

December 2014

# Recoverers

The Newsletter of the Stroke Recovery Research Center | Medical University of South Carolina



Welcome to the neighborhood!

MUSC's College of Health Professions and College of Medicine have collaborated to create a research center committed to improving stroke recovery and positively impacting quality of life for stroke survivors.

## Inside Recoverers

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The Medical University of South Carolina has been awarded \$10,823,406 from the National Institutes of Health (NIH) to support an Institutional Development Award (IDeA) Center of Biomedical Research Excellence (P20GM109040). The IDeA program builds research capacities in states that historically have had low levels of NIH funding by supporting basic, clinical and translational research; faculty development; and infrastructure improvements.





## From the Director

I am thrilled to be writing as the Director of the newly established Stroke Recovery Research Center, MUSC's most recent NIH Center of Biomedical Research Excellence (COBRE). The COBRE program is a cornerstone of the Institutional Development Award (IDeA) program, which builds research capacities in states that historically have had low levels of NIH funding by supporting basic, clinical and translational research; faculty development; and infrastructure improvements (Figure 1). Our research center supports projects from basic science work in animals through clinical trials in recovery from stroke and provides mentored research projects for five junior faculty members (see below). I wish to thank NIH for its investment in our dream and look forward to leading the center as we build a nationally prominent research program in stroke recovery at MUSC. We want to make a difference for the people of South Carolina, who are especially burdened by stroke.

Our organizing concept is that better understanding of the experience-dependent nature of neural plasticity will allow us to investigate and exploit inherent neural recovery processes, develop and translate novel mechanism-based interventional strategies and ultimately improve the function and quality of life of individuals recovering from stroke. This knowledge and its translation into clinically effective interventions will be crucially facilitated by development of a theory-based measurement framework that includes quantitative measures of: 1) normal neurological function, 2) underlying structural and functional damage after stroke, 3) experience-dependent neural plasticity during rehabilitation, 4) structural and functional changes post-rehabilitation, and 5) the functional recovery of each individual patient (Figure 2).

All of our work is facilitated by four full service scientific core resources to support

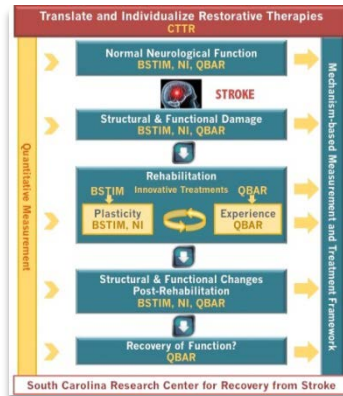
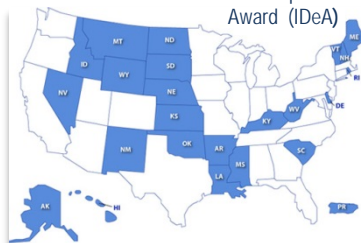


Figure 2

stroke recovery research: Quantitative Behavioral Assessment and Rehabilitation (QBAR) core, provides resources for kinematic, kinetic, EMG and metabolic cost assessments and rehabilitation protocols; Brain Stimulation (BSTIM) core, provides TMS-based neurophysiological assessments and supports rTMS and tDCS protocols for rehabilitation; Neuroimaging (NI) core, provides structural and functional MRI and MR spectroscopy analyses; and Clinical and Translational Tools and Resources (CTTR) core, provides subject recruitment resources, a bioinformatics enabled database registry and biostatistical support.

Currently, outcomes following stroke are suboptimal because of major gaps in foundational understanding of the neural circuitry (substrates and processes) underlying behavior, as well as their repair and reorganization (i.e., neural plasticity). Additionally, clinicians currently have inadequate ways to define and measure behavior and the health status of the neural circuitry underlying that behavior. As shown in Figure 2, our center brings together diverse experts and unique tools to work toward developing a novel comprehensive multidisciplinary theoretical framework with associated quantitative measurements enabled by cutting-edge techniques and equipment.

Figure 1 - Shaded states are eligible for The Institutional Development Award (IDeA)



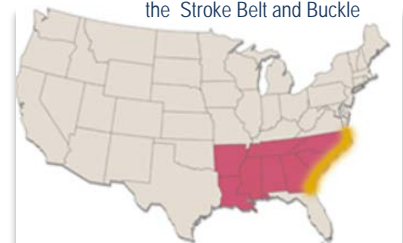
While translation of methods to augment plasticity inspired by basic science knowledge holds exceptional promise for advancing the field, rehabilitation interventions will necessarily play a central role in advancing recovery from stroke. Even if the highest hopes for cell-based therapies (i.e., neural repair by stem cells), pharmaceuticals or other adjuvant methods of enhancing neural plasticity are realized, rehabilitation will be crucial as the behavioral engine to 'teach' the new neural circuitry to perform the necessary functions.

Rehabilitation researchers at most universities do not have easy access to the wide range of tools available in the cores of our center. We have added cutting edge brain stimulation and neuroimaging to quantitative behavioral assessments in the rehabilitation research toolbox. MUSC and our center are relatively unique in this range of capabilities. While we are thrilled with where we are, we plan to keep building and integrate more specialties and acquire more unique measurement and intervention resources.

Our goal in establishing the center was to give smart people the opportunity to work across disciplines with the best resources and collaborators and watch what they are able to do. Our center is an interdisciplinary collaboration between clinicians and basic scientists, between the College of Health Professions and the College of Medicine, to do the best team science and improve recovery from stroke here in the buckle of the stroke belt (Figure 3). We are an inter-professional team of occupational therapists, physical therapists, neurologists, engineers and basic scientists. Starting up the center has been a fun process and great things are already happening. I cannot wait to see what we are able to accomplish as we keep working together.

**Steve Kautz, PhD**  
Director, Stroke Recovery Research Center

Figure 3 - A map of the US highlighting the Stroke Belt and Buckle



The shared goals of the investigators at the Stroke Recovery Research Center are to improve recovery and increase quality of life for stroke survivors. The Center's five Junior Investigators represent the fields of neurology, physical therapy, translational and basic science. Working with senior investigators, they strive to develop unprecedented recovery-based interventions potentially altering the landscape of stroke rehabilitation.

## Meet our Junior Investigators



### Andy Shih, PhD

**Research focus:** Current projects focus on advancing the understanding and treatment of vascular diseases in human subjects including stroke and vascular dementia. This research is expected to impact measurement of brain function and detection of microvascular lesions by non-invasive imaging techniques such as MRI.

**Current COBRE project:** Microvascular Function and Neuroplasticity after Stroke



### Chris Gregory, PhD, PT

**Research focus:** Research examines the physiological and biomechanical determinants of walking performance in persons following central nervous system injury (SCI or stroke). A significant aspect of this research program is the overall goal of improving the design and delivery of therapeutic interventions aimed at improving functional ability and quality of life in persons following neurological injury.

**Current COBRE project:** Treating Depression and Enhancing Locomotor Recovery Post-Stroke



### Colleen Hanlon, PhD

**Research focus:** The overarching theme of Dr. Hanlon's research interest includes imaging and harnessing the neuroplastic properties of the brain that lead to reorganization of function and response to injury.

**Current COBRE project:** Investigating the Neurobiologic Basis for Loss of Cortical Laterality in Chronic Stroke Patients



### Mark Bowden, PhD, PT

**Research focus:** Current projects focus on developing patient-specific neurorehabilitation measurement, treatments, and outcomes in order to influence clinical decision-making and individualization of treatments to improve the rehabilitation of walking after neurological injury.

**Current COBRE project:** Excitatory and Inhibitory rTMS as Mechanistic Contributors to Walking Recovery



### Wuwei (Wayne) Feng, MD

**Research focus:** Dr. Feng's research focuses on developing imaging biomarker for post-stroke motor outcomes and enhancement of motor recovery using noninvasive brain stimulation techniques, including the individualization of transcranial direct current stimulation (tDCS) therapy on stroke patients and the development of a novel tDCS delivery system.

**Current COBRE project:** Optimizing Transcranial Direct Current Stimulation Current and Electrode Montage for Stroke Patients

## Rehabilitation Research Open House

Through the promise of greater investigation and the potential for new and innovative approaches impacting rehabilitation and recovery, research offers hope for many who have had a stroke or neurological injury. MUSC recognizes the importance of biomedical research as evidenced in their continued support and promotion of the Center for Rehabilitation Research in Neurological Conditions (CRRNC). On Thursday, November 6th the College of Health Professions hosted an Open House at the Center to celebrate recent accomplishments and demonstrate an increased focus and investment in advancing research capabilities within the College of Health Professions.

The event celebrated the first endowed chair in the history of the College of Health Professions, the Christie Family Endowed Chair in Stroke Rehabilitation Research, which was established through a \$1,000,000.00 gift in 2013 by Mr. and Mrs. Stuart Christie on behalf of their family. Originally from NJ and now residing at Bishop Gadsden, the Christies have been long-time friends of the University. Mr. Christie is a retired executive from Johnson and Johnson and their oldest daughter, Barbara Christie, serves on the College of Health Professions newly formed Advancement Council.

Additionally, the evening was a celebration of the Stroke Recovery Research Center (SRRRC), established through a \$10.8 million COBRE/NIH grant awarded in June of 2014 and having the distinction of being the largest Institutional Development Award (IDeA) MUSC has received to date.

The event showcased the research facilities and investigators of the Quantitative and Behavioral Assessment and Rehabilitation core of the Stroke Recovery Research Center and featured remarks by MUSC representatives, including Dr. David Cole, President, Dr. Mark Sothmann, Vice President for Academic Affairs and Provost, Dr. Lisa K. Saladin, Dean, College of Health Professions, Dr. Jim Krause, Director, CRRNC, Dr. Steve Kautz, Associate Director, CRRNC, Director, SRRRC, and Dr. Robert Adams, Associate Director, SRRRC. Each spoke to MUSC's recent accomplishments in research and the great promise of the new COBRE focused on stroke recovery research.



The Stroke Recovery Research Center's Director, Dr. Steve Kautz, and Co-Director, Dr. Robert Adams, at the CRRNC Open House.

"(I) look forward to working with the entire team here to make new things, good things, happen for people who have survived stroke"

Dr. Robert Adams



MUSC leadership including (left to right), Dr. Cole, President, Dr. Sothmann, Vice President for Academic Affairs and Provost, Dr. Saladin, Dean, College of Health Professions, and Dr. Krause, Director, CRRNC, provided remarks at the event.





The audience awaiting the remarks by MUSC leadership at the Rehabilitation Research Open House November 6, 2014.



COBRE Pilot Project Investigator Jesse Dean answered questions in the Locomotor Energetics and Assessment Lab.



Junior Investigator Mark Bowden explains the research conducted in the Neuro-Stimulation Lab.



Biostatistics leader Viswanathan Ramakrishnan (far right) observes a demonstration in the Upper Extremity Motor Assessment Lab.

## Visiting Professor



Dr. Marom Bikson Associate Professor of Biomedical Engineering the City College of the City University of New York

Dr. Marom Bikson is a consultant for the Brain Stimulation Core (BSTIM) who will make yearly visits to Charleston. Dr. Bikson is an Associate Professor in the Department of Biomedical Engineering at The City College of New York of CUNY and also in Programs in Biology and Engineering at The Graduate Center CUNY. In addition, he is co-director of Neural Engineering at The City College of New York and the New York Center for Biomedical Engineering. Through an array of research and engineering design tools including cellular and animal studies, computer simulations, imaging, and clinical evaluation, Dr. Bikson's research group studies the effects of electricity on the human body and applies this knowledge toward the development of medical devices and electrical safety guidelines. Dr. Bikson's consulting role helps build and create direct computational models of the brain regions being stimulated with either TMS or tDCS, and guides their application in studies with stroke patients.

Through the BSTIM Core, he will be available for consultation in these areas, including travel to MUSC for seminars and data analysis discussions. During a recent visit to MUSC Friday, December 12<sup>th</sup>, Dr. Bikson spoke at the Stroke Recovery Research Center, followed by a review session for the Center's Junior Investigator projects.

## Active Grants in Stroke Recovery Research

Faculty/PI Name	Title	Sponsor	Project Dates	Funding
Bowden, Mark	Augmentation of Locomotor Adaptation Post-Stroke	VA/RRD	7/1/13-6/30/18	\$907,000
Dean, Jesse	Post-Stroke Contributors to Increased Energetic Cost and Decreased Gait Stability	VA/RRD	October 2012 – September 2016	\$ 639,100
Feng, Wayne	Prediction and Imaging Biomarker for Post-Stroke Motor Recovery	American Heart Association	January 2014-December 2017	\$308,000
Feng, Wayne	ASPIRE: Adult SPasticity International Registry on BOTOX® Treatment	Allergan, Inc.	September 2014-October 2017	\$87,000
Gregory, Chris	Functional Electrical Stimulation Assisted Cycling after Stroke	NIH-DE-CTR	9/16/2013-5/31/15	\$86,650
Gregory, Chris	Skeletal Muscle Plasticity as an Indicator of Functional Performance Post-Stroke	VA/RRD	10/1/13-9/30/17	\$1,100,000
Jensen/Adkins (MPI)	Prediction of Motor Outcome after Acute Stroke using Diffusional Kurtosis	NIH/NINDS	2/15/14-1/31/16	\$275,000
Kautz, Steve	Do Spinal and Cortical tDCS Suggest Distinct and Synergistic Neuromechanical Mechanisms for Post-Stroke Walking Recovery	Veterans Administration	January 2012 – December 2014	\$150,000
Tomlinson, Stephen	Novel Therapies to Improve Functional Recovery after Stroke	VA/RRD	3/21/14-3/31/18	\$876,544
Woodbury, Michelle	Patient-Targeted Upper Extremity Rehabilitation after Stroke	VA/RRD	4/1/13-3/31/17	\$1,100,00
Woodbury, Michelle	Virtual Environment for Stroke Rehabilitation	NIH-DE-CTR	12/1/13-11/30/14	\$86,000

## Newly Active Grants in Stroke Recovery Research

Faculty/PI Name	Title	Sponsor	Project Dates	Funding
Bonilha, Leonardo	Brain Connectivity Supporting Language Recovery in Aphasia	NIH/NINDS	7/01/2014 - 7/01/2019	\$1,751,940
Gregory, Chris	Rural Veterans Telerehabilitation Initiative: RVTRI Stroke	Veterans Administration	10/1/14-9/30/15	\$275,050
Feng, Wayne/ Woodbury, Michelle	The Halo-MUSC Motor Stroke Rehabilitation Clinical Trial	Halo Neurosciences	Projected 2/1/15-1/30/16	\$286,770
Finetto, Christian	Biomechanical Assessment of the Relationship between Postural Control and Fine Motor Skills in People with Stroke	MUSC Inter-Professional	Projected 1/1/15-12/31/15	\$20,000
Kautz, Steve	Research Career Scientist	Veterans Administration	October 2014 – September 2019	\$530,000
Shih, Andy	In Vivo Optogenetic Control of Vascular Contractile Cells	AHA	7/01/14-6/30/16	\$140,000
Woodbury, Michelle	Virtual Environment for Stroke Rehabilitation	NIH-DE-CTR	11/30/14-5/30/15	\$50,000

## Pilot Project Program

The **Stroke Recovery Research Center** is proud to introduce its first year's Pilot Project Investigators. We put out a call for proposals in July. We received 13 proposals on a wide range of topics from investigators representing 11 different departments, and were able to fund 5 out of the 13 excellent applications. We are excited to support these projects and grow stroke recovery research at MUSC.

PI	Department	Name	Grant Category
Alexander Awgulewitsch	Rheumatology	Exploring potential roles of Hox genes in stroke recovery	Discovery
Jesse Dean	Physical Therapy	Application of ultrasound technology to enhance the quantitative measurement of post-stroke behavior and function	Novel Methods
Xingbao Li	Psychiatry	Paired associative stimulation modulates motor excitability and plasticity in chronic stroke patients	Mentored Investigator (Early Career)
Donna Roberts	Radiology	fMRI BOLD signal as a Biomarker for Optimal Dosing of rTMS of Rehabilitation in Chronic Stroke Patients	Mentored Investigator (Early Career)
Stephen Tomlinson	Microbiology & Immunology	Complement-dependent inflammation and experience-dependent neural plasticity after stroke	Discovery

## Fall 2014 Grant Applications in Stroke Recovery Research

Faculty/PI Name	Title	Sponsor	Project Dates	Funding
Falangola, Maria de Fatima/Adkins, DeAnna (MPI)	The Effect of Midazolam in Acute Stroke Morphology, Behavioral Recovery and Diffusional Kurtosis Imaging Outcomes	NIH/NINDS	2/01/2015-1/30/2017	\$275,000
Grattan, Emily (Mentors Michelle Woodbury, Steve Kautz)	Examining Measurement of Behavioral Neglect Post Stroke	VA Rehabilitation Research, Career Development-1	June 2015-June 2017	\$154,600
Kautz, Steve	Relationship between Impaired Post-Stroke Coordination and Dynamic Balance and Mobility	VA Rehabilitation Research Merit Award	July 2015-July 2019	\$1,100,000
Ross, Ryan/Gregory, Chris	Effects of Depression and Aerobic Exercise on Locomotor Recovery in Stroke Survivors	NIH _ F31 Pre-Doctoral Fellowship	July 2015-June 2017	\$50,000
Tomlinson, Stephen/Adkins, DeAnna (MPI)	Interplay between Complement and Rehabilitation Mediated Mechanisms of Recovery after Stroke	NIH/NINDS	2/01/2015-1/30/2017	\$275,000





Do you have news to submit for the next issue, or are you interested in becoming a Recovers reporter?

Please contact:  
Danielle Hutchison  
hutchiso@musc.edu

Check out the new Stroke Recovery Research Center website:

[www.musc.edu/srrc](http://www.musc.edu/srrc)

## February is Heart Health Month



Manage your risk of cardiovascular disease (CVD)—including heart disease, stroke, and high blood pressure—through diet, regular physical activity, weight management, stress management, and smoking cessation.

For more information: <http://www.cdc.gov/Features/HeartMonth/>



Website:  
[www.musc.edu/srrc](http://www.musc.edu/srrc)

Phone:  
843.792.4608

Fax:  
843.792.1358



Stroke Recovery Research Center  
77 President Street, Building C  
MSC 700  
Charleston, SC 29425

## Upcoming Events

January 7-8, 2015  
COBRE Annual Meeting

January 23, 2015  
Visiting Professor, Dr. Pam Duncan

February 12, 2015  
Executive Committee Meeting

March 12, 2015  
Executive Committee Meeting

April 9, 2015  
Executive Committee Meeting

April 13, 2015  
Frontiers of Neuroscience Meeting

April 14, 2015  
Visiting Professor, Dr. Tom Carmichael

April 20, 2014  
Neural Mechanisms of Rehabilitation  
Satellite Meeting

April 21-24, 2015  
Neural Control of Movement Meeting