to test theories of brain structure and function, towards the goal of devising optimal strategies for rehabilitation and recovery.”

We look forward to continuing to keep in touch with Dr. Mailend and Dr. Garcea as they develop their independent research programs.



MRRI
MOSS REHABILITATION
RESEARCH INSTITUTE

MossRehab
EINSTEIN HEALTHCARE NETWORK

APHASIA CENTER

Innovating Aphasia Rehabilitation with Animal-Assisted Therapy

The hallmark impairment for persons with aphasia is word retrieval difficulty, and it can sometimes be so severe that individuals can only produce one or two words. However, some of the effects of aphasia that are most disruptive to well-being are not the word-finding problems themselves, but rather the resulting social isolation, loss of friendships, and reduced opportunities for community engagement. This is particularly impactful when considered in light of the fact that individuals with aphasia retain the drive to communicate and their pragmatic communication skills such as use of 'body language', facial expression, and tone of voice. It is these strengths that make people with aphasia ideal candidates for work with animals, which attend as much if not more to how we communicate than to what we say.



The Aphasia Center has recently been awarded an NIH grant to conduct pioneering research on an animal-assisted therapy for people with aphasia that is designed to harness these strengths and target the psychosocial consequences of aphasia. Originally funded as an Albert Einstein Society Innovative Program, the Persons with Aphasia Training Dogs Program was designed by Dr. Sharon M. Antonucci to teach participants positive reinforcement dog training techniques. The current study will evaluate the benefits of new skill learning and the advantages of interaction with family- or shelter-dwelling dogs to increase confidence and social engagement to support participants in living well with aphasia.

TRAUMATIC BRAIN INJURY TREATMENT AND OUTCOMES

Introducing Dr. Umesh Venkatesan, Director of the Brain Trauma and Behavior Lab



In 2019, MRRI welcomed Dr. Umesh “Umi” Venkatesan to our team of exceptional Institute Scientists. Dr. Venkatesan’s focus is on the neuropsychology of traumatic brain injury (TBI), an interest cultivated through his undergraduate work at Johns Hopkins University and subsequently as a research assistant in medical rehabilitation. On his early scientific experiences, Dr. Venkatesan notes, “I explored a range of neuroscience research. However, working with younger individuals with moderate-to-severe TBI, in particular, directed my attention towards the importance of rehabilitation in chronic, life-altering disability and the need for continued care.” His passion for this topic led him to pursue a Ph.D. in clinical psychology at Pennsylvania State University. With a focus in clinical neuropsychology, he also completed a predoctoral clinical internship at Alpert Medical School (Brown University) and postdoctoral training within the VA Boston Healthcare System.

Dr. Venkatesan established the Brain Trauma and Behavior (BraTBehavior) Lab upon arriving at MRRI. His scientific program includes three main lines of research: the mechanisms and manifestations of memory problems after TBI, issues related to aging with a TBI or sustaining a TBI as an older adult, and pre-injury influences (e.g., psychological functioning, socioeconomic status) on post-injury outcomes. The BraTBehavior Lab also collaborates closely with the TBI research team in the Brain Injury Neuropsychology Lab led by Dr. Amanda Rabinowitz.

Dr. Venkatesan explains that it is a long and uncertain road to an independent research career. “As many scientists will testify, that feeling of uncertainty never quite goes away, but it is assuaged by a supportive environment and the resources to perform quality science,” he says. “I am thrilled and thankful for the opportunity to work with such bright minds and compassionate hearts at MRRI.”

Outside the lab, you may find Dr. Venkatesan singing, dancing, hiking, running, and enjoying various cuisines in the company of friends and family. He is an accomplished Indian classical dancer and a trained classical and contemporary vocalist. Dr. Venkatesan notes that the performing arts provide both a reprieve from and fresh perspectives on life stressors, and he feels this has been essential to his personal and professional pursuits alike.

We published 46 new posts on the MRRI blog last year, and we look forward to sharing more stories and updates with you in 2021!

Visit our blog at mrrri.org/blog/ to keep up to date on what’s new at MRRI.

2020 ACCOMPLISHMENT HIGHLIGHTS

18
Conference
Presentations

Dr. Umi Venkatesan's work on post-traumatic amnesia and chronic memory impairment after TBI received an Early Career poster award from the American Congress of Rehabilitation Medicine.

Dr. Shailesh Kantak and Dr. Laurel Buxbaum were awarded an Albert Einstein Society grant to study behavioral and neurophysiologic bases of arm choice during goal-directed reaching actions after stroke.

The Manual for the Rehabilitation Treatment Specification System (RTSS) developed by Dr. John Whyte and colleagues has been downloaded nearly 500 times internationally. The RTSS is being incorporated in rehabilitation science curricula in various universities, and RTSS concepts are at the foundation of new recommendations for how rehabilitation treatments should be reported.

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Grants
Funded

Dr. Sharon M. Antonucci received NIH/NICHD funding to study the Persons with Aphasia Training Dogs Program, an animal-assisted therapy. She also serves on two regional advisory committees (Project Bridge and the Aphasia Resource Collaboration Hub) that provide connections, research opportunities, and clinical and research resources to those living with aphasia.

Dr. Laurel Buxbaum published 4 peer-reviewed journal research articles and a chapter on cognitive-motor disorders in *The Cognitive Neurosciences*, a well-regarded textbook. She also serves on the Program Committee of the American Society of Neurorehabilitation.

Dr. Dylan Edwards served on an international committee to develop training guidelines for non-invasive brain stimulation to address an important gap in the field. He and colleagues also found that brain stimulation assessment combined with clinical assessment, can predict recovery of arm function after intensive rehabilitation in people living with muscle weakness after a stroke.

Dr. Shailesh Kantak and his team demonstrated a causal role of the contralesional motor cortex in dexterous goal-directed actions of the weaker hand after stroke. His lab also determined the differential effects of instructional focus on grasping in left and right hemisphere stroke.

Dr. Erica Middleton published multiple peer-reviewed research articles, as well as a book chapter, co-authored with Dr. Daniel Mirman, that will appear in the highly regarded *Oxford Handbook of the Mental Lexicon*. Dr. Middleton serves on the Program Committee of the Academy of Aphasia.

Dr. Amanda Rabinowitz will serve as site principal investigator on a 5-year multi-site grant award from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) to develop a chronic disease management model for people living with TBI.

Dr. Amanda Therrien was invited to present her work on motor learning in cerebellar ataxia as the PT/OT keynote speaker for the 40th Annual Neurorehabilitation Conference at the Encompass Health Rehabilitation Hospital of Braintree. She also published research showing that a novel approach to motor training may reduce elements of cerebellar reaching ataxia.

Dr. Umi Venkatesan published on multiple aspects of health related to chronic TBI, including a study discussing how depression and social cognition are independently related to everyday function. Additionally, he was awarded a grant from the Albert Einstein Society to study the impact of adverse childhood experiences on TBI outcomes.

Dr. Aaron Wong organized an international workshop on lesion-symptom mapping, a technique used to identify relationships between behavioral deficits and lesioned brain regions in patients with stroke. Work from his lab was also presented at Neuromatch, a new global online neuroscience conference dedicated to making science more open and accessible.

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Research
Papers

OUR RESEARCH REGISTRY

MRRRI Database Supports Research in Neurorehabilitation



Moss Rehabilitation Research Institute maintains a registry of over 2,000 research volunteers, and this registry helps support rehabilitation research in the MossRehab community. Volunteers include adults who have a neurological condition such as a stroke or traumatic brain injury, as well as adults who do not have a neurological condition. In the past year, MRRRI and MossRehab have continued working together to expand the MRRRI Research Registry to include people with Parkinson's disease who are interested in research opportunities.

We are grateful to all of our research volunteers and their families. Their participation is vital to the discovery of state-of-the-art, evidence-based neurorehabilitation treatments at MossRehab.

To learn more, please visit <http://mrrri.org/patient-research-registry/>