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,

Adelyn Brecher, CCC-SLP

Letter from Adelyn Brecher, CCC-SLP
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.

New Studies Examine Primary Motor Cortex Changes in Degenerative Cerebellar Ataxia

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 neuroanatomic 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.

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 and participate in 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/.
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.

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.
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.