CHALLENGE ACCEPTED

ACTIVITY REPORT





CHALLENGE ACCEPTED

AS A PIONEER AMONG REHABILITATION PROVIDERS, MOSSREHAB ACCEPTS THE CHALLENGE OF CHANGE AND HELPS LEAD THE FIELD IN PATIENT SERVICE, ADVOCACY, RESEARCH AND EDUCATION.



IN A CHANGING HEALTHCARE ENVIRONMENT, MOSSREHAB LEADERS CONTINUE TO WORK WITHIN PROFESSIONAL **ASSOCIATIONS LIKE THE AMERICAN MEDICAL REHABILITATION PROVIDERS ASSOCIATION, THE AMERICAN ACADEMY OF** PHYSICAL MEDICINE AND REHABILITATION. AND THE **ASSOCIATION OF ACADEMIC PHYSIATRISTS TO MAKE SURE** THAT REHABILITATION RESOURCES REMAIN ACCESSIBLE TO THE PATIENTS WHO NEED THEM. WE ADVOCATE AND WORK WITH STATE AND FEDERAL GOVERNMENT AND OUR ACUTE CARE COLLEAGUES TO DO THE SAME, PAVING THE WAY FOR A STREAMLINED AND ROBUST CONTINUUM OF CARE.



REDEFINING Outcomes

NO CHALLENGE TOO GREAT

MossRehab is proud of its strong reputation for helping people recover from some of the most complex neurological and functional impairments. Because of its breadth of resources, our rehabilitation system attracts patients from across the country whose complex needs often require a longer stay. MossRehab accepts the challenge to provide the care they need, get them home to their families, and provide community integration services that help people regain their lives over the long term.

COMMITMENT TO PATIENT CARE AND SAFETY

MossRehab annual volumes have increased to more than 2,800 inpatient admissions and 180,000 outpatient visits in part due to our commitments to:

- Listen to our customers. For patients and families, this includes hourly nursing rounds, administrative rounds, surveys, and checking on them after discharge.
- Vigilantly guard patient safety and maintain 15 Commission on Accreditation of Rehabilitation Facilities accreditations.
- Deepen innovative safety programs such as Pressure Ulcer Prevention, Prevention of Catheter-Associated Urinary Tract Infection, Medical Early Warning System for Rehabilitation to reduce unplanned transfers, and implementation of Comprehensive Unit-based Safety Program.
- Keep patients and families close to home by opening new locations. MossRehab operates six inpatient locations and 14 specialized outpatient locations and continues to grow.
- Provide continuing support services beyond the typical reimbursable recovery period specialized for people with traumatic brain injury (TBI), stroke, neuromuscular conditions, spinal cord injury, or amputation.

ENSURING PATIENT SATISFACTION

This year, **82.5%** of MossRehab inpatients gave us their **highest ratings** (9 or 10 on a 10-point scale) for **patient satisfaction**, compared with the national average of 77.6%, a score that has continued to improve over the last five years.^[1]

Among outpatients with TBI, 95.6% gave MossRehab their highest ratings, and 100% said they would recommend MossRehab to others.

DRIVING PROCESS IMPROVEMENTS

MossRehab's internal approach to navigating healthcare reform and positioning itself for long-term success has been to prioritize the transparency of patient care and outcomes data and to analyze and communicate it programmatically, and at the unit level.

Rehabilitation medicine is highly individualized, so MossRehab meets its institutional mission of being dedicated to advancing the field of medical rehabilitation through research, advocacy and education. We start by understanding program goals, looking closely at its different patient populations, clinicians, and facilities, defining issues at the unit level and identifying how to solve them systematically. Targeted improvement goals are different for each patient population and care setting. With this approach, MossRehab has been able to effect changes that add up to better patient outcomes while remaining cost-conscious, efficient and effective.

IN 2016, MOSSREHABOUTCOMES CONTINUED TO SURPASS MANY NATIONAL BENCHMARKS

	MOSSREHAB	NATIONAL BENCHMARK	SOURCE
CASE MIX INDEX	1.4847	1.3405	
DISCHARGE TO HOME AND COMMUNITY	72.34%	70.18%	
TRANSFER TO ACUTE	12.91%	11.26%	
AVERAGE LENGTH OF STAY	16.18	14.37	eRehabData®
FIM CHANGE	28.84	25.09	
FIM EFFICIENCY (CHANGE PER DAY)	2.41	2.05	
PATIENT SATISFACTION RATE	80%	78.80%	
PATIENT RECOMMENDATION RATE	85.30%	81.30%	NATIONAL RESEARCH CORPORATION





LEADERSHIP

OPERATIONAL EXCELLENCE

MossRehab and Moss Rehabilitation Research Institute have been very fortunate to retain talented, long-term staff. This year, we completed transition plans to allow a few key leaders to move into and onto new opportunities.

"PATIENT OUTCOMES AND PATIENT EXPERIENCE ARE OF UTMOST IMPORTANCE. IN ORDER TO ADVANCE MOSSREHAB'S MISSION TO IMPROVE MORE LIVES OF PEOPLE WITH DISABILITIES, IT IS IMPERATIVE TO LISTEN TO THE VOICE OF ALL OUR CUSTOMERS — PATIENTS AND THEIR FAMILIES, CLINICIANS, AND PROVIDERS — TO BETTER UNDERSTAND THEIR NEEDS."

TOM SMITH, OTR/L, MBA HEALTHCARE ADMINISTRATION, CHIEF OPERATING OFFICER, MOSSREHAB

Thomas Smith, OTR/L, MBA Healthcare Administration, is the new chief operating officer (COO) of MossRehab and Einstein Medical Center Elkins Park – a promotion from his position as assistant vice president of MossRehab, where he opened two new facilities and provided operational oversight for the Drucker Brain Injury Center and three of MossRehab's satellite inpatient rehabilitation units.

Smith began his career at MossRehab as an occupational therapist in the stroke and traumatic brain injury programs in 1989. His perspective balancing patient and business interests will help MossRehab continue to fulfill its mission and patient-centered philosophy in today's dynamic healthcare environment.

Smith is a board member of the **Rehabilitation and Community Providers Association (RCPA)**, a trade association of Pennsylvania health and human service providers. Along with **Alberto Esquenazi**, **MD**, **chief medical officer**, who serves on the board, Smith also represents MossRehab as a member of the **American Medical Rehabilitation Providers Association**. These engagements help MossRehab influence state and federal policies and collaborate with peer organizations to exchange information and experiences.





MOSSREHAB ADVANCED LOCALLY AND NATIONALLY DURING RUTH LEFTON'S YEARS AS COO, AND WE ARE DEEPLY THANKFUL FOR HER ADMINISTRATIVE LEADERSHIP. HER OPEN-DOOR POLICY AND CLEAR COMMUNICATION STYLE ALLOWED US TO THRIVE IN A CHANGING HEALTHCARE ENVIRONMENT, LEAVING US IN A STRONG POSITION.**J7**

ALBERTO ESQUENAZI, MD, CHIEF MEDICAL OFFICER, MOSSREHAB

This year, **Ruth Lefton** was promoted from COO of MossRehab to COO of Einstein Medical Center Philadelphia, replacing A. Susan Bernini upon her retirement from an exceptional 45-year career.

Within Einstein Healthcare Network, Lefton has expanded responsibilities for two acute care Einstein Medical Center locations (Philadelphia and Elkins Park), MossRehab, and Willowcrest, the largest subacute skilled nursing and rehabilitation center in the greater Philadelphia area.

Lefton became a state and national policy leader and educator for healthcare providers in a time of significant legislative changes. One of her priorities as COO will be to bring MossRehab's patient-focused **integrated delivery care team model** to the acute care side of Einstein Healthcare Network.



MRRI SALUTES APHASIA PIONEERS



Myrna Schwartz, PhD

Myrna Schwartz, PhD and Ruth Fink, MA, CCC-SLP, cofounders of the MossRehab Aphasia Center in 1996, retired this year after 25 years of trailblazing leadership.

MossRehab Aphasia Center was in the vanguard of creating community spaces and a care continuum for people with aphasia who no longer had access to insured therapies. Today, the Center meets the longterm communication and psychosocial needs of people with aphasia by providing them with information and peer support, conversation cafés and book clubs, and opportunities to participate in research and treatment.

Dr. Schwartz co-founded the Moss Rehabilitation Research Institute (MMRI) in 1992 with John Whyte, MD, PhD. As director of its Language and Aphasia Laboratory



Ruth Fink, MA, CCC-SLP

and research director of the MossRehab Aphasia Center, Dr. Schwartz pioneered the use of convergent behavioral, computational, and neuroimaging methods to investigate how the mind and brain access words. She remains scientist emerita at MRRI.

Ruth Fink joined MRRI as an experienced speechlanguage pathologist to help lead treatment research on sentence processing, word retrieval and computerassisted aphasia rehabilitation. Fink co-developed MossTalk Words[®], a computer-assisted treatment for word retrieval disorders, and served as clinical director of the MossRehab Aphasia Center since its inception. Fink is a founding member of Aphasia Access, an alliance of Life Participation Providers, where she is a current board member.

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MOSSREHAB WOULD LIKE TO THANK MYRNA SCHWARTZ AND RUTH FINK FOR THEIR LASTING CONTRIBUTIONS TO THE FIELD OF REHABILITATION RESEARCH, ADDING TO OUR COLLECTIVE UNDERSTANDING OF THE COGNITIVE PROCESSES BEHIND LANGUAGE AND SPEECH, AND CREATING A SUITE OF PROGRAMS THAT ALLOWS PEOPLE WITH APHASIA TO REGAIN FUNCTION, DIGNITY, AND COMMUNITY OVER LONG PERIODS OF RECOVERY.

JOHN WHYTE, MD, PHD DIRECTOR, MOSS REHABILITATION RESEARCH INSTITUTE

MOSS REHABILITATION



Working closely with John Whyte, MD, PhD, co founder and director of Moss Rehabilitation Research Institute (MRRI), longtime institute scientist Laurel J. Buxbaum, PsyD has been appointed associate director of MRRI.

Dr. Buxbaum has worked for MRRI for over 20 years as **director** of its **Cognition and Action Laboratory**, where she leads an NIH- and foundation-funded research program focusing on how the brain processes objects, actions, and the body. Because her interests lie at the junction of cognitive neuroscience, memory, and motor control, she helps facilitate collaboration across MRRI labs and communication with several scientific peer groups worldwide.

Dr. Buxbaum is helping to ensure that the quality of behavioral and neuroimaging data in MRRI's growing patient research registry reflects recent developments in statistical and neuroscience methods. She also is helping to raise scientific and public awareness of our highly regarded contributions to neurorehabilitation science by enhancing MRRI's online presence.

See our work in progress at MRRI's new website and blog at MRRI.org



RESEARCH INSTITUTE



MRRI and the MossRehab Aphasia Center welcomes its new **clinical director**, **Sharon M. Antonucci**, **PhD**. Dr. Antonucci took the reins of outpatient therapies at our Advanced Clinical Therapy Program and longerterm community support groups and classes at our Aphasia Activity Center upon the retirement of Ruth Fink, MA, CCC-SLP in 2016.

Dr. Antonucci has researched the underlying nature of word retrieval deficits and group treatment for aphasia — interests that began when she worked with mentors Pélagie Beeson, PhD and Audrey Holland, PhD, CCC-SLP, BC-ANCDS at the University of Arizona. Building upon an NIH-funded project, Dr. Antonucci is pursuing new knowledge to fine-tune treatments for word retrieval deficits. Her studies examine semantically guided word retrieval and the neural substrates of language processing in adults. Bridging clinical therapy with research, her current project combines MRI brain imaging and behavioral language assessment to discover how damage to specific brain regions can impact word retrieval, and how understanding brain-behavior relationships can inform individualized treatment options.



PIONEERING REHABILITATION ROBOTICS



MOSSREHAB IS

A NATIONAL & WORLD LEADER IN CLINICAL INNOVATIONS USING ADVANCED REHABILITATION TECHNOLOGIES.



Our collection of 20 robotic devices to help assess and treat functional deficits is the largest by far in the U.S., giving patients and our skillful staff a wealth of highly individualized treatment options not available elsewhere.

For more than a decade, MossRehab has been instrumental in working with engineers around the world to **help develop**, **test**, **and refine computerassisted devices** that meet the special rehabilitation needs of people recovering from traumatic brain injury (TBI), stroke, spinal cord injury, other neurological disorders, or limb amputation.

Many **benefits** reinforce this commitment to discover and apply new technologies. Task-specific functional repetition is key to relearning motor function, and in this aspect, robotic technologies boost our clinical capabilities in many important ways.

ROBOTICS:

- Help clinicians deliver more precise, personalized, reproducible, and repetitive treatment.
- Allow greater intensity and efficiency of exercises.
- Help clinicians monitor progress on individual treatment plans.
- Provide objective outcome measures that allow seamless transition through the care continuum.
- Allow patients with severe neurological injury to begin treatment earlier, by sensing and providing as-needed assistance and ensuring their comfort and safety.
- Allow patients to transition more quickly from supported or assisted gait training to unsupported walking in natural environments.
- Prevent falls and injuries and reduce demands on staff.
- Help keep patients engaged and motivated.

MOSSREHAB ROBOTICS: HOW WE LEAD

FIRST IN THE U.S. (2015) TO OFFER AND WORK ON INDICATIONS FOR THE ANDAGO, A REVOLUTIONARY, UNTETHERED DEVICE THAT INTUITIVELY ASSISTS UPRIGHT, HANDS-FREE POSTURE WHILE WALKING ON ANY LEVEL SURFACE.

EXCLUSIVE U.S. CLINICAL TRIAL (2015) OF THE LOKOMAT®PRO ENHANCED EXOSKELETON TREADMILL SYSTEM, WITH AN IMPROVED USER INTERFACE AND FEATURES THAT PERMIT LONGER, MORE INTENSIVE SESSIONS.

AMONG THE FIRST IN THE U.S. (2015) TO OFFER SAFEGAITTM, A CEILING-MOUNTED, DYNAMIC SUPPORT SYSTEM TO PREVENT FALLS DURING LOCOMOTOR TRAINING.

FIRST IN THE U.S. (2015) TO HELP DEVELOP AND OFFER THE AMADEO EMG, THE MOST ADVANCED HAND-FINGER THERAPY DEVICE WITH A NEW SURFACE ELECTROMYOGRAPHY (EMG) TRIGGER FEATURE TO ACTIVATE THERAPEUTIC INTERVENTIONS.

FIRST IN THE U.S. (2015) TO HELP DEVELOP AND OFFER THE AMADEO S, A DEVICE THAT INCORPORATES EMG SIGNALS TO PROVIDE HAND-FINGER THERAPY AND TO MEASURE SPASTICITY.

FIRST IN THE U.S. (2013) TO OFFER A TYROMOTION COLLECTION OF 4 ROBOTS FOR SPECIALIZED ASSESSMENT AND TRAINING OF ARMS, HANDS AND FINGERS (DIEGO®, PABLO®, TYMO®, AMADEO®).

FIRST IN THE U.S. (2013) TO PROVIDE OCCUPATIONAL THERAPY WITH ARMEO®POWER, THE MOST ADVANCED TOOL FOR EARLY STAGE UPPER-LIMB REHABILITATION TO STRENGTHEN, IMPROVE REACH, AND PRACTICE FUNCTIONAL SKILLS.

FIRST IN THE U.S. (2011) TO CLINICALLY TRIAL AND OFFER THE G-EO SYSTEM[™] EVOLUTION, A ROBOT-ASSISTED TOOL FOR GAIT REHABILITATION, STEP CLIMBING, AND DESCENT.

AMONG THE FIRST IN THE U.S. (2010) TO TEST AND OFFER THE ALTERG™ TIBION BIONIC LEG IN ACUTE STROKE REHABILITATION, THE FIRST WEARABLE ROBOTIC ORTHOSIS OF ITS KIND TO AID TRANSFERS AND GAIT TRAINING.

FIRST IN THE U.S. (2009) TO HELP DEVELOP, CONDUCT EXCLUSIVE CLINICAL TRIAL, AND OFFER REWALK[™], A LIGHTWEIGHT, MOTORIZED EXOSKELETON SUIT THAT ENABLES PEOPLE PARALYZED BY SPINAL CORD INJURIES TO STAND, WALK, AND IN SOME CASES, CLIMB STAIRS INDEPENDENTLY.

FIRST IN THE MID-ATLANTIC REGION (2008) TO OFFER THE LOKOMAT® EXOSKELETON TREADMILL SYSTEM, PROVIDING INTUITIVELY ADJUSTED GAIT ASSISTANCE AND PERFORMANCE MEASUREMENTS.

FIRST IN THE U.S. (2007) TO CLINICALLY TRIAL AND OFFER THE REO THERAPY UPPER-LIMB ROBOTIC DEVICE TO HELP RESTORE THE ARM'S GROSS MOTOR SKILLS.

MossRehab.com/Robotics

LOCOMOTOR TRAINING PROGRAM

This year, with the support of a gift from Barbara and David S. Loeb, Jr., MossRehab completed the structure of its clinical Locomotor Training Program with an array of technologies, including many of the available robotic bodyweight support systems that help reduce falls and fatigue during standing and walking, allowing patients to start their rehabilitations earlier and tolerate longer treatment sessions.

The program's newest bodyweight support system, the **Andago**, helps bridge the gap from treadmill gait training to level surface walking, keeping patients safe and supported on any flat floor while they prepare to transfer motor skills into real-world environments.

SafeGait[™] is a ceiling-mounted system that can offset up to half a person's bodyweight, distinguishes between intentional steps and falls, and helps therapists track walking progress on individualized programs. G-EO System[™] Evolution adaptively helps to train leg muscles, and Lokomat[®] exoskeleton systems help regulate leg movements, weight shift and balance to assist practicing a natural walking pattern. Our collection of three Lokomats is a highlight of this program.

This comprehensive program began with a focus on bridging inpatient and outpatient therapies for persons with spinal cord injuries; now, we are expanding these applications to stroke and traumatic brain injury. We are interested particularly in the great potential of robotic technologies to assist safe, acute phase rehabilitation very soon after a neurological event.

MossRehab's use of robotics garnered the attention of the Craig H. Neilsen Foundation, which funds

research, education, and quality-of-life programs aimed at improving the lives of those with spinal cord injuries. The Foundation awarded a \$70,000 grant to the MossRehab Spinal Cord Locomotor Training Program, which will allow us to obtain an additional robotic device and enhance our delivery care model, as well as collect data on the effectiveness of technology applications in rehabilitation.

MIRROR THERAPY RESEARCH USING THE PHANTOM[®] HAPTIC DEVICE

Mirror therapy is effective and widely used to treat impaired motor control after unilateral stroke, but more needs to be understood about its underlying sensorimotor processes to fine-tune assessment and treatment methods.

This year, MossRehab launched the first robotics study of its kind to better understand how and why mirror therapy works. The study uses the Phantom[®] Premium[™] haptic device, resembling a joystick on a robotic arm, to provide a highly detailed record of participants' upper limb movements and to administer a force field that experimentally tests different proprioceptive and visual inputs. Phase I of this research is looking at healthy participants, and Phase II will involve participants with hemiparesis.

NEW APPLICATION TO ASSESS TONE AND SPASTICITY

MossRehab is using the Tyromotion Amadeo handfinger therapy device as a new tool to assess tone and spasticity, potentially yielding more quantifiable and reproducible measurements of Modified Ashworth Scale and Tardieu Scale scores than current clinical approaches.





RESEARCH



MossRehab is extremely fortunate to be integrated with Moss Rehabilitation Research Institute (MRRI), internationally recognized for its collaborative neurorehabilitation research that advances theoretical knowledge and improves patient care by advancing the scientific bases for assessment and treatment.

This year, MRRI managed **30 concurrent lines of investigation** that span the **science of movement**, **language**, **and cognition**, working with research partners across the United States, Europe, Argentina, Australia, Israel, and Mexico.



MRRI ADVOCATES FOR THE

FUTURE OF REHABILITATION RESEARCH

Researchers at MRRI provide leadership to promote rehabilitation research in the United States and make recommendations to federal agencies.

Laurel Buxbaum, PsyD and Tessa Hart, PhD participated in the May 2016 meeting of the National Center for Medical Rehabilitation Research (NCMRR) Advisory Board, where they contributed to the NCMRR Research Plan alongside the Center's new director, Alison Cernich, PhD.

As chair of its **Public Policy Committee**, **John Whyte**, **MD**, **PhD** represents the **Association of Academic Physiatrists (AAP)** in advocating for public policies to improve the federal coordination and funding of rehabilitation research and maximize returns on these investments for injured Americans. This year, Dr. Whyte was part of the AAP team that met with members of Congress to gain their sponsorship and support for **S. 800** / **HR 1631**, a recently approved bill to enhance research coordination within NIH and other agencies and to promote information sharing via an annual rehabilitation progress report and conference.

Alberto Esquenazi, MD was named again to the Advisory Committee on Prosthetics and Special Disabilities Programs for the U.S. Department of Veterans Affairs (VA). He had served in this role once before, from 1997 to 2004, to advise the VA on rehabilitation research and prosthetics for veterans and to assess VA programs addressing a broad range of injuries and impairments.

MRRICEMENTS FOUNDATIONS

WITHIN REHABILITATION RESEARCH

I'M EXCITED TO BE AT MRRI, A PLACE WHERE I CAN EXPAND MY THEORETICAL RESEARCH TOWARD CLINICAL RELEVANCE. THE RESOURCES AVAILABLE AT MOSS REHABILITATION RESEARCH INSTITUTE AND IN MOSSREHAB'S CLINICAL SETTINGS ARE ONE OF ITS DEFINING CHARACTERISTICS. MRRI IS ONE OF THE ONLY PLACES WITH THIS KIND OF COLLABORATIVE ENVIRONMENT AND RESEARCH INFRASTRUCTURE. THE PROJECTS I AM WORKING ON HERE WOULD BE VERY DIFFICULT TO DO ANYWHERE ELSE.

EDWARD WLOTKO, PHD, DIRECTOR, MRRI COGNITIVE NEUROPHYSIOLOGY AND NEUROPSYCHOLOGY LABORATORY

DATA DRIVE DISCOVERY

MRRI's **Patient Research Registry** is one of the **largest databases of its kind in the world**. Comprised of records from over 2,200 individuals recovering from traumatic brain injury (TBI) or stroke, the registry contains demographic and clinical data on individuals interested in participating in eligible research studies. It also contains research-quality structural and functional neuroimaging data that can support analyses of brainbehavior relationships.

Insights into the functional connectivity of brain networks and research using voxel-based lesionsymptom mapping are just two recent examples of the scientific progress made possible by the registry. To learn more about the registry, go to MRRI.org/patient-research-registry.

MRRI's **Responsiveness Program database** has 17 years of clinical and outcome data on patients with the most severe forms of brain injuries, resulting in **prolonged disorders of consciousness**. Analyses of these data have allowed us to characterize types of injuries, varied patterns of recovery, and some of the patient and treatment factors associated with clinical improvements.

An exciting finding emerging from this research is that a large proportion of patients with TBI can continue to recover and gain independence for years beyond discharge.

TAXONOMY FOR REHABILITATION TREATMENTS

With major funding from the **Patient-Centered Outcomes Research Institute (PCORI)**, MRRI is collaborating with several other institutions to tackle one of the biggest challenges in rehabilitation research – standardizing the specification of rehabilitation treatments according to their targeted effects and mechanisms.

It has been difficult to study the effectiveness of experience-based treatments (e.g., gait training, memory remediation) because there has been no standard nomenclature that conveys therapeutic content. Clinicians and researchers may use the same name for treatments that have very different methods and durations, or apply different terms to largely overlapping treatment experiences.

MRRI's John Whyte, MD, PhD is leading a research team and international advisory board to develop conceptual rules, a theory-based system, and a manual that will enable clinicians and researchers to define and name rehabilitation therapies in terms of their known or hypothesized "active ingredients." Experiential exercises will help evaluate and improve the manual, with the ultimate goal for it to be adopted to standardize treatment specification for the purposes of research, training, and quality assurance.

COGNITIVE SCIENCE

AND REHABILITATION



MRRI ADVANCES NEW UNDERSTANDING IN THE ASSESSMENT AND TREATMENT OF COGNITIVE, BEHAVIORAL AND MOTOR CONTROL DEFICITS.

OBJECT KNOWLEDGE AND OBJECT USE

This year, a research team led by MRRI's Laurel Buxbaum, PsyD was awarded a five-year, \$2.9M grant from NIH to continue studying how the brain and mind organize actions for object use, and how this organization can be disrupted by stroke.

Dr. Buxbaum's laboratory has been making progress in this area for 20 years, and recently published the largest study ever conducted of the brain lesions that cause apraxia in the prestigious journal, *Brain*. In part, they demonstrated that object use is stored as a combination of gesture knowledge and procedure knowledge. They also found particular areas on the left side of the brain that store memories of object use actions.

In the next phase of research, Dr. Buxbaum's team, including colleagues from the University of Pennsylvania and NIH, will pursue several interrelated studies using techniques like eye tracking and functional neuroimaging to discover how different object actions are planned, how connections between

brain regions may be disrupted in apraxia, and how actions are learned over repeated experiences.

USING EEG TO UNDERSTAND LANGUAGE COMPREHENSION

Building upon federally funded investigations into how each hemisphere of the brain contributes to language comprehension and how these processes may change over a lifetime, Edward Wlotko, PhD is leading a project to study how the brain uses context predictively to understand language.

The research uses EEG to measure event-related brain potentials that illuminate how a healthy brain and a brain injured by stroke respond to context in language. Preliminary results suggest there are individual differences in how the two hemispheres use context information. The goal of this work is to improve our understanding of inter-individual differences in brain function and differences in the specific problems experienced by patients to help better focus assessment and treatment for cognitive impairments.

TRAUMATIC BRAIN INJURY

TRAUMATIC BRAIN INJURY MODEL SYSTEM

MRRI and the MossRehab Drucker Brain Injury Center host one of 16 Traumatic Brain Injury Model Systems (TBIMS) sponsored by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). For nearly 20 years, Tessa Hart, PhD and John Whyte, MD, PhD have been leading the MossRehab TBI Model System to conduct original research, collaborate in national longitudinal studies and disseminate information to the scientific community and to individuals with TBI, their families and professional care providers. We are proud of this rare opportunity to help significantly elevate the standard of rehabilitation throughout the continuum of care, from onset to community and vocational re-entry, and to help improve long-term functional, cognitive, and quality-of-life outcomes for individuals with TBI.

MossRehab is one of six TBIMS Research Centers conducting a national study of sleep apnea in TBI populations. Building upon research that found that 50% of patients with brain injury admitted to acute care and 37% of people with TBI were diagnosed with sleep apnea, a team led by Dr. Risa Richardson (Tampa VA Research and Education Foundation), in collaboration with MossRehab, now is working with a major PCORI grant to study the comparative effectiveness of sleep apnea screening and diagnostic tools for people with brain injury. By testing options like home-based actigraphy, we hope to understand and ease common complaints of cognitive impairment and sleepiness after TBI by diagnosing sleep disorders earlier and in an environment that is less disruptive than a sleep lab.

THE SCIENCE OF RESILIENCE

Measures of brain injury severity explain only a fraction of the variance in TBI outcomes. MRRI's Amanda Rabinowitz, PhD is leading investigations to discover unknown factors that may influence TBI recovery. As part of a larger research program, the Resilience study has adapted proven instruments from the field of positive psychology to find the best ways to measure pre-TBI personality traits like hope, optimism, meaning-making and grit. Since these traits of resilience can be modifiable, and have been shown to influence outcomes in other clinical populations, our hope is to determine the aspects of personality robustly related to post-TBI outcomes in order to develop new interventions that can enhance recovery.

MOSSGOAL BEHAVIORAL ACTIVATION FOR DEPRESSION AND ANXIETY

A high incidence of depression and anxiety among people with TBI may be linked with being less active than they were pre-injury, which can include social isolation and a loss of interest in pleasurable pursuits. People with TBI may fall into a vicious cycle of low activity, low mood, and reduced motivation for engaging in previously rewarding activities. MRRI's Tessa Hart, PhD is leading a study to address these interrelated problems, adapting treatment methods for depression and health maintenance. It uses just one session of face-to-face therapy based on behavioral activation (BA), which helps identify and plan for pleasurable activities, followed by electronic text reminders to help people with TBI to engage in those activities. Such small interventions have been shown to help improve mood by increasing exposure to environmental reward in other clinical populations. Jessie Fann, MD, MPH, a psychiatrist with expertise in BA and TBI treatment (University of Washington School of Medicine), helped MRRI design the first BA intervention of its kind for this population. The team developed a new piece of web-based software, MossGoal, that allows a therapist to design, automate and track replies to text messages. Patient responses have been very promising, and quantitative results are expected by early 2017.

MOVEMENT SCIENCE

PHANTOM LIMB PAIN

As one of several lines of research into how amputation changes the way the brain represents the body and its surrounding space, Laurel Buxbaum, PsyD is collaborating with neurology and engineering researchers at the University of Pennsylvania to assess if virtual reality (VR) exercises can be used therapeutically to alleviate phantom limb pain.

In their experiment, participants with lower-limb amputations perform a series of virtual reality tasks, such as rappelling down a cliff. Motion trackers create an image in the VR environment indicating that both lower limbs are participating in the task.

The study is in its early stages but preliminary results have been extremely encouraging. The compelling sensation that both limbs are intact may close a sensory feedback loop, leading to a significant reduction in debilitating phantom limb pain after just a few sessions of use.

MIRROR THERAPY

Mirror therapy (MT) is an effective treatment for many people with unilateral arm deficits after stroke, and it has great potential to help more individuals over longer periods because it can be repeated at home. With a five-year, \$1.6 million NIH grant, a team led by Steven Jax, PhD, director of the MRRI Perceptual Motor Control Laboratory, is completing the largest clinical trial of home-based MT. Results are expected in Spring 2017 and may clarify the neural regions critical for MT, significantly aiding clinical decision making and suggesting future therapies combining MT and brain stimulation.

BIMANUAL COORDINATION

Nearly all daily activities require bimanual coordination, yet current literature and clinical treatments focus heavily on unilateral rehabilitation after stroke. Not much information exists to understand how two arms work together or how left and right hemispheres of the brain communicate or interact to control movements.

As one of multiple lines of inquiry to understand and characterize the neural mechanisms behind how people move and learn to move, Shailesh Kantak, PhD, PT, director of the MRRI Neuroplasticity and Motor Behavior Laboratory, is leading a study of bimanual coordination funded in part by a 2016 Albert Einstein Society research award.

This research uses a virtual reality environment to examine the factors of perception that influence bimanual task performance. It also employs noninvasive transcranial magnetic stimulation to assess how neurons in different areas of the brain work collectively to effect coordinated arm movements. This dual approach has the potential to improve assessment of strokerelated impairments and make rehabilitation more effective than current approaches.





EDUCATION

CHALLENGE ACCEPTED

EDUCATE & TRAIN

FUTURE GENERATIONS

OF PHYSIATRISTS &

NEUROREHABILITATION RESEARCHERS



TEMPLE/MOSSREHAB RESIDENCY TRAINING PROGRAM IN PHYSICAL MEDICINE AND REHABILITATION (PM&R)

A fixture in academia for 49 years, this three-year, Accreditation Council on Graduate Medical Education (ACGME)-accredited program was founded by one of the fathers of physiatry, Frank H. Krusen, and remains a very successful collaboration between Temple University School of Medicine and MossRehab. Alumni have been appointed to leadership positions in the field of PM&R, including presidencies within the American Academy of PM&R, American Congress of Rehabilitation Medicine, and the Association of Academic Physiatrists. In 2016, 27 residents were educated and trained, and eight graduated.

MOSSREHAB BRAIN INJURY MEDICINE FELLOWSHIP

This new program became ACGME-accredited in 2016 and welcomes its first fellow in 2017. Led by Miriam Segal, MD and guided by board-certified brain injury physiatrists within MossRehab's Traumatic Brain Injury (TBI) Model System, fellows receive instruction and exposure to a dedicated 26-bed TBI inpatient unit, concussion program, pioneering rehabilitation robotics, spasticity management techniques, community integration services, and collaboration with the Moss Rehabilitation Research Institute.

MOSSREHAB ORTHOPEDIC PHYSICAL THERAPY RESIDENCY

Our first orthopedic physical therapy (PT) resident completed this new one-year, full-time program in 2016. The residency teaches advanced skills in diagnosis and treatment, utilizing mentors in outpatient units to prepare PTs to become excellent clinicians, educators, and leaders in physical therapy. This program prepares residents for American Board of Physical Therapy Residency and Fellowship Education certification.

MOSSREHAB OCCUPATIONAL THERAPY RESIDENCY IN PHYSICAL REHABILITATION

This intensive, one-year program provides clinical and didactic learning opportunities to prepare occupational therapists for board certification and a career in rehabilitation. Residents receive one-onone mentoring with fieldwork educators, instruction and structured learning experiences and provide therapy on inpatient and outpatient units. The program is training two residents in its first year, and is progressing toward full accreditation from American Occupational Therapy Association.

REHABILITATION MEDICINE SCIENTIST TRAINING PROGRAM AT MOSS REHABILITATION RESEARCH INSTITUTE (MRRI)

With funding and partnership from NIH and the Association of Academic Physiatrists, MRRI director John Whyte, MD, PhD co-leads the national Rehabilitation Medicine Scientist Training Program to provide rigorous research training, mentorship, and career development for physiatrists committed to becoming scientifically productive faculty members, feeding the pipeline of academic rehabilitation research.

POSTDOCTORAL FELLOWSHIPS IN TRANSLATIONAL NEUROSCIENCE AND NEUROREHABILITATION RESEARCH

With NIH funding, MRRI collaborates with the Department of Neurology and the Center for Functional Neuroimaging at the University of Pennsylvania to offer this three-year didactic and hands-on training program for four postdoctoral fellows at a time. Expert faculty train fellows and prepare them to help translate scientific advances in the fields of cognition, motor control, and neuroplasticity into validated, clinically useful rehabilitation assessments and treatments.



GROWTH & RECOGNITION

NEW PHYSICIANS

PHYSICAL MEDICINE & REHABILITATION (PM&R), MOSSREHAB

	BACKGROUND	CLINICAL FOCUS AT MOSSREHAB
PHILIP NOTO, DO	Board certified in PM&R and Pain Medicine; Fellow in Pain Medicine, JFK Medical Center; Temple University/ MossRehab Residency Training Program	Musculoskeletal, spine conditions, and pain management
TARIQ RAJNARINE, MD	Board certified in PM&R and eligible in Spinal Cord Injury Medicine; Fellow in Spinal Cord Injury Medicine, Ichan School of Medicine at Mount Sinai; PM&R Chief Resident, New York Medical College	Spinal cord injury medicine, central nervous system disorders, and cancer rehabilitation
MARLYN S. RAMOS LAMBOY, MD	Board certified in PM&R and Spinal Cord Injury Medicine; PM&R Division Chief, Berkshire Medical Center; Fellow in Spinal Cord Injury Rehabilitation, University of Pittsburgh Medical Center at Mercy Hospital; PM&R Chief Resident, New York Medical College	Spinal cord injury medicine, neurorehabilitation, spasticity, adaptive avocational activities, and community reintegration



Philip Noto, DO



Tariq Rajnarine, MD



Marlyn S. Ramos Lamboy, MD



NEW RESEARCHERS

MOSS REHABILITATION RESEARCH INSTITUTE (MRRI)

	TITLE	INTERESTS	RESEARCH FOCUS AT MRRI
SHARON M. ANTONUCCI, PHD	Clinical Director, MossRehab Aphasia Center; Lead Clinician Researcher, MRRI	Aphasia rehabilitation, treatment for impaired lexical retrieval, lexical- semantic processing, and brain-behavior relationships in persons with aphasia	Cognitive neuropsychological language assessment and lesion analysis; Development of treatments for lexical retrieval impairments in persons with aphasia
EDWARD WLOTKO, PHD	Director, Cognitive Neurophysiology and Neuropsychology Laboratory (NEW); Institute Scientist, MRRI	Hemispheric asymmetry in language and cognition, cognitive and neural changes in healthy aging, neuropsychology	Using EEG to discover how the brain uses context to understand language



Sharon M. Antonucci, PhD



Edward Wlotko, PhD

MOSSREHAB INPATIENT &

MOSSREHAB OPERATES 6 INPATIENT UNITS AND 14 OUTPATIENT LOCATIONS

THROUGHOUT THE GREATER PHILADELPHIA REGION AND CONTINUES TO GROW ANNUALLY. EINSTEIN HEALTHCARE NETWORK, PARENT COMPANY OF MOSSREHAB, PLANS TO OPEN ADDITIONAL AMBULATORY CARE CENTERS AND NEW OUTPATIENT MOSSREHAB LOCATIONS.



OUTPATIENT LOCATIONS



AWARDS

MOSSREHAB IS GRATEFUL TO CONTINUE TO EARN LOCAL AND NATIONAL RECOGNITION IN THE FIELD OF PHYSICAL MEDICINE AND REHABILITATION FOR CLINICAL EXCELLENCE, PATIENT CARE, RESEARCH AND EDUCATION.

2016 PROFESSIONAL DISTINCTIONS

Philadelphia Business Journal recognized **Alberto Esquenazi, MD** as a Healthcare Innovator for championing the use of robotic technologies in physical medicine and rehabilitation.

Dr. Esquenazi was inducted into the Sociedad Mexicana de Medicina Física y Rehabilitación as an Honorary Member during the association's 50th anniversary celebration.

Thomas Watanabe, MD received the 2016 Distinguished Clinician Award from the American Academy of Physical Medicine and Rehabilitation, selected for his contributions to advance physiatry through scholarly teaching and outstanding patient care.

Dr. Watanabe serves as clinical director of MossRehab's renowned Drucker Brain Injury Center and its Stroke and Neurological Diseases Center, and serves as senior editor of the *PM&R* journal, a professional education resource for peer-reviewed, clinically relevant, and evidence-based research.

Dr. Watanabe leads several clinical research projects at MossRehab — including a clinical trial to assess the safety and efficacy of using stem cells to enhance motor recovery after stroke and traumatic brain injury (TBI), and a study to test a high-tech upper extremity protocol for patients recovering from stroke — and he co-directs a Traumatic Brain Injury Model System (TBIMS) study to develop a pain measurement tool for patients unable to communicate after TBI, with Glostrup Hospital in Copenhagen and Boston Rehabilitation Outcomes Center.

John Whyte, MD, PhD was inducted into the National Academy of Medicine (NAM), formerly the Institute of Medicine. A high honor driven by peer recognition, NAM membership is reserved for those who demonstrate outstanding commitment to service and make major contributions to the advancement of the medical sciences, healthcare and public health.

Dr. Whyte also received a 2016 Outstanding Service Award from the Association of Academic Physiatrists, the professional association for academic researchers dedicated to improving training, mentorship, exchange, collaboration, and funding for PM&R.

Dr. Whyte serves as director of the Moss Rehabilitation Research Institute and its TBI Rehabilitation Research Laboratory, and co-directs the MossRehab TBI Model System with Tessa Hart, PhD.



TOP 10 IN NATION, "BEST HOSPITALS"

U.S. NEWS & WORLD REPORT

FOR 23 YEARS, MOSSREHAB HAS BEEN HONORED AS A "BEST HOSPITAL" FOR REHABILITATION BY *U.S. NEWS & WORLD REPORT.* 2016 WAS MOSSREHAB'S 7TH CONSECUTIVE YEAR RANKED IN THE TOP 10, MAINTAINING ITS POSITION AS THE TOP-RANKED REHABILITATION PROVIDER IN PENNSYLVANIA. THANK YOU FOR RECOGNIZING OUR COMMITMENT TO REHABILITATION SCIENCE AND RESEARCH, CLINICAL EXCELLENCE, PATIENT CARE, EDUCATION AND ADVOCACY.



TOP WORKPLACES IN GREATER PHILADELPHIA

For the sixth year in a row, MossRehab was recognized by the *Philadelphia Inquirer*, *Daily News*, and Philly.com as one of greater Philadelphia's "Top Workplaces." Honorees were nominated by employees and selected on the basis of survey feedback about management, career opportunity, compensation, benefits and culture.

2016 TOP DOCTORS

Yet again, MossRehab is proud to be well represented in the Castle Connolly Guide and on *Philadelphia* magazine's list of "Top Doctors." Congratulations to these MossRehab physicians recognized by their peers for clinical excellence in physical medicine and rehabilitation.

Alberto Esquenazi, MD



Nathaniel H. Mayer, MD



C.R. Sridhara, MD



Thomas Watanabe, MD

Alberto Esquenazi, MD John Otto Haas Chair and Professor of PM&R and MossRehab Chief Medical Officer

Nathaniel H. Mayer, MD Director, Motor Control Analysis Laboratory

C.R. Sridhara, MD Clinical Director, Electrodiagnostic Laboratory

Thomas Watanabe, MD Clinical Director, Drucker Brain Injury Center; Stroke and Neurological Diseases Center

Honorees were chosen as best in their medical specialties by a regional survey of physicians and by a physician-led review of their backgrounds and professional achievements. This annual distinction is a partnership between Castle Connolly Medical Ltd. and *Philadelphia* magazine. Several MossRehab physicians were also recognized as "Best Doctors in America" and "America's Top Doctors" by Castle Connolly.

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THANK YOU TO ALL MOSSREHAB STAFF — NEARLY 1,000 DEDICATED INDIVIDUALS — WHO GO ABOVE AND BEYOND TO POSITIVELY CHANGE PATIENTS' LIVES ON A DAILY BASIS. SUCH THINGS ARE ONLY POSSIBLE WHEN YOU LOVE WHAT YOU DO, AND WHERE YOU DO IT.

TOM SMITH, OTR/L, MBA HEALTHCARE ADMINISTRATION CHIEF OPERATING OFFICER, MOSSREHAB



PHILANTHROPIC Support

CHALLENGE

STRENGTHENING EDUCATIONAL



COLLABORATING GLOBALLY TO ADVANCE ROBOTICS

An additional contribution to the chair of PM&R position sponsored by the Otto Haas Charitable Trust allows Alberto Esquenazi, MD, chief medical officer of MossRehab, to collaborate nationally and globally to foster education and develop clinical advances in rehabilitation, and new applications for robotic technologies in the diagnosis and treatment of functional disabilities.

CREATING A FORUM FOR RESEARCH AND DISCOURSE

The Shrier family created an endowment to strengthen current internal and external educational activities around rehabilitation research. In part, the endowment allows the Moss Rehabilitation Research Institute (MRRI) to host an annual ten-lecture series for clinicians and researchers on Topics in Rehabilitation Science, which can be attended in person or online. It also enables MRRI scientists to participate in, and present at, top research conferences around the world.

ACCEPTED

AND COMMUNITY OUTREACH

BRINGING SUPERIOR CARE WITHIN REACH

The Kahn family created a scholarship fund to enable persons with aphasia to participate in all MossRehab Aphasia Center programs, regardless of their financial means. Using a social model of rehabilitation, the Aphasia Activity Center helps to solve discharge issues and provides low-cost opportunities for lifelong recovery services beyond the limits of insurance coverage.

Scholarships cover some of the fees for three major programs run by speech-language pathologists aided by trained volunteers. The Constance Sheerr Kittner Conversation Cafés (Connie's Cafés) provide a weekly opportunity to practice conversation skills. Talking Book Clubs meet once a week to work on reading comprehension and discussion. The Computer Lab provides one-on-one guided work with various software programs to focus on specific deficits and individualized treatment.

HEALING LIVES, 150 YEARS AND COUNTING

2016 marked the 150th anniversary of Einstein Healthcare Network, parent network of MossRehab, and the culmination of a highly successful fundraising campaign. The Einstein campaign surpassed its financial goal of \$150 million, yielding \$167.4 million to continue to improve and transform healthcare into the 21st century. Campaign funds will support strategic and transformative growth in three key areas:

- 1 | Improving the patient care experience through investments in building infrastructure and integrated digital healthcare technology.
- 2 | Enhancing clinical excellence through leading-edge research initiatives.
- 3 | Expanding outreach, wellness programming, and education to empower patients to participate in and advocate for their own healthcare.

MOSSREHAB'S MISSION

MOSSREHAB IS COMMITTED TO OFFERING THE HIGHEST LEVEL OF PATIENT SERVICE AND IS DEDICATED TO ADVANCING THE FIELD OF MEDICAL REHABILITATION THROUGH RESEARCH, ADVOCACY AND EDUCATION.











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