

M R R I

**MOSS REHABILITATION
RESEARCH INSTITUTE**

Annual Report

2023

Moss Rehabilitation Research Institute

From Theory-Driven Research to Clinical Treatments in
Neurorehabilitation



Jefferson Moss-Magee Rehabilitation

Mission

Moss Rehabilitation Research Institute (MRRI) is devoted to improving the lives of individuals with neurological-related disabilities through research.

Research at MRRI occupies a unique position within a translational “pipeline” from basic neuroscience to clinical neuroscience and neurorehabilitation.

We perform basic research, framed by theoretical perspectives, that maintains contact with the complexities of real-world functioning and leads to advances in neurorehabilitation assessment and treatment.

We perform patient-based research that informs basic science theories of complex cognitive and motor functioning and their neural bases, and on the processes of change in these systems.

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2023 Update

MRRI continues to grow in its 4th decade of operation, breaking new ground in theoretical and clinically applied research and expanding its reach and reputation nationally and worldwide. Prestigious international collaborations include our long-standing partnerships with international Scientists in Residence from University College London and McMaster University. Our annual research citations have increased exponentially over the last several years, indicating sustained and growing impact in the field of translational neuroscience and neurorehabilitation. The Institute continues to maintain approximately 40 grants and contracts each year, with the majority of our competitive grant funding coming from the National Institutes of Health and the National Institute on Disability, Independent Living, and Rehabilitation Research.

MossRehab again achieved U.S. News and World Report best hospitals status, ranking an impressive 6th in the nation, rounding out 30 years in the top 10. In addition to exceptional clinical care, MRRI contributes to the reputation, research excellence, and productivity of the overall organization. Clinical-research integration remains central to our mission including both programmatic activities and individual externally-funded research projects. The Moss Traumatic Brain Injury Model System (TBIMS), one of the longest continuously funded TBIMS in the U.S., was awarded funding for its 6th consecutive cycle, with clinician input woven throughout research design, data collection, and dissemination of findings to clinical and consumer stakeholders. The Klein Family Parkinson's Rehabilitation Center launched a new initiative of clinical-research integration grants, and the first award is underway. The MossRehab Aphasia Center, in its 27th year of operation, continues to serve the community through the Advanced Clinical Therapy Program and through innovative virtual programs offered by the Aphasia Activities Center, which had more than 1,900 visits this year.

The past year has seen MRRI rapidly integrating with the Jefferson Enterprise, and we are proud to see how the Institute and our individual Scientists are adapting and leveraging the opportunities offered by this position. With MossRehab and Magee Rehabilitation Hospital, both leading rehab hospitals, coming under unified

leadership as “Jefferson Moss-Magee Rehabilitation”, the mutual opportunities for expanding research capacity and productivity are evident. MRRI is leading efforts to extend programmatic research across both sites.

MRRI scientists formally became Faculty of the Thomas Jefferson University (TJU), Department of Rehabilitation Medicine, within Sidney Kimmel Medical College, thanks to support from university leadership, in addition to the impressive records of accomplishment and prompt and thorough completion of administrative requirements by our Scientists. These appointments bring with them access to a wealth of university resources and a path to expand our academic training activity in exciting ways, including by adding graduate student training to the first-rate post-doctoral training program already in place at MRRI.

We would like to strongly commend our exceptional administrative team and recognizing the effort, skill, and grace with which they and the entire Institute stepped up to ensure a relatively seamless transition and integration with the Jefferson system. In addition, we are indebted to our gracious donors and the office of institutional advancement for supporting our programs, experimental work, equipment, and activities. This year, we were honored to receive generous endowment commitments towards studies of stroke and Parkinson’s disease, as well as an Institute Directorship in the name of the late Nancy Wachtel Shrier, a long-term supporter of the Institute. We sincerely thank all of our donors for enabling our ground-breaking work and helping us make strides toward our mission.

Well done to the MRRI community for another outstanding year of accomplishments. The annual report and achievements described within are exceptional and a shared source of pride. We look forward to the coming year and the ever-increasing buzz of activity within our walls. Science in progress.

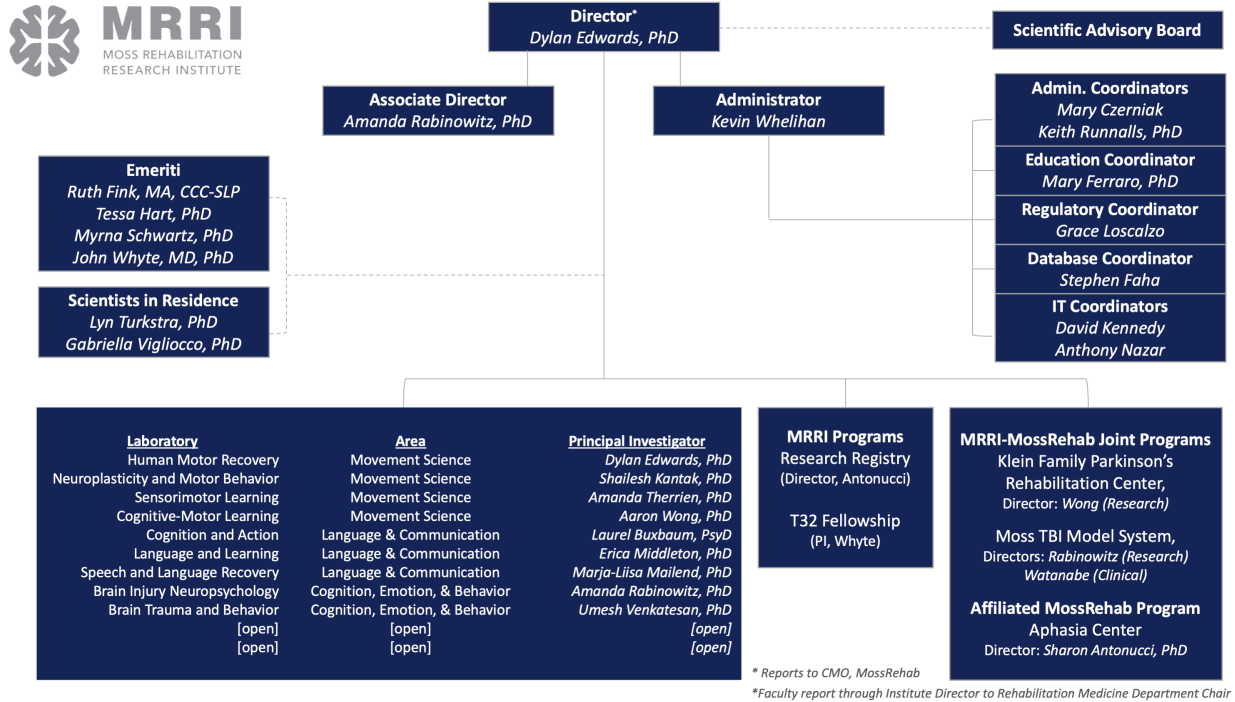


Dylan J. Edwards, PhD
Nancy Wachtel Shrier Director,
Moss Rehabilitation Research Institute



Amanda R. Rabinowitz, PhD
Associate Director, Moss
Rehabilitation Research Institute

MRRRI Organizational Structure



Staffing

Led by Dr. Dylan Edwards, MRRRI employs a diverse and talented team of scientists, fellows, research support personnel, administrative staff, and adjunct clinician scientists to conduct our cutting-edge research. The diagram above shows the organization of the Institute, our laboratories, scientists, and other personnel. MossRehab leadership continues to provide principal oversight and infrastructure support, especially relating to clinical-research.

STAFFING	FTE
TOTAL FTE	68
INSTITUTE SCIENTISTS	10
INSTITUTE SCIENTIST EMERITI	4
SCIENTISTS IN RESIDENCE	2
POST-DOCTORAL FELLOWS	5
RESEARCH ASSISTANTS	25.5
PARTICIPANT RECRUITMENT	4.5
ADMINISTRATIVE	6
ADJUNCT FACULTY/AFFILIATED SCIENTISTS	11

Space

MRRRI is a premier institute for rehabilitation and neuroscience research that occupies over 18,000 square feet, primarily located within a renovated office building on the campus of MossRehab Hospital in Elkins Park, PA. Testing and office space is available within the research institute, and the facilities are fully accessible.

We are pleased to have expanded our footprint to include TJU Center City, with a new multipurpose lab and office space that is proving convenient for experimental work, research participant interviews, and meetings.

SPACE	SQ FT
TOTAL ALLOCATED SPACE	18,164
MRRRI BUILDING	16,960
FIRST FLOOR	6,590
SECOND FLOOR	2,370
THIRD FLOOR	8,000
HOSPITAL – MOSSREHAB – ELKINS PARK	510
SECOND FLOOR WEST	410
FOURTH FLOOR - TBI	100
HOSPITAL – MOSSREHAB – TABOR ROAD	100
4TH FLOOR SLEY	100
JEFFERSON: CURTIS BUILDING	594
ROOM 705	594

Research, Clinical, and Academic Environment

Moss Rehabilitation Research Institute

MRRI is an internationally recognized institute for rehabilitation and neuroscience research whose mission spans a translational “pipeline” from theory-driven research to clinical treatments in neurorehabilitation. The ten Institute Scientists at MRRI, alongside affiliated scientists, postdoctoral fellows, research assistants, and visiting students, perform basic research, framed by theoretical perspectives that maintain contact with the complexities of real-world function and lead to advances in neurorehabilitation assessment and treatment. We also perform patient-based research that informs basic science theories of complex cognitive, perceptual, and motor functioning and their neural bases, and on the processes of change in these systems. MRRI occupies over 18,000 square feet, primarily within in a renovated office building on the campus of Jefferson Moss-Magee Rehabilitation Hospital in Elkins Park, PA. Testing and office space is also available within the hospital (Jefferson Moss-Magee—Elkins Park, Jefferson Einstein Hospital, and City Center Sidney Kimmel Medical College).

MRRI hosts numerous regular meetings of relevance to translational neurorehabilitation research, including the 1) Shrier Family Topics in Rehabilitation Science Lecture Series, a monthly presentation by a MRRI or outside researcher; 2) Institute Forum Grants Workshops, a monthly workshop for MRRI senior staff and postdoctoral fellows focused on grant-writing skills; 3) Institute Forum Visiting Scholar Lecture Series, a series of talks by influential external scientists; and 4) T32 Lecture Series, a monthly colloquium covering a broad variety of relevant topics. Research / clinical mixers are held by teams of individuals to foster collaboration and research inquiry.

Postdoctoral Training in Translational Neurorehabilitation Research: Since 2013, MRRI has been funded by a T32 grant from the NIH for postdoctoral training in translational neurorehabilitation research, to supplement postdoctoral training slots supported by research grants and institutional funds. This training grant, under the direction of Dr. John Whyte, involves mentors from MRRI and from

behavioral neurology and neuroimaging at the University of Pennsylvania. The combination of NIH and internal funding provides support for 5 trainees for 3 years. MRRI trains additional postdoctoral fellows with support from individual research grants. We recruit basic scientists to learn rigorous methods of clinical research and clinical researchers to enhance the theoretical and methodologic sophistication of their research. Regardless of funding source, postdoctoral fellows affiliated with MRRI receive a rich didactic curriculum, along with structured career goal setting and mentored research. Trainees benefit from the clinical and technical resources available across the two institutions and from the existing programs of collaborative multidisciplinary research in which their mentors are engaged.

Our postdoctoral training program is continuing to provide exceptional instruction and research experience for the next generation of neuroscience and neurorehabilitation scientists. As a testament to the success of the program, former postdoctoral fellow Dr. Haley Dresang accepted a faculty position as Assistant Professor in the Department of Communication Sciences and Disorders at the University of Wisconsin-Madison at the start of FY2023, and former postdoctoral fellow Dr. Masahiro Yamada recently began a new position as Assistant Professor in the Department of Kinesiology at Whittier College.

Jefferson Moss-Magee Rehabilitation and Jefferson Health

Jefferson Moss-Magee Rehabilitation Hospital: MossRehab leadership continues to provide principal oversight and infrastructure support, especially relating to clinical-research integration through Dr. Alberto Esquenazi, Chief Clinical Officer and John Otto Haas Endowed Chair of Physical Medicine and Rehabilitation at Jefferson Moss-Magee Rehabilitation and Enterprise SVP for Rehabilitation and Post-Acute care at Thomas Jefferson University Hospitals. Jefferson Health is one of the region's leading health systems. Housed in the same campus, Jefferson Moss-Magee (Elkins Park) and MRRI have fostered a close collaboration to create a true "research culture informed by clinical needs" within the continuum of patient care for neurological rehabilitation, and an impressive array of resources to support clinical research. Jefferson Moss-Magee Rehabilitation Hospital is accredited by

the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and Commission on Accreditation of Rehabilitation Facilities (CARF), and it has been recognized for 31 years as one of the nation's best rehabilitation hospitals in the U.S. News and World Report survey. MossRehab has been named, for 11 years, one of the "Best Workplaces" among large employers in the Philadelphia area.

The inpatient programs admit more than 1,000 patients with stroke and traumatic brain injury (TBI), nearly 300 persons with spinal cord injury, and an equal number of persons with limb amputation annually across five sites: campuses at the Elkins Park Hospital, Jefferson Bucks Hospitals and Doylestown Hospital in suburban Philadelphia, and Tabor Road and Jefferson Frankford in Philadelphia. Combined with Magee Rehabilitation, the number of inpatient sites increases by one and the total number of outpatient sites near 40 across the region. The outpatient stroke programs provide services to approximately 2,500 patients annually. Services are provided at additional locations in the Philadelphia area and its suburbs.

MossRehab is recognized for excellence in care, with outcomes that consistently exceed the national mean when measured by CMS section GG score change and percentage of patients returning home. In addition, MossRehab has high patient satisfaction. MossRehab is an early adopter of technology and is a leader in rehabilitation technology innovation, with a number of firsts in the nation regarding the use of robotics in rehabilitation. MossRehab was first in introducing the REO[®], Armeo[®] Power, and the Tyromotion[®] upper limb robots to clinical use, and it was first in the nation with ReWalk[®], Restore[®], Geo-Evolution[®], and Lyra[®]. MossRehab has designed and performed clinical trials with ReWalk[®], Lokomat[®], Geo, ReStore, Armeo, and GloReha, and it recently completed a trial in robotics in acute stroke rehabilitation. MossRehab has an established, world-class technology and robotics in rehabilitation program.

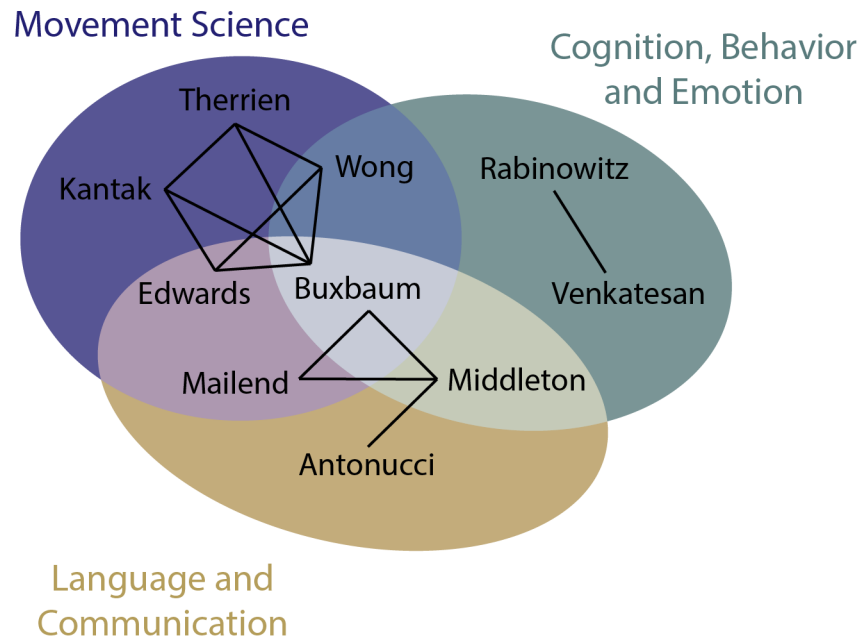
Thomas Jefferson University

Jefferson's academic arm, Thomas Jefferson University (TJU), houses one of the oldest medical schools in the country, the Sidney Kimmel Medical College (SKMC), and provides exceptional research infrastructure. MRRI Scientists hold academic

appointments in the SKMC Department of Rehabilitation Medicine, chaired by Dr. Steve Williams, MD. The Department trains medical students, residents, and fellows in physical medicine and rehabilitation. Medical training at TJU is complemented by the Jefferson College of Rehabilitation Sciences. The College of Rehabilitation Sciences, in addition to having research strengths and related competitive grants in spinal cord injury and rehabilitation outcomes measurement, houses educational programs in occupational therapy, physical therapy, speech-language pathology, athletic training, and exercise science. TJU comprises 11 other colleges, schools, and institutes, many of which complement and synergize with MRRI Institute Scientists' interests in science, health, and engineering, providing fertile ground for the cross-disciplinary advancement of both teaching and research.

Translational Neurorehabilitation Research Focus Areas

MRRI scientists conduct world class research that spans three distinct focus areas. Research programs are highly interconnected, and there is substantial collaboration between our scientists.



Laboratories

Brain Injury Neuropsychology Laboratory: (Amanda Rabinowitz, PhD, Director) The Brain Injury Neuropsychology Laboratory studies the neurobiological and psychosocial factors that influence recovery from traumatic brain injury (TBI) across the spectrum of injury severity. This lab houses the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR)-funded Moss Traumatic Brain Injury Model System, part of a 16-center network to study outcomes and treatment of TBI.

Programs of Research:

- The use of mobile technology for brain injury rehabilitation assessment and intervention
- Neuropathological substrates of chronic and neurodegenerative effects of brain injury
- Treatment of depression in persons with moderate-severe TBI
- Resilience after brain injury
- Chronic effects of moderate-severe TBI on functional outcomes and brain health
- Participation in contact sports as a risk factor for cognitive and emotional impairment in later life

Brain Trauma and Behavior Laboratory: (Umesh “Umi” Venkatesan, PhD, Director) The Brain Trauma and Behavior Laboratory studies the cognitive and functional health of individuals with a remote history of moderate or severe traumatic brain injury (chronic TBI) as well as older individuals with new-onset TBI. One of its major goals is to characterize the potential for and optimize the detection of pathological brain aging in TBI. To this end, the lab uses cognitive neuroscientific approaches to identify or develop behavioral assessments and potential treatment interventions that are informed by neurobiological models of TBI and aging.

Programs of Research:

- Cognitive, functional, and neurobiological characterization of chronic TBI
- Neuropsychological methods for evaluating neurodegenerative disease risk or prodrome in chronic TBI
- Assessment of episodic memory in chronic TBI
- Pre-, peri-, and post-morbid health considerations for outcome in older adults with more recent TBI
- Social determinants of health and health behaviors

Cognition and Action Laboratory: (Laurel J. Buxbaum, PsyD, Director) The Cognition and Action Laboratory investigates the interface between cognitive representations of objects, tasks, and action planning processes using behavioral testing with healthy and brain-damaged participants, support vector lesion symptom mapping (SVR-LSM, a machine learning approach), eye tracking, virtual reality, and fMRI. This work enables us to understand how conceptual representations may be “grounded”, and the aspects of object representations that may be disrupted after stroke to frontal, temporal, or parietal brain regions. In addition, the lab studies the role of spatial and body representations in the control of attention and action.

Programs of Research:

- The role of body representations and visual information in action production
- Task-related activation of tool-related actions
- Virtual reality treatment of phantom limb pain
- Representations of the body in phantom limb syndrome
- Functional and resting state connectivity of the skilled action network
- Action and non-action sequencing in the left hemisphere
- Apraxia rehabilitation using network-strengthening treatment
- Multimodal communication and co-speech gesture

Cognitive-Motor Learning Laboratory: (Aaron L. Wong, PhD, Director) The goal of the Cognitive-Motor Learning Laboratory is to understand how interactions between the cognitive and motor systems allow us to acquire and maintain skilled

actions and become movement experts. This includes identifying the processes that contribute both to the planning and the online control of actions. Using motion tracking of the eyes and arms in healthy individuals and in patients with neurological disorders, the aim is to not only gain a better understanding of the motor system from a neurological and theoretical standpoint, but to also identify new approaches to enhance rehabilitation efforts.

Programs of Research:

- The use of trajectory and body configuration representations in planning and on-line control during movement imitation
- The contribution of verbal, visual, and proprioceptive instructions in planning praxis actions
- Interactions between motivation, effort, and learning in neurotypical individuals and in patients with Parkinson's disease

Human Motor Recovery Laboratory: (Dylan J. Edwards, PhD, Director) The Human Motor Recovery Laboratory has several lines of research addressing recovery of voluntary movement control in humans following stroke or spinal cord injury. Quantitative clinical neurophysiology, neuroimaging, and kinematic data are studied to understand the basis of motor symptoms and inform emerging physical rehabilitation strategies. Clinical treatment trials using intensive motor training are supplemented by experimental non-invasive neuromodulation.

Programs of research:

- Systems-level neurobiology of dysfunction and recovery
- Intensive robot-assisted training, combinatorial interventions
- Non-invasive stimulation technique development
- Outcome prediction
- Telerehabilitation

Language and Learning Laboratory: (Erica L. Middleton, PhD, Director) The Language and Learning Laboratory is dedicated to understanding the processes

involved in language production as well as how such processes are disrupted in acquired language disorder (aphasia). A major focus is to develop efficacious treatments of aphasia grounded in a theoretical understanding of fundamental mechanisms of language use, learning, and language change.

Programs of Research:

- Monitoring of naming errors in aphasia
- Retrieval practice (i.e., testing) effects and distributed practice effects in rehabilitation of naming impairments in aphasia
- Retrieval practice and distributed practice effects in treatment of word comprehension deficits in aphasia
- Semantic context effects in naming
- Use-dependent language change (i.e., incremental learning) in lexical access

Neuroplasticity and Motor Behavior Laboratory: (Shailesh Kantak, PhD, Director)

The main goal of the Neuroplasticity and Motor Behavior Laboratory is to optimize motor recovery and learning in patients with neurological disorders (e.g., stroke, cerebral palsy) through a better understanding of the neural plasticity that underlies motor performance, recovery, and rehabilitation strategies. The research in this laboratory encompasses a spectrum from basic science experiments to understand motor behavior in healthy controls and patients at one end to exploring the effects of innovative treatment strategies to augment motor recovery at the other end. The research employs motion analyses to characterize and quantify movement strategies as they evolve with motor practice and time in patients with neurological disorders. Further, another goal is to probe noninvasive brain stimulation techniques applied through careful neuronavigation to probe specific brain regions to understand their role in motor learning and recovery. Finally, the acquired information is used to plan innovative strategies to promote learning and recovery in patients with neurological injuries.

Programs of Research:

- Brain-behavior correlates of motor skill learning and transfer following stroke

- Practice structure and motor skill learning
- Bimanual coordination after stroke
- Behavioral and neuroanatomic basis of arm use and nonuse after stroke
- Modulation of learning and recovery with noninvasive brain stimulation

Sensorimotor Learning Laboratory: (Amanda Therrien, PhD, Director) The Sensorimotor Learning Laboratory studies how upper extremity movements are learned and controlled and how damage to specific brain areas may alter these processes. The lab uses a combination of 3-D motion capture, virtual reality, and robotic techniques to assess human behavior in both healthy individuals and neurologic populations with damage to the cerebellum. This work enables the investigation of (1) the neural mechanisms through which different sources of sensory information are integrated, (2) how this information is used to learn and control upper extremity movement, and (3) whether these mechanisms can be leveraged in the development of new rehabilitation therapies for individuals with motor impairment.

Programs of Research:

- Mechanisms of motor learning that are spared versus impaired by cerebellar damage
- Cerebellar contributions to somatosensory perception
- Interactions between adaptive and reinforcement motor learning
- Interactions between adaptive motor learning and sensory perception
- Validation of clinical outcome measures for cerebellar ataxia

Speech and Language Recovery Laboratory: (Marja-Liisa Mailend, PhD, Director) The Speech and Language Recovery Laboratory investigates the cognitive architecture of speech and language production and its disorders. With a primary emphasis on impairments of phonological encoding and speech motor planning, the long-term goal of our work is to develop theory-driven and evidence-based assessments and treatment programs to strengthen functional communication in people with aphasia and apraxia of speech. Research in our laboratory employs

various methods including behavioral speech and language assessments, acoustic analysis, psycholinguistic reaction time studies, and support vector lesion symptom mapping.

Programs of Research:

- Underlying mechanism of speech motor planning and speech motor planning impairments
- Differential diagnosis of apraxia of speech
- Speech entrainment treatment for people with aphasia and apraxia of speech

MRRRI Programs and Core Facilities

Scientists at MRRRI have expertise in a broad array of methodological approaches used in neurorehabilitation research. MRRRI's infrastructure supports the recruitment of research participants, and our Methodological Cores compile and maintain the tools, resources, and procedures that are used across MRRRI's 10 research laboratories and programs.

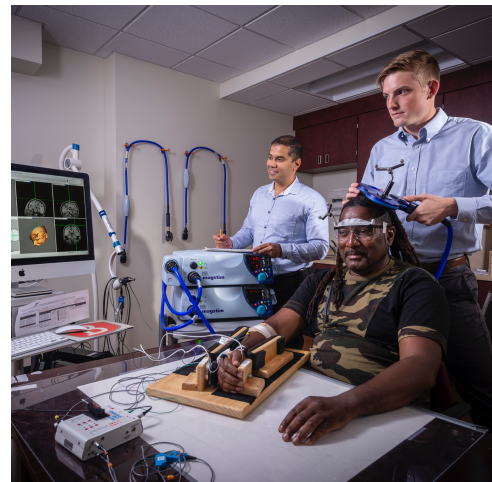
MRRRI Research Registry:

MRRRI has a unique and invaluable infrastructure for patient-based research. The MRRRI Patient Research Registry, directed by Sharon M. Antonucci, PhD, CCC-SLP, currently includes approximately 1,235 active research volunteers with imaging-verified stroke and 624 individuals with traumatic brain injury from which we draw study participants. Research-quality MRI or CT scans and hand-drawn lesion reconstructions are available for 91 individuals with stroke; resting-state fMRI and diffusion data are available for 9 of these individuals. The Registry also includes 32 members with Parkinsonism, enrollment of whom began in fiscal year 2020, and about 200 neurotypical volunteers. Administrative staff assist in recruiting participants into the Registry from MossRehab's inpatient and outpatient facilities. Retention is aided by annual mailings with birthday letters.

Brain Structure & Function Core:

The Brain Structure and Function Core provides centralized resources, protocols, technical information, and methods for neuroimaging (including structural and functional magnetic resonance imaging), electrical stimulation, and electroencephalography across MRRRI labs to optimize organization and efficiency. Current documentation includes:

- A database tracking progress in obtaining imaging and lesion segmentation of MRRRI research participants
- Detailed scanning protocols across Penn and Jefferson sites



- Lesion mask files

Measurement Methodological Core:

The Measurement core maintains a shared resource library that documents assessments and assessment resources (e.g., databanks such as AphasiaBank) across content areas. Available documentation includes:

- Domain(s)/sub-domains assessed
- Appropriate population(s)
- Standardization and psychometric information
- Published benchmarks for change
- Instrument availability

Motion Analysis Core:

The Motion Analysis Core oversees specialized equipment shared across MRRI laboratories, used in studies to understand how the nervous system controls and learns movements and how damage to specific brain structures impairs these processes. These resources include:

- Two systems for precise 3-dimensional optical motion capture (Codamotion, Vicon) and a system for magnetic motion capture (NDI trakSTAR) for cases where optical tracking is unsuitable.
- Two virtual reality devices (Oculus Rift S, Oculus Quest 2) that can be integrated with optical or magnetic motion capture using custom-developed software, which permits the study of visual integration in movement control.
- Two robotic devices (KINARM Bimanual Exoskeleton, ARMEO Power) to allow additional investigation of somatosensory and haptic influences on movement control.



- Eye tracking systems (Eyelink 1000, Pupil Labs) to monitor gaze position while individuals are viewing stimuli and generating movement or to study the control of eye movements in their own right.
- Three electromyography systems: two wired (CED, Motion Labs) and one wireless (Delsys Trigno) which can be used to simultaneously record muscle activation while tasks are performed using the motion capture or robotic equipment.

MRI Virtual Reality Core:

This shared facility provides the infrastructure to support experiments conducted using virtual reality. Available equipment includes:

- two head-mounted virtual-reality systems (Vive, HTC and Oculus Quest, Oculus) each with two hand-held controllers and associated optical tracking system.
- a magnetic tracking system (TrakSTAR, Ascension Technologies).
- an optical hand-tracking system (Leap Motion).
- an integrated eye-tracking system (Pupil Labs).
- a dedicated PC running custom-written software in Unity.



MRRI and Jefferson Moss-Magee Joint Programs

Moss Traumatic Brain Injury Model System: Co-led by Project Directors Amanda Rabinowitz, PhD, and Thomas Watanabe, MD), the Drucker Brain Injury Center, now at Jefferson Moss-Magee Rehabilitation, has been designated by the National Institute of Disability, Independent Living and Rehabilitation Research (NIDILRR) as a Traumatic Brain Injury Model System (TBIMS) since 1997 for its culture of research integrated with care. One of 16 centers nationally, the Moss TBIMS was renewed in 2022 for its 6th consecutive cycle of competitive funding. The Moss TBIMS center combines clinical expertise with research excellence in TBI rehabilitation. Researchers at MRRI manage projects run locally as well in collaboration with other TBIMS centers. Information on TBI Model System patients is added to the national database that contains data from thousands of people with TBI. This database is used to study the factors that predict recovery and outcomes of TBI. Moss projects for the current cycle include:

- A randomized controlled trial of a hybrid clinician-delivered and mobile health program for promoting physical activity in persons with moderate to severe TBI, led by Dr. Amanda Rabinowitz in collaboration with Institute Scientist Emerita, Dr. Tessa Hart.
- A Clinical Knowledge Translation project led by Dr. Rabinowitz in collaboration with Dr. Hart, and Scientist in Residence, Dr. Lyn Turkstra.
- Dr. Umesh Venkatesan is site-PI for a multi-center observational study examining the impact of neighborhood environment and early childhood adversity on outcomes after TBI.
- Dr. Rabinowitz is site-PI for a multi-center observational study to characterize profiles of health perceptions and beliefs in persons with moderate to severe TBI.
- Scientist Emeritus and Former Director, Dr. John Whyte is site-PI for a multi-center observational study to measure utilization and impact of state-provided programs on outcomes after TBI.

MossRehab Aphasia Center: (Sharon M. Antonucci, PhD, CCC-SLP, Director) Founded in 1996, the MossRehab Aphasia Center is a joint endeavor by MossRehab and MRRI to meet the long-term communication and psychosocial needs of individuals who have been affected by chronic and progressive aphasia. It is a warm and welcoming place where people can find information and peer support, as well as participate in research and treatment.

The Aphasia Center provides focused and meaningful intervention at strategic points in the recovery process. This can occur through short-term outpatient therapy in the Advanced Clinical Therapy (ACT) program, through the various groups and classes in the Aphasia Activity Center, or through participation in research at MRRI.

MossRehab Aphasia Center was founded on several basic principles:

- Recovery from aphasia involves a life-long process of re-education, adaptation, and support
- Under the right conditions, people with aphasia can continue to recover even years after the onset of aphasia
- Participating in social, recreational, and educational activities reduces isolation and helps people with aphasia and their families make psychosocial adjustments
- Individuals with aphasia and their families can play an important role in increasing public awareness of aphasia

Dr. Antonucci directs the Aphasia Center research program. Her work focuses on theoretically-motivated aphasia rehabilitation informed both by cognitive neuropsychological models of language and by the Life Participation Approach to Aphasia.

Klein Family Parkinson's Rehabilitation Center: (Aaron L. Wong, PhD, Director-Scientific) Founded in 2018 with the generous support of the Klein Family, the Klein Family Parkinson's Rehabilitation Center is dedicated to improving the lives

of patients with Parkinson's disease by integrating clinical, rehabilitation, and research efforts throughout MossRehab and MRRI.

The Center has three primary aims:

- Increasing opportunities for patients to engage in research by expanding the current MRRI Research Registry to include patients with Parkinson's disease
 - Improving care for patients with Parkinson's disease by offering a multidisciplinary clinic. This clinic brings together a team of experts typically involved in the care of individuals with Parkinson's Disease, including an Occupational Therapist, Physical Therapist, Speech Language Pathologist, Physician, and Social Worker. Together, this team evaluates individuals using a collaborative approach to coordinate care and address goals that might otherwise be challenging to recognize or achieve by one clinical discipline alone, and the clinic tracks outcomes longitudinally over time.
 - Increasing interaction amongst clinicians, therapists, and researchers to facilitate collaborative efforts across departments and to collectively identify new approaches for improving patient care. This will be fueled by the awarding of clinical-research integration grants (beginning in fall 2022) to support novel research projects and clinical programs aimed at improving the lives of individuals with Parkinson's disease.
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Adjunct Faculty/Affiliated Scientists

The academic environment at MRRI is enhanced by researchers and clinician-scientists within the Jefferson enterprise who contribute to neurorehabilitation research and collaborate with MRRI faculty on externally-funded investigator-initiated projects and papers. Our Affiliated Scientists also include faculty mentors from the University of Pennsylvania for a jointly administered T32 grant from the NIH for postdoctoral training in translational neurorehabilitation research.

Internal:

Inna Chervoneva, PhD

Professor of Biostatistics at Thomas Jefferson University.

Alberto Esquenazi, MD

Chief Clinical Officer and John Otto Haas Endowed Chair of Physical Medicine and Rehabilitation at Jefferson Moss-Magee Rehabilitation; Enterprise SVP for Rehabilitation and Post-Acute care at Thomas Jefferson University Hospitals.

Mary Ferraro, PhD, OTR/L

Adjunct Faculty, Education Coordinator at the Drucker Brain Injury Center.

Benjamin Lieby, PhD

Professor and Division Head of Biostatistics at Thomas Jefferson University.

Nathaniel Mayer, MD

Director of the Motor Control Analysis Laboratory at Jefferson Moss-Magee Rehabilitation.

Marlyn Ramos-Lambo, MD

Clinical Director of the Jefferson Moss-Magee Spinal Cord Injury program.

Andy Packel, PT, NCS

Physical Therapy Adv. Clinician, Jefferson Moss-Magee Rehabilitation.

Thomas Watanabe, MD

Clinical Director of the Drucker Brain Injury Center; Co-Project Director of the Moss Traumatic Brain Injury Model System; Co-Director of the Jefferson Moss-Magee Stroke Rehabilitation Program.

External:

H. Branch Coslett, MD

Professor of Neurology; Professor in the Center for Cognitive Neuroscience, Co-Director of the Laboratory for Cognition and Neural Stimulation at the Perelman School of Medicine at the University of Pennsylvania.

John Detre, MD

Professor of Neurology; Director of the Center for Functional Neuroimaging; Director of the Brain Science Center; Co-Director of the Center for Advanced Magnetic Resonance Imaging and Spectroscopy at the Perelman School of Medicine at the University of Pennsylvania.

Roy Hamilton, MD, MS

Director of the Laboratory for Cognition and Neural Stimulation; Vice Chair for Inclusion and Diversity; Director of the Penn Brain Science, Innovation, Translation, and Modulation (brainSTIM) Center; Professor of Neurology; Professor of Neurology in Physical Medicine and Rehabilitation; Professor of Neurology in Psychiatry at the Perelman School of Medicine at the University of Pennsylvania.

Emeriti

MRRIs Institute Scientists Emeriti are distinguished researchers in their fields who have led productive research careers and made substantial contributions to the field of neurorehabilitation. Institute Scientist Emeriti continue to enrich the culture and operations of the institute through ongoing collaborations with current faculty and participation in Institute events.

Ruth Fink, MA, CCC-SLP: Ruth Fink, a cofounder and former Clinical Director of the MossRehab Aphasia Center and MRRIs clinician researcher, remains involved with the Aphasia Center as an informal consultant. She promotes external relationships and supports ongoing Development efforts, providing input to annual campaigns, maintaining contact with supporters, and lending her name to solicitation letters and follow-ups as needed. Ruth continues her involvement with Aphasia Access, an organization of which MossRehab Aphasia Center is a founding member.

Tessa Hart, PhD: Dr. Hart directed the Traumatic Brain Injury Clinical Research Laboratory at MRRIs and the Moss Traumatic Brain Injury Model System until her transition to Emerita status in January, 2019. Dr. Hart continues to work with TBI Model System investigators on collaborative projects. Dr. Hart continues to serve on federal grant review panels and journal editorial boards, is active in the Rehabilitation Treatment Specification System (RTSS) Working Group of the American Congress of Rehabilitation Medicine, and was an invited participant in the NINDS/NICHDS Common Data Elements Working Group focused on neurorehabilitation interventions.

Myrna Schwartz, PhD: Dr. Schwartz, the former Associate Director of MRRIs, provides consultation to several MRRIs scientists. In The Language and Learning Laboratory directed by Dr. Erica Middleton, Dr. Schwartz is serving as a Co-Investigator on an NIH award to Dr. Middleton, providing feedback on methodological and study design details, and she recently published a manuscript

with Dr. Middleton examining spontaneous error monitoring and learning in aphasia.

John Whyte, MD, PhD: Dr. Whyte stepped down as Director of MRRI in 2018. He has remained involved in clinical research on recovery from moderate-severe brain injury, with a particular emphasis on disorders of consciousness (DOC). He is a co-investigator on MossRehab's Traumatic Brain Injury Model System (TBIMS) and several other TBI-related projects. Dr. Whyte also led the development of the RTSS. In addition to his research, Dr. Whyte serves as a career mentor to junior scientists at MRRI and beyond. He developed and now co-leads the Rehabilitation Medicine Scientist Training Program (RMSTP), and he also serves as Principal Investigator of the T32 postdoctoral research training program in Translational Neurorehabilitation Research. In addition, Dr. Whyte serves as a peer reviewer for multiple journals and funding agencies. In 2023, Dr. Whyte received the Association of Academic Physiatrists (AAP) Distinguished Member Award.

Scientists in Residence

MRRI adjunct staff include two Scientists in Residence who each participate in several extended visits per year at MRRI. During this time, they give lectures, attend lab meetings, and provide consultative input to MRRI Senior Staff. The Scientist in Residence program was developed to continue to foster collaborations with exceptional researchers at world-class institutions around the world.

Gabriella Vigliocco, PhD: Dr. Vigliocco is a Professor at the University College London, where she directs the Language and Cognition Laboratory. She became a Scientist in Residence in 2017, and she continues to collaborate regularly with researchers at MRRI in the language and action domains. In August 2023, Dr. Vigliocco and her graduate student Isobel Chick visited MRRI to advance research in collaboration with Dr. Laurel Buxbaum examining the impacts of gesture on naming ability in people with aphasia.

Lyn Turkstra, PhD: Dr. Turkstra is a Professor in the School of Rehabilitation Science and Assistant Dean of the Speech-Language Pathology Program at McMaster University in Ontario Canada. She has been a Scientist in Resident at MRRI since July 2019, and her research focus areas include cognition and communication after a brain injury. She collaborates with both MRRI researchers and MossRehab clinicians on multiple research and clinical translation projects to improve the care of patients with acquired brain injury. During her visit in July 2023, Dr. Turkstra and colleagues at MRRI/MossRehab built on the success of their Post-Traumatic Amnesia Protocol project, continuing the development of a program to systematically train staff how best to maximize learning and performance for patients with a full spectrum of memory abilities, across the diverse content areas involved in inpatient rehabilitation.

Scientific Advisory Board

MRRI is dedicated to conducting rigorous, high-quality science from theory-driven research to clinical treatments in neurorehabilitation. To help ensure the Institute continues to operate at the cutting edge of the field, MRRI maintains a Scientific Advisory Board composed of diverse experts in relevant areas of neuroscience, neurorehabilitation, and research strategy. This Board provides valuable feedback on MRRI's scientific research, as well as the Institute's operations. As part of the Scientific Advisory Board, Members meet annually with MRRI scientists and leaders to discuss their scholarly activities from the prior year, current challenges, opportunities, and plans for the future.

In July 2023, MRRI was excited to welcome two new Scientific Advisory Board Members, Dr. Jennifer Bogner and Dr. Lewis Wheaton. Dr. Bogner has over 30 years of experience conducting research on traumatic brain injury. Her work has examined behavioral and emotional regulation, substance misuse, community participation, the long-term effects of traumatic brain injury, and factors that influence patient outcomes after rehabilitation. Dr. Wheaton's research over the past two decades has investigated motor planning and motor control, apraxia, and the mechanisms of motor recovery in people with limb amputations, stroke, and other central nervous system injuries. His work aims to improve rehabilitation in upper limb amputees through a deeper understanding of the relationship between the neurophysiology of motor learning and prosthesis adaptation.

Pablo A. Celnik, MD

Chief Executive Officer, Shirley Ryan AbilityLab.

Jennifer Bogner, PhD, ABPP, FACRM

Bert C. Wiley Professor of Physical Medicine and Rehabilitation; Professor of Physical Medicine and Rehabilitation, The Ohio State University.

Leslie J. Gonzalez-Rothi, PhD

Professor Emeritus, Department of Neurology, University of Florida.

Argye Beth Hillis, MD

Director, Cerebrovascular Division of Neurology, Johns Hopkins School of Medicine; Professor of Neurology, Johns Hopkins School of Medicine.

Kenneth Pugh, PhD

President and Director of Research, Haskins Laboratory; Associate Professor, Department of Linguistics, Yale University.

Eric L. Shipp, PhD, MBA

Associate Director, Finance and Administration, Glenn Biggs Institute for Alzheimer's and Neurodegenerative Diseases, University of Texas Health Science Center at San Antonio.

Lewis A. Wheaton, PhD

Associate Professor, School of Biological Sciences, Georgia Institute of Technology; Adjunct Faculty in the Department of Rehabilitation Medicine at Emory University School of Medicine.

Financial / Strategic Consultant

Robert Forrester, MBA

Consultant to research institutions, principally independent non-profits, on matters of organization, finance, affiliation, strategy, and regulation.

Publications Fiscal Year 2023

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Presentations Fiscal Year 2023

MRRI Institute Scientists collectively delivered a total 37 presentations during the past fiscal year. There were 22 oral and poster presentations at local, national, and international conferences and meetings, and MRRI scientists presented at five professional workshops and courses, four grand rounds, and six invited talks. Among these presentations were an invited symposium, a national award lecture, distinguished visitor presentation, visiting scholar presentations, and an international keynote lecture.

Ambron, E., Williamson, R., Rombokas, E., Li, J-S, Coslett, H.B., **Buxbaum, L.J.** *Mechanisms and neuroanatomy of virtual reality treatment of phantom limb pain.* Poster presented at the Cognitive Neuroscience Society Meeting, San Francisco, CA (March 2023).

Antonucci, S. *Supporting communication: Strategies for conversation and care partners.* Empowering Caregivers Workshop Series, The Penn Memory Center, Philadelphia, PA (December 2022).

Buxbaum, L.J. *Limb apraxia: A disorder at the cognitive-motor interface.* Invited lecture, Neurology Grand Rounds, University of California Los Angeles (December 2022).

Buxbaum, L.J. *Semantic selection and monitoring of tool actions in the left hemisphere.* Invited talk, Neuroscience Seminar Series, Visiting Scholars, Distinguished Visitors, Georgetown University, Washington, DC (February 2023).

Buxbaum, L.J. *Limb Apraxia: A disorder at the cognitive-motor interface.* Invited talk, Neurology Grand Rounds, University of Pittsburgh, Pittsburgh, PA (March 2023).

Buxbaum, L.J. *Disorders at the cognitive-motor interface.* Temple/Moss Physical Medicine and Rehabilitation Grand Rounds, Elkins Park, PA (April 2023).

Buxbaum, L.J. *Planning, selection, and monitoring of tool-use actions in the left hemisphere.* Invited talk, Sapienza University, Rome, Italy (June 2023).

Carter, L., **Therrien, A.S., Wong, A.L.** *Different sensory information is used for state estimation when stationary or moving.* Society for the Neural Control of Movement. Victoria, Canada (April 2023).

Cramer, C., Kumar, S., Nguyen, T., **Esquenazi, A.,** Brinkman, L., Ferreira, C., Su, M., Stein, S., May, J., Hendrix, A., Finley, C., Howard, E., **Edwards, D.J.** *Intensive rehabilitation therapy using telehealth methods early after stroke.* 147th meeting of the American Neurological Association, Chicago, IL (October 2022).

Dresang, H.C., Williamson, R., Kim, H., Hillis, A.E., **Buxbaum, L.J.** *Components of limb apraxia distinguish patients with different primary progressive aphasia variants.* Society for the Neurobiology of Language, Philadelphia, PA

(October 2022).

Edwards, D.J. *Robotically enhanced motor practice in neurorehabilitation.* Neuroergonomics & NYC Neuromodulation Conference, New York (July 2022).

Edwards, D.J. *Recovery of voluntary movement after stroke and spinal cord injury.* Invited Speaker, Edith Cowan University Lecture Series, Perth Australia (July 2022).

Edwards, D.J. *Open TMS and TES modeling problems in clinical rehabilitation.* Brain and Human Body Modeling Conference: From Fast and Accurate Computational Modeling to Clinical Practice. The Martinos Center for Biomedical Imaging at Massachusetts General Hospital (August 2022) virtual.

Edwards, D.J. *Challenges for translation of neuromodulation in rehabilitation.* Keynote speaker, NC NM4R Introductory Workshop, Medical University of South Carolina, Charleston, SC (October 2022).

Edwards, D.J. *Intensive gait training in chronic incomplete spinal cord injury using robot-assisted exoskeletons: rational, outcomes, and interpretation of a RCT.* 12th World Congress for Neurorehabilitation, Vienna, Austria (December 2022).

Edwards, D.J., Kumar, S., Nguyen, T., **Esquenazi, A.,** Brinkman, L., Ferreira, I., Su, M., Stein, S., May, J., Hendrix, A., Finley, C., Howard, E., Cramer, S. *The promise of telerehabilitation to increase upper limb therapy dose and improve continuity of care during early post stroke recovery.* Poster presented at the American Society of Neurorehabilitation Meeting, Charleston, SC (March 2023).

Esquenazi, A., Edwards, D.J. *Technology and other innovations for rehabilitation.* Farber Town Hall, Vickie and Jack Farber Institute for Neuroscience, Jefferson Health, Philadelphia, PA (May 2023).

Gordon J.K., Gilmore N., Cherney L.R., et al: Demystifying Aphasia Treatment Using the Rehabilitation Treatment Specification System (RTSS) (Symposium Discussant **Whyte, J.**). Annual Meeting of the American Congress of Rehabilitation Medicine, Chicago, IL (November 2022).

Jacob, J., Potts, C., **Buxbaum, L.J., Kantak, S.** *Task difficulty influences paretic arm choice during goal-directed planar reaching movements after right hemispheric stroke.* Poster presented at the American Society of Neurorehabilitation meeting, Charleston, SC (March 2023).

Jones, G., Gibson, J., **Whyte, J.,** Pinto, S.M. *Accelerating the application of evidence in brain injury rehabilitation: Introduction to the Rehabilitation Treatment Specification System (RTSS).* International Brain Injury Association, Dublin, Ireland (March 2023).

Juckett L., Van Stan J.H., Tierney-Hendricks C., **Whyte J.,** et al. Symposium: From Specification to Implementation: Advancing the Field through the Rehabilitation Treatment Specification System. Annual Meeting of the American Congress of Rehabilitation Medicine, Chicago, IL (November 2022).

Middleton, E.L., Duquette, K.L., Rawson, K. *Successive learning: An examination of session-dosage and criterion-level dosage in naming impairment in aphasia.* Poster presented at the 60th Annual Meeting of the Academy of Aphasia, Philadelphia, PA (October 2022).

Pöldsepp, K., **Mailend, M.-L.** *The Estonian version of the Chapel Hill Multilingual Intelligibility Test (CHMIT-Est)*. Poster presented at the 8th Nordic Aphasia Conference, Reykjavik, Iceland (June 2023).

Potts, C., Williamson, R., **Kantak, S., Buxbaum, L.J.** *Cognitive load disrupts reach efficiency, speed, and curvature in chronic stroke*. Poster presented at the Neural Control of Movement Meeting, Vancouver, British Columbia (April 2023).

Therrien, A.S. *State estimation and reinforcement learning following cerebellar damage*. Society for the Neural Control of Movement, Dublin, Ireland (July 2022).

Therrien, A.S. Invited Talk. *Cerebellar Ataxia: A disorder at the sensory-motor interface*. Shirley Ryan Ability Lab Interprofessional Stroke Course. Chicago, IL (May 2023).

Therrien, A.S. *Cerebellar Ataxia: A disorder at the sensory-motor interface*. MossRehab Physical Medicine and Rehabilitation Department Grand Rounds, Philadelphia, PA (May 2023).

Thibault S, **Buxbaum L.J., Wong A.L.** *Tool-use impairments in limb apraxia arise from errors in both planning and execution*. Poster presented at the Workshop on Concepts, Actions, Objects: Functional and Neural Perspectives (CAOs). Università Di Trento, Center for Mind Brain Sciences, Rovereto, Italy (May 2023).

Thothathiri, M., Kirkwood, J., **Middleton, E.L., Patra, A.** *Multimodal measures in persons with agrammatism reveal a complex relationship between cognitive control and sentence processing*. Poster presented at the Society for the Neurobiology of Language, Philadelphia, PA (October 2022).

Thothathiri, M., Kirkwood, J., **Middleton, E.L., Patra, A.** *Multimodal measures in persons with*

agrammatism reveal a complex relationship between cognitive control and sentence processing. Poster presented at the 60th Annual Meeting of the Academy of Aphasia, Philadelphia, PA (October 2022).

Van Stan J.H., Zanca J., **Whyte J.**, et al. *Instructional Course: Rehabilitation Treatment Specification System: Intermediate/Advanced Application in Rehabilitation Education, Research, and Clinical Practice*. Annual Meeting of the American Congress of Rehabilitation Medicine, Chicago, IL (November 2022).

Venkatesan, U. *Adverse childhood experiences in adults with moderate-severe traumatic brain injury: relevance to current psychological distress and health-related quality of life*. The International Brain Injury Association 14th World Congress on Brain Injury, Dublin, Ireland (April 2023).

Whyte J. *What to expect*. Rehabilitation Medicine Scientist Training Workshop, Anaheim, CA (February 2023).

Whyte J., Eubanks J., Pinto S., Welch S. *Rehabilitation Treatment Specification System*. Symposium, Association of Academic Physiatrists Meeting, Anaheim, CA (February 2023).

Wong, A.L., Green, A.L., Issacs, M.W. *Deciding how to move in the face of uncertainty*. Poster presentation at the Society for the Neural Control of Movement, Dublin, Ireland (July 2022).

Wong, A.L. *Multiple interacting processes for planning movement*. Motor Neuroscience Seminar, Texas A&M University, College Station, TX (February 2023).

Zangakis, D., **Wong, A.L., Therrien, A.S.**
*Adapting to novel dynamics realigns the perception of
limb movement, but not limb position.* Poster

presented at the Society for the Neural Control of
Movement. Victoria, Canada (April 2023).

Shrier Family Topics in Rehabilitation Science Lecture Series

Shrier Family Topics in Rehabilitation Science Lecture Series is a series of informal colloquia that bridge the clinical and research worlds. The goal is to inform MossRehab and MRRI staff about ongoing projects of institute staff and adjunct scientists in an atmosphere that encourages discussion about methodological issues related to the research projects. Presentations focus on data and analysis from presenters' recent and ongoing studies, rather than syntheses and literature reviews. The hour-long colloquia are presented at noon on the third Wednesday of the month.

Date	Speaker	Title of Talk
9/20/22	Rebecca Lewthwaite, PhD	Optimizing the movement System with motivational and attentional conditions
10/19/22	Natalie Gilmore, PhD, CCC-SLP	Intensive cognitive and communication rehabilitation for young adults with acquired brain injury
11/16/22	Amanda Therrien, PhD	Can we predict residual motor learning capacity after cerebellar damage?
1/18/23	Anila D'Mello, PhD	Cerebellar contributions to human cognition
2/15/23	Masahiro Yamada, PhD	Low-intensity strength training with blood flow restriction as a potential approach to improve force generation after stroke
3/15/23	Dylan J. Edwards, PhD	Challenges for translation of neuromodulation in rehabilitation
4/19/23	Umesh Venkatesan, PhD	From social determinants of health to private experiences of disability after traumatic brain injury
5/17/23	Simon Thibault, PhD	Tool-use deficits after left hemisphere stroke
6/21/23	Marja-Liisa Mailend, PhD	Differential diagnosis of acquired apraxia of speech and the Apraxia of Speech Rating Scale

Institute Forum Visiting Scholar Lecture Series

The Visiting Scholar Lectures are colloquia where invited speakers from national and international institutions present research spanning the fields of neuroscience and neurorehabilitation. The lectures are open to MossRehab and MRRI Institute staff, as well as individuals from other institutions via Zoom. These lectures are also made available to the public on our YouTube channel. The goal of this lecture series is to provide an educational forum that highlights new developments in the fields of research represented at the MRRI.

In February of this year, Amy J. Bastian PhD, PT, Chief Science Officer, Kennedy Krieger Institute and Professor of Neuroscience and Neurology at the Johns Hopkins School of Medicine presented at the Whyte-Schwartz Annual Lecture honoring John Whyte and Myrna Schwartz, who founded MRRI in 1992. Dr. Bastian's presentation was titled *Learning and relearning movement*, and she discussed normal and abnormal motor learning, and how we can use our understanding of motor learning to improve rehabilitation for individuals with neurological damage.

Date	Speaker	Title of Talk
9/8/22	Shannon Juengst, PhD, CRC	Multidimensional health perceptions: conceptualization, measurement, and implementation
2/22/23	Amy Bastian, PT, PhD	Learning and relearning movement
4/26/23	Joo-Hyun Song, PhD	How does action training affect perception and cognition?

Postdoctoral Training

MRI offers an outstanding postdoctoral research training program funded by an NIH T32 fellowship in translational neurorehabilitation research. In fiscal year 2023, there were a total of 7 postdoctoral fellows in the program, including our newest fellows Amy Lebkuecher, PhD, Yingxue Tian, PhD, and Anna Krason, PhD. Trainees from basic science and clinical disciplines participate in a core curriculum of didactic and workshop sessions and are immersed in ongoing research and hands-on training that offers opportunities for presentation, publication, and grant writing. In addition, MRI hosts a series of seminars each year for T32 trainees providing in-depth training and discussion on important topics related to scholarship and career development.

Date	Speaker	Title of Talk
7/13/22	Umesh Venkatesan, PhD Amanda Rabinowitz, PhD	Health disparities in neurorehabilitation
9/14/22	John Whyte, MD, PhD	Translational neurorehabilitation research: Navigating the obstacles of the translational pipeline
11/9/22	John Whyte, MD, PhD	Translational research: Where does my research fit in?
12/14/22	Amanda Rabinowitz, PhD Marie McNeely, PhD John Whyte, MD, PhD	Communicating science to peers and the public
1/11/23	Laurel Buxbaum, PsyD Erica Middleton, PhD Amanda Rabinowitz, PhD John Whyte, MD, PhD	Clinical trial designs in rehabilitation research
2/8/23	John Detre, MD	MR imaging methods in neurorehabilitation research
3/8/23	Roy Hamilton, MD Laurel Buxbaum, PsyD	Early Career Funding Strategies
5/10/23	Dylan Edwards, PhD Shailesh Kantak, PT, PhD Amanda Therrien, PhD Aaron Wong, PhD	The Robot as Research Equipment and Therapeutic Device
6/14/23	John Whyte, MD, PhD	The ICF: What Level of Functioning Are You Studying?

MRRI Internal Competitive Funding

Peer Review Committee

Each year, MRRI earmarks seed money for internal research projects conducted by principal investigators at MossRehab and MRRI. Research projects are typically preliminary studies intended to lead to extramural funding or clinical program development. The Peer Review Committee is composed of scientists from MRRI and clinicians from MossRehab. The Committee reviews research applications for scientific merit, institutional impact, and budget projections.

Projects approved for funding are considered promising, innovative, feasible, and consistent with the interests of the research institute and MossRehab. The proposed projects should demonstrate: clearly defined goals that are feasible given anticipated resources, a realistic plan and budget that describe activities appropriate to meet project goals potential for significant impact or possible extramural funding. One project was funded during 2023.

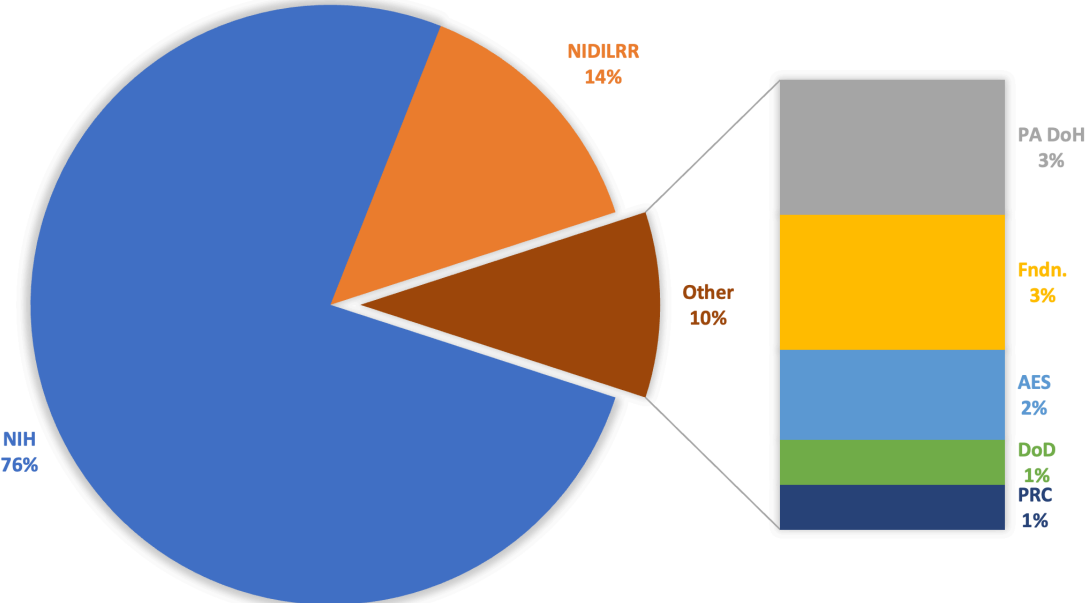
- Co-Speech Gesture and Naming in Aphasia, Laurel Buxbaum, PsyD

Klein Family Parkinson's Rehabilitation Center

In fiscal year 2023, the Klein Family Parkinson's Rehabilitation Center awarded a new grant to Jacqueline Brown, PT, DPT, NCS, as principal investigator. The grant is entitled "Utilization of Robotic EksoSkeleton to achieve high dosing, intensity, and complexity of gait in treatment of people with Parkinson's Disease".

Competitive Funding Summary

MRRI research is funded by a diverse mix of government, non-profit, and internal institutional funding mechanisms. The majority of grant support comes from the National Institutes of Health.



- AES Albert Einstein Society
- DoD Department of Defense
- Fndn Support from non-profit foundations
- NIDILRR National Institute on Disability, Independent Living, and Rehabilitation Research
- NIH National Institutes of Health
- PA DoH Pennsylvania Department of Health
- PRC Peer Review Committee

Grants and Contracts Fiscal Year 2023

COMPETITIVE FUNDING

Principal Investigator	Title of Project	Source of Funds
Antonucci, Sharon, PhD, CCC-SLP	Assessing an animal assisted treatment program for adults with aphasia. The persons with aphasia training dogs program	NIH / NICHD
Antonucci, Sharon, PhD, CCC-SLP	Translational and clinical implementation of a test of language and short-term memory in aphasia	NIH
Antonucci, Sharon, PhD, CCC-SLP	Strategy, training & education program for people living with primary aggressive aphasia	Einstein Society
Buxbaum, Laurel, PsyD	Efficacy and mechanisms of virtual reality treatment of phantom limb pain	NIH / NICHD
Buxbaum, Laurel, PsyD	Mechanistic and neuroanatomic bases of disparity between arm capacity and use	NIH / NICHD
Buxbaum, Laurel, PsyD	Virtual reality assessment of arm choice under cognitive load: feasibility and piloting	PA DoH
Buxbaum, Laurel, PsyD	Understanding action selection in the tool use network	NIH / NINDS
Buxbaum, Laurel, PsyD, Haley Dresang, PhD	Upregulating action semantics to facilitate naming in aphasia	PRC
Buxbaum, Laurel, PsyD, Amy Lebkuecher, PhD	Co-speech gesture and naming in aphasia	PRC
Edwards, Dylan, PhD	TRANScranial direct current stimulation for Post-stroke motor Recovery - a phase II study (TRANSPORT 2)	NIH
Edwards, Dylan, PhD	National Center of Neuromodulation for Rehabilitation (NC NM4R)	NIH
Edwards, Dylan, PhD Kantak, Shailesh, PhD	Precision targeting for transcranial magnetic stimulation treatment in stroke	Chernowitz Medical Research Foundation
Edwards, Dylan, PhD	RTMS during inpatient rehabilitation to promote recovery from spinal cord injury	PA DoH

Kantak, Shailesh, PhD	Perceptual motor interaction to improve bimanual coordination after stroke	NIH / NICHHD
Kantak, Shailesh, PhD	Cognitive and neurophysiological mechanisms of arm action after stroke	Einstein Society
Mailend, Marja-Liisa, PhD	Efficacy and optimization of speech entrainment practices for people with aphasia	NIH / NIDCD
Middleton, Erica, PhD	Retrieval practice principles: A theory of learning for aphasia rehabilitation	NIH / NIDCD
Middleton, Erica, PhD	Transcranial magnetic stimulation for aphasia: efficacy and neural basis	NIH
Middleton, Erica, PhD	Cognitive control and sentence processing in aphasia	NIH
Middleton, Erica, PhD	Cognitive and neural basis of functional communication deficits in post-stroke aphasia	NIH
Rabinowitz, Amanda, PhD	The Moss Traumatic Brain Injury Model System	NIDLIRR
Rabinowitz, Amanda, PhD	Positive personality attributes in TBI	PA DoH
Rabinowitz, Amanda, PhD	Characterization and treatment of chronic pain after severe traumatic brain injury	NIDLIRR
Rabinowitz, Amanda, PhD	RERC on ICT access for mobile rehabilitation (mRehab)	NIDLIRR
Rabinowitz, Amanda, PhD	BeHEALTHY: Chronic disease management for traumatic brain injury (TBI)	NIDLIRR
Rabinowitz, Amanda, PhD	Comparing treatment approaches to promote inpatient rehabilitation effectiveness for traumatic brain injury (CARE 4 TBI)	NIH
Rabinowitz, Amanda, PhD	Enrich brain health project 2	DoD
Ramos-Lambooy, Marlyn, MD	mHealth-based just-in-time adaptive intervention to improve physical activity of individuals with spinal cord injury	NIH
Therrien, Amanda, PhD	Static and dynamic state estimation in upper limb control	PRC

Therrien, Amanda, PhD	Motor learning after cerebellar damage: the role of the primary motor cortex	NIH
Venkatesan, Umesh, PhD	Adverse childhood experiences in adults with traumatic brain injury	Einstein Society
Venkatesan, Umesh, PhD	MRI markers of feedback timing during learning in individuals with TBI with and without clinical depression	NIH
Watanabe, Thomas, MD	Improving transition from acute to post-acute care following TBI	PCORI
Whyte, John, MD, PhD	Postdoctoral training in translational neurorehabilitation research	NIH / NICHD
Whyte, John, MD, PhD	Rehabilitation Medicine Scientist Training (RMST) Program	NIH
Wong, Aaron, PhD	Effort costs and reward values in Parkinson's disease	PRC
Wong, Aaron, PhD	Investigating a dual-pathway framework for Praxis	NIH / NINDS

INDUSTRY SPONSORED TRIALS

Barcikowski, Jaclyn, MD/ Esquenazi, Alberto, MD	The efficacy of a frequency-tuned electromagnetic field treatment in facilitating the recovery of subacute ischemic stroke patients – a pivotal study	BrainQ Technologies
Esquenazi, Alberto, MD	Video and temporal spatial parameters assessment of gait after Dysport treatment: a pilot study	lpsen Pharmaceuticals
Esquenazi, Alberto, MD	Protocol No. F-FR-52120 an international, multicenter, observational prospective longitudinal study to assess the effectiveness of ABONONT-A injections for adult lower limb spasticity in a real-life cohort (ABOLISH)	lpsen Pharmaceuticals
Esquenazi, Alberto, MD	Effectiveness of a peer visitation program to improve patient activation and functional outcomes and quality of life during amputation rehabilitation	Prosthetic Design & Research
Moon, Daniel, MD	Phase 2 randomized, double-blind, placebo controlled, parallel group dose ranging multi-center trial to evaluate the efficacy and safety of DaxbolulinumtoxinA	Revance Therapeutics, Inc

Moon, Daniel, MD	Prospective, Open-label, Long-term, Multi-center, Registry to Assess the Safety and Efficacy of the Bioness Stimrouter Neuromodulation System in Subjects with Chronic Pain of Peripheral Nerve Origin	Bioness, Inc.
Talaty, Mukal, PhD	An Active Pelvis Orthosis (APO) for post-stroke gait rehabilitation: a pilot study	Iuvo Siri

MRRI

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