MRRI
MOSS REHABILITATION
RESEARCH INSTITUTE
50 Township Line Rd.
Elkins Park, PA 19027

MRRI Letters
Moss Rehabilitation Research Institute

In 2022, MossRehab was once again ranked among the top 10 rehabilitation facilities in the country by U.S. News & World Report.

MESSAGE FROM THE DIRECTOR

2023 is off to a fantastic start at MRRI. The level of productivity and vibrancy is delightful to observe as our scientists uncover new results and tackle complex scientific theories and clinical problems. Most notable and rewarding is the in-person teamwork at Elkins Park after a prolonged period of mostly remote work. The energy and creativity that comes from in-person interactions with our clinical collaborators, research participants, and administrative support colleagues is truly invaluable to our work.

Last year was filled with great accomplishments, demonstrating our team's enduring commitment to cutting-edge and clinically-relevant science. You can read more about our recent activities in our latest Annual Report. We have an exciting year ahead with many opportunities, and no doubt challenges that we will overcome together. This year, we will continue to make progress on various research projects spanning the translational continuum, disseminate our research locally, nationally, and internationally, and continue to provide exceptional training to early-career scientists. We are excited to see what 2023 has in store. Wishing all a happy and productive year.

Sincerely,

D Edwards

Dylan Edwards, PhD

LETTER FROM ADELYN BRECHER, CCC-SLP

Reflections on three decades of research at MRRI

I came to MRRI in 1992 enticed by the research world and eager for a new challenge as a clinical Speech-Language Pathologist. My first task was to listen to tapes and measure how long it took people with aphasia to name pictures. That project in the Aphasia Lab led by Dr. Myrna Schwartz was to last 6 months. Fast forward thirty years, and I stand ready to retire from a journey I call my "professional gift".

The Research Institute gave me endless time and resources to study topics in depth. I worked on countless scientific studies related to aphasia, but also on projects that required creativity and technological learning. Throughout the years, I received generous mentorship in how to successfully achieve goals and disseminate findings to the community. I also had a treasured responsibility to train new Research Assistants in how to communicate successfully with the selfless people with aphasia who made our projects successful. The ability to maintain these clinical ties within a research setting was a highlight.

There is a spirit of congeniality at the Research Institute that is hard to duplicate. Over the years, the staff has grown considerably, but one constant has been an Institute-wide genuine respect for the knowledge that each ancillary discipline contributed. It's been an honor to be an Associate here.

I look forward to all the joys associated with free time and family, but I sense my future may hold a future research project or two!

Sincerely,

Adelyn R. Brecher

Adelyn R. Brecher

30 Years of MRRI: A Look at the Institute's Founding and History

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Celebrating 30 Years of

Over the past three decades, research MRRI has changed clinical practice in neurorehabilitation, advanced our understanding of the relationships between brain structure and function, and eased the burden of disease from neurological conditions worldwide. As the Institute celebrated its 30th anniversary last year, it is exciting to reflect on how MRRI came to be and its many accomplishments.

Drs. John Whyte and Myrna Schwartz (MRRI's Founding Director and Associate Director, respectively) worked with the MossRehab board to establish MRRI in 1992. Over the years, promising researchers were recruited, and MRRI scientists have made numerous important contributions to the field of neurorehabilitation.

The Institute currently has ten laboratories and programs, and MRRI scientists have exceptional track records of research funding. The bridge between contemporary clinical practice at MossRehab and the ground-breaking translational research continues to be a key strength at MRRI and serves to attract clinicians working at MossRehab as collaborators. In 2021, Einstein Healthcare Network and Jefferson Health finalized a merger that brought these two outstanding organizations together and provided even more opportunities for MRRI to grow and continue its legacy of research excellence.

New Studies Examine Primary Motor Cortex Changes in Degenerative Cerebellar Ataxia

A person's ability to properly coordinate their movements as they go through their daily life relies on a part of the brain called the cerebellum. Cerebellar ataxia is a movement disorder that results when the cerebellum is damaged. People with cerebellar ataxia have difficulty controlling their balance, and their walking can have a "drunken" appearance. Damage to the cerebellum also impairs the control of reaching movements, eye movements, and speech.
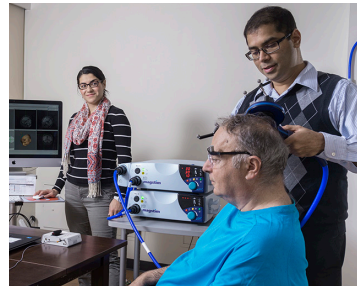
Current interventions often show limited success because cerebellar damage impairs an important mechanism for learning to alter movement patterns, called adaptation. For the past few years, Amanda Therrien, PhD, has been studying whether people with cerebellar degeneration can leverage a different mechanism, called reinforcement learning, to change their movement. This work has shown that reinforcement learning is less dependent on cerebellar integrity than adaptation and that people with cerebellar degeneration can use reinforcement learning to change their movement patterns.

Dr. Therrien's research has revealed variability in the responses to reinforcement learning interventions in people with cerebellar degeneration. The ability to predict which people are likely to benefit most from reinforcement learning is a critical step in translating this kind of training to interventions that could be useful in clinical settings.

Reinforcement learning depends on excitatory plasticity in a region of the brain called the primary motor cortex. The cerebellum is highly connected with the primary motor cortex, and cerebellar damage can alter primary motor cortex activity in a way that may hinder the plasticity needed to leverage reinforcement learning. Dr. Therrien received a grant from the National Center for Neuromodulation for Rehabilitation to use non-invasive brain stimulation to study changes in primary motor cortex activity in people with degenerative cerebellar ataxia. Shailesh Kantak, PT, PhD, is a co-investigator on the grant, and Dylan Edwards, PhD, will serve as a consultant. The project will determine whether these changes can predict responsiveness to a reinforcement learning intervention.

Subscribe to our YouTube channel (youtube.com/user/MossRehabResearch) to see recent videos featuring our researchers, presentations from the Shrier Family Topics In Rehabilitation Science Seminar Series, MRRI Visiting Scholar Lectures, and more!

COGNITIVE NEUROSCIENCE

MRRI Researchers Are Studying the Disparity Between Arm Capacity and Use in Stroke

Laurel Buxbaum, PsyD, and Shailesh Kantak, PT, PhD, were awarded a $2.5 million grant award from the National Institutes of Health (NIH) to study the cognitive and neuroanatomic factors that influence arm choice after stroke.

As many as 94% of stroke survivors exhibit reduced use of one arm, with adverse consequences for disability, caregiver burden, and quality of life. Approximately 40%-80% of individuals who fail to use the affected arm in daily life possess adequate sensory-motor capacity to do so. The disparity between arm use and capacity (i.e., Use/Capacity Disparity — UCD) occurs across a broad spectrum of sensory-motor severity and is a perplexing and urgent problem in neuro-rehabilitation. Perhaps in part because UCD lies at the interface of sensory-motor processing and cognitive/affective phenomena, very little past research has assessed its underlying mechanisms or neuroanatomic biomarkers. The NIH grant awarded to Drs. Buxbaum and Kantak will test the predictions of three hypotheses of the mechanisms underlying UCD: the sensorimotor, attention, and apathy/motivation accounts.

By the end of the grant period, the research will determine the demographic, sensorimotor, neuropsychological, and neuroanatomical factors that predict UCD and will validate a clinically-useful VR assessment tool. Given the limited knowledge base in this area, this comprehensive research will pave the way for the development of treatments targeted to underlying mechanisms and enhanced identification of at-risk individuals.

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

You can help make a difference by supporting our research at MRRI.
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MRRI WELCOMES NEW POSTDOCTORAL FELLOWS

### Four New Postdoctoral Researchers Joined MRRI in 2022

Over the years, Moss Rehabilitation Research Institute (MRRI) scientists have provided outstanding mentorship and training to postdoctoral fellows from diverse academic, cultural, and geographic backgrounds. In 2022, MRRI was delighted to welcome Simon Thibault, PhD, Yingxue Tian, PhD, Amy Lebkuecher, PhD, and Anna Krason, PhD, to the Institute.

Dr. Thibault (top left) is receiving mentorship from Aaron Wong, PhD, and Laurel Buxbaum, PsyD. He will continue developing his research program to better understand the neurocognitive mechanisms supporting the use of tools and how tool use relates to other cognitive functions, including language. He will leverage MRRI's Research Registry to begin working with individuals with damage to particular areas of the brain following stroke to understand what factors may make the use of tools difficult for these individuals.

Dr. Tian (top right) is working under the joint mentorship of Erica Middleton, PhD, and Marja-Liisa Mailend, PhD, to investigate the connection between language, working memory, and long-term memory. Specifically, she will study the relationship between the cognitive-linguistic profiles of people with aphasia and different types of speech errors. She will also investigate the individual differences in response to treatment from different training approaches for word retrieval in aphasia.

Dr. Lebkuecher (bottom left) is being mentored by Laurel Buxbaum, PsyD, from MRRI, as well as H. Branch Coslett, MD, from The University of Pennsylvania. She will continue investigating the connection between language and motor domains by evaluating motor and language abilities in patients with aphasia or apraxia resulting from left-hemisphere stroke. Dr. Lebkuecher also looks forward to continuing her research on analogous error patterns across motor planning and language domains.

Dr. Krason (bottom right) is contributing to a joint NIH project led by Erica Middleton, PhD, from MRRI and Malathi Thothathiri, PhD, from George Washington University. In this project, Dr. Krason will use EEG and eye-tracking methods to investigate the impact of cognitive control deficits on sentence comprehension in individuals with aphasia. She will also continue her collaboration with the Language and Cognition lab at UCL, as well as with Drs. Buxbaum and Vigliocco on their project examining multimodal communication in aphasia.
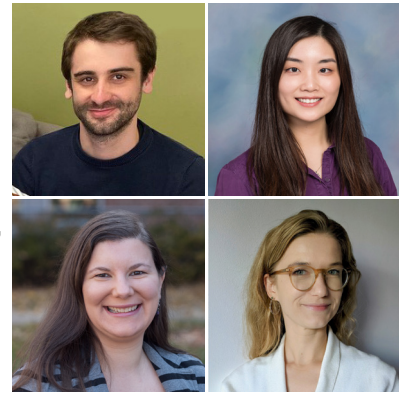
OUR RESEARCH REGISTRY

MRRI's Research Registry Helps Scientists Make Important Discoveries

Founded in 2000, the MRRI Research Registry is a computer database that allows MossRehab patients and members of the community to learn about research opportunities that may ultimately benefit them or others. The Registry is directed by Sharon M. Antonucci, PhD, CCC-SLP, and it is a unique and valuable resource for MRRI scientists and collaborators. Participation in each research opportunity is completely voluntary.

MRRI scientists are committed to improving the lives of people with neurological disabilities through research. The time, effort, and dedication of research participants has been critical in the success of MRRI scientists in advancing our knowledge in the fields of neuroscience and neurorehabilitation. We are grateful to all of our research volunteers and their families.

For more information about the MRRI Research Registry and how to get involved, please visit the Registry webpage at https://mrri.org/patient-research-registry/.

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MossRehab Now part of Jefferson Health

LANGUAGE AND COMMUNICATION: THE APHASIA CENTER

The Advanced Clinical Therapy Program is Improving Care for People with Aphasia

The MossRehab Aphasia Center Advanced Clinical Therapy (ACT) Program is a unique-to-the-region collaboration among MossRehab Hospital, MRRI, and the MossRehab Aphasia Center bringing 'up-to-the-minute' aphasia rehabilitation research directly into the clinical setting. When the ACT Program began, treatment was commonly unavailable for those with chronic aphasia due to prevailing beliefs that continued improvement was not possible after more than a few months post-stroke. However, a group of researchers around the world, including scientists at MRRI, were studying new treatments and documenting improvement in people with chronic aphasia. This work showed that individuals with aphasia were responsive to treatment even years after stroke.

The ACT Program was developed to bridge cutting edge research with speech-language pathologists' clinical expertise for the benefit of individuals with aphasia. Through this program, the MossRehab Aphasia Center became a leader in implementing aphasia rehabilitation approaches based on models of how language is processed in the brain, combined with a functional, person-centered approach to developing direct treatment and home practice programs. Informed by 'hot-off-the-press' research findings, speech-language pathologists who understood the methods for taking a theoretically-motivated case-report approach to their practice began to work with individuals with chronic aphasia.

Today, speech-language pathologists within the ACT Program continue to communicate directly with MRRI researchers, staying apprised of the latest aphasia rehabilitation research for those with chronic aphasia, as well as primary progressive aphasia. Their work incorporates a wide variety of evidence-based assessment and treatment protocols individualized to each patient and grounded in the Life Participation Approach to Aphasia. The Life Participation Approach to Aphasia prioritizes collaborating with each individual to develop and progress toward the goals they have for themselves.

COGNITION, EMOTION, & BEHAVIOR

MRRI and MossRehab Recognized for Continued Excellence in TBI Research and Care

MossRehab's Drucker Brain Injury Program and MRRI celebrated the sixth renewal of their world-class Traumatic Brain Injury (TBI) Model System supported by the National Institute on Disability, Independent Living and Rehabilitation Research (NIDILRR).

The MossRehab TBI Model System has been continuously funded since 1997, and with this most recent renewal, funding has been secured through 2027. Members of the MossRehab TBI Model System have continued to demonstrate exceptional clinical care, as well as research productivity, innovation, and knowledge dissemination in the field of TBI rehabilitation.

The MossRehab TBI Model System is led by Amanda Rabinowitz, PhD, and Tom Watanabe, MD. "Our continued involvement in the TBI Model System allows MossRehab and MRRI to remain at the forefront of research and knowledge translation that will shape the future of TBI care," Dr. Rabinowitz noted, adding that "the funding and collaborative infrastructure will continue to support important local and multi-site research."

Research supported by the TBI Model System funding recently includes longitudinal research in collaboration with other premier centers across the nation, and local research designed to improve TBI treatments and outcomes. In addition, the MossRehab TBI Model System will engage in a variety of consumer-facing activities in collaboration with treatment staff, former patients and members of their families, community members, and local organizations such as the Brain Injury Association of Pennsylvania.

Through the MossRehab TBI Model System, MRRI scientists and MossRehab clinicians will continue to work together to advance the standard of care for treating TBI and improve the outcomes for patients.

42 Conference Presentations	6 New Grants Funded	51 Research Papers

Dr. Sharon M. Antonucci presented a live "Ask the Expert" Webinar for the National Aphasia Association entitled "Animal-Assisted Therapy," as well as making appearances on local ABC, CBS, and Fox news affiliates to provide information about aphasia following the announcement of Bruce Willis' diagnosis. Dr. Antonucci also served on the conference committee for the 2022 International Aphasia Rehabilitation Conference.

Dr. Laurel Buxbaum received a grant award from Sapienza University, Rome, Italy, to serve as a visiting scholar. She also served on the board of directors for the American Society of Neurorehabilitation. Dr. Buxbaum gave a Neurology Grand Rounds presentation titled "Limb apraxia: A disorder at the cognitive-motor interface" at the University of California Los Angeles.

Dr. Dylan Edwards co-authored several new papers, including results from a clinical trial examining speech-language therapy and repetitive transcranial magnetic stimulation for post-stroke aphasia (*Neurorehabil Neural Repair*) and a review on the effects of transcranial random noise stimulation (*Neuroscience & Biobehavioral Reviews*). He was also a keynote speaker for the Edith Cowan University Lecture Series in Australia and the National Center of Neuromodulation for Rehabilitation's Introductory Workshop.

Dr. Shailesh Kantak received support from the Peer Review Committee of MRRI to begin a new line of investigation of modulation of cerebellar-cortical connectivity in stroke. Dr. Kantak was also awarded the Neurology Special Interest Group Award of Excellence from the American Physical Therapy Association - Pennsylvania chapter.

Dr. Marja-Liisa Mailend continued her research on an NIH-funded project to investigate the efficacy of speech entrainment practice for people with aphasia. In collaboration with Dr. Erica Middleton, she also received a grant from the Albert Einstein Society to investigate generalization of single-word training to the context of connected speech.

Dr. Erica Middleton continued to direct research funded by NIH seeking to establish the relevance of powerful learning principles derived from basic psychological research for optimizing the treatment of comprehension and production impairments in aphasia. Work from her lab was published in various outlets including *Neuropsychology*, *Language Cognition and Neuroscience*, and *Cognition*. Dr. Middleton also contributed to a review article on the application of learning principles to aphasia treatment, to appear in the *Journal of Speech Language and Hearing Research*.

Dr. Amanda Rabinowitz is tremendously proud to have led the successful renewal of The Moss Traumatic Brain Injury Model System for its 6th consecutive 5-year cycle. Additionally, she received the 2022 Rosenthal Award for outstanding paper based on data collected by the Traumatic Brain Injury Model System for her publication in the *Journal of Neurotrauma* entitled, "Aging with Traumatic Brain Injury: Deleterious Effects of Injury Chronicity Are Most Pronounced in Later Life."

Dr. Amanda Therrien and Dr. Shailesh Kantak received a grant from the National Center of Neuromodulation for Rehabilitation to study how cerebellar damage disrupts activity in the primary motor cortex and whether this change alters motor learning ability.

Dr. Umesh Venkatesan contributed to several publications in outlets including the *Journal of the International Neuropsychological Society*, *Journal of Head Trauma Rehabilitation*, and *Archives of Physical Medicine and Rehabilitation*. He was also invited to attend an NIH-funded workshop on psychometric methods in cognitive aging research at Lake Tahoe. Additionally, he completed data collection on an Einstein-funded pilot study examining adverse childhood experiences in adults with chronic TBI, findings from which will be presented at the World Congress on Brain Injury in 2023 in Dublin, Ireland.

Dr. Aaron Wong and his collaborators published several research articles in journals including *Cortex*, *eNeuro*, and *Human Movement Science*, as well as a perspective piece with Dr. Amanda Therrien on the importance of studying the interactions between motor learning processes. Dr. Wong was also elected to the Board of Directors for the Society for the Neural Control of Movement.

Drs. Laurel Buxbaum and Shailesh Kantak received funding from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) of the NIH to study the Mechanistic and neuroanatomic bases of disparity between arm capacity and use in stroke.

Former MRRI Director and Institute Scientist Emeritus Dr. John Whyte has been selected to receive the Distinguished Member Award from the Association of Academic Physiatrists.