

# Recovers

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



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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

## From the Director



We can all be very proud of the progress of the past year, as I am happy to report we made significant gains toward our mission in the Stroke Recovery Research Center's opening year. In our second year, we continue to build momentum to promote the overall goal of building on MUSC's existing research infrastructure to increase multidisciplinary collaborative research focused on stroke recovery. We look forward to continued growth and the positive impact of new collaborations, most recently through the June 1<sup>st</sup> release of the Request For Applications for our Pilot Project Program and new clinical trials in telerehabilitation (NIH funded) and in transcranial direct current stimulation for recovery of upper extremity function (industry funded by Halo Neurosciences).

Our aim of mentoring junior scientists has driven the development of a number of mentoring processes and opportunities to advance the careers of our Junior Investigators. In addition to COBRE sponsored journal clubs, core seminars, and the monthly Executive Committee/Junior Investigator meetings, over the past few months Charleston played host to the Frontiers of Neuroscience Meeting, Neural Mechanisms of Rehabilitation Satellite Meeting, and Neural Control of Movement Conference. Each provided opportunities to learn from experts in the field, present on research gains and explore new collaborations. Additionally, we have been privileged to host a number of visiting scholars, including Dr. Laurel Buxbaum, Dr. Jon Wolpaw, Dr. Tom Carmichael and Dr. Flavio Frolich.

At the beginning of our second year, our four scientific cores are fully staffed, equipped and meeting the needs of our current research. Thus, we are shifting our focus to prepare for projected growth. We are developing ways to track core usage and best address the maintenance needs for equipment experiencing increased use so that we will be able to better manage our resources for the continued support of COBRE research. Likewise, the CTRR core's Registry for Stroke Recovery, RESTORE, began enrolling participants in March, and is building momentum in establishing a pool of interested study participants to support the Center's recruitment and retention needs.

I am grateful for the successes of our first year, and look forward to the outcomes of the new collaborations being forged as they enhance our impact in stroke recovery research.

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

# The Impact of StrokeNet

## StrokeNet

The National Institutes of Health created the NIH StrokeNet to conduct small and large clinical trials and research studies to advance acute stroke treatment, stroke prevention, and recovery and rehabilitation following a stroke. In 2013, MUSC was selected as 1 of 25 regional centers across the U.S. to participate in this network. MUSC's South Carolina Collaborative Alliance for Stroke Trials (SC-CoAST), in conjunction with the University of South Carolina's Department of Neurology and Greenville Health System's Neurological Institute, serves urban and rural/underserved communities throughout South Carolina. The network is designed to provide an infrastructure and pipeline for exciting new potential treatments for patients with stroke and those at risk for stroke. For more information on research within the StrokeNet including funding announcements please visit: <http://nihstrokenet.org/research>.



## TeleRehab

One of the first projects funded as part of the NIH StrokeNet is the *Telerehabilitation in the Home versus Therapy In-Clinic for Patients with Stroke* (TeleRehab) led by Dr. Steven Cramer at the University of California, Irvine. The study will test the effectiveness of a home-based telehealth system designed to improve motor recovery and patient education after stroke. Due MUSC's strengths in stroke recovery research and the rurality of South Carolina, the Stroke Recovery Research Center at MUSC was asked to participate in the study with Michelle Woodbury, PhD, as local Principal Investigator.



A minimum of 20 subjects at MUSC with arm motor deficits 4-20 weeks after an ischemic stroke will be randomized to receive 6 weeks of intensive arm motor therapy (a) in a traditional in-clinic setting or (b) via in-home telerehabilitation (rehabilitation services delivered to the subject's home via an internet-connected computer). Telehealth has enormous potential to address unmet needs in the growing population of stroke survivors.



In the coming years the Stroke Recovery Research Center targets playing an increased role in StrokeNet, contributing to the successful outcomes of a number of clinical trials in stroke recovery and establishing MUSC as a leader in stroke recovery research.



# Guest Scholars

## Dr. Flavio Frohlich



Dr. Flavio Frohlich is an Assistant Professor of Psychiatry, Cell Biology & Physiology, and Biomedical Engineering at the University of North Carolina, School of Medicine. His laboratory studies cortical state dynamics and develops non-invasive brain stimulation approaches to treat neuropsychiatric illnesses such as schizophrenia, autism, and depression that are caused by pathological network dynamics. Dr. Frohlich employs a multidisciplinary approach that combines large-scale computer simulations of cortical networks, in vitro multi electrode and patch-clamp electrophysiology, parallel extracellular electrophysiology in awake and anesthetized ferrets, and electroencephalography combined with transcranial current stimulation in humans. The integration of these methods allow for the discovery of the fundamental guiding principles of cortical network dynamics and the development of targeted, individualized brain-stimulation based on control engineering for the treatment of psychiatric patient populations for which there exists little help from currently approved medications.

Following a talk by Dr. Frohlich on June 11, 2015, he was joined by COBRE Executive Committee members and Junior Investigators for a Roundtable discussing his research program and his general input on different brain stimulation paradigms. He also met individually with some of the investigators and was given tours of the COBRE's cores.

## Dr. Tom Carmichael



Dr. Tom Carmichael served as the keynote speaker for the **Frontiers of Neuroscience Meeting** held here in Charleston April 13, 2015. Dr. Carmichael is a neurologist and neuroscientist at the Geffen School of Medicine at UCLA, and professor and Vice Chair for Research and Programs in the Department of Neurology, with active laboratory and clinical interests in stroke and neurorehabilitation. Dr. Carmichael's laboratory studies the molecular and cellular mechanisms of neural repair after stroke and other forms of brain injury, focusing on the processes of axonal sprouting and neural stem cell responses after stroke, and on neural stem cell transplantation.

COBRE team members were provided the opportunity on April 14<sup>th</sup> to meet with Dr. Carmichael and discuss relevant research, including a Roundtable with Junior Investigators and Executive Committee members, a lunch with students, postdocs and trainees doing stroke basic research, and a tour of SRRC's labs.

## Dr. Laurel Buxbaum



Laurel Buxbaum, PsyD, visited MUSC on March 26, 2015. Dr. Buxbaum is an Institute Scientist and Director of the Right Hemisphere Stroke Center at Moss Rehabilitation Research Institute. She is also a Research Associate Professor of Rehabilitation Medicine at Thomas Jefferson University. During her visit, Dr. Buxbaum met with the COBRE Mentorship Team and Junior Investigators. Over lunch, the group discussed issues related to cognitive rehabilitation and protocols for categorizing imaging data regarding lesion location for a database.

Dr. Buxbaum also met individually with several faculty members and post-doctoral scholars to discuss future projects and collaborations. Doctoral students had the opportunity to meet with Dr. Buxbaum to learn about rehabilitation research conducted in a non-academic research setting and to seek advice from a Senior Scientist. Dr. Buxbaum then presented her work to a multi-disciplinary group of faculty, students, and local clinicians. Her presentation, "Right Hemisphere Stroke," provided an overview of impairments associated with right hemisphere stroke (RHS), emphasizing the poor outcomes associated with lesions to the right hemisphere of the brain. Dr. Buxbaum discussed assessment methods for individuals with RHS and evidence based interventions to address impairments. Dr. Buxbaum then described the unique and innovative Right Hemisphere Stroke Center at Moss Rehabilitation Research Institute which specializes in assessing and treating individuals with RHS. The Center serves as a model for how researchers and clinicians can work together as a team to incorporate the latest research findings into clinical practice.

## Dr. Jon Wolpaw



On April 17, 2015, Dr. Jonathan Wolpaw spent time at the Stroke Recovery Research Center (SRRC) providing a mentorship opportunity for COBRE investigators. Through his roles as a Research Physician, Wadsworth Center, Neural Injury and Repair, Professor, School of Public Health, Biomedical Sciences, and Director of the National Center for Adaptive Neurotechnologies, for over 30 years Dr. Wolpaw has been dedicated to spinal cord plasticity and BCI research and development. In each area, his work began by illuminating

fundamental principles and went on to clinical applications that improve the quality of life in people with neurological disorders Dr. Wolpaw has been and continues to be an internationally recognized leader in two distinctive fields of neuroscience. His current and future work is focused on combining these two highly promising research areas and on broadening their scope under the umbrella of adaptive neurotechnologies. This broadened approach aims to produce new technologies that interact with specific CNS pathways for beneficial purposes.

Included in the schedule April 17<sup>th</sup> was a talk by Dr. Wolpaw, a tour of the labs of the QBAR Core, time spend with COBRE faculty and staff, and a roundtable with COBRE Junior Investigators and leadership. We thank Dr. Wolpaw for his visit and the opportunity to learn from his knowledge and expertise.

# A Punch for Recovery

One of the features of the Quantitative and Behavioral Assessment and Rehabilitation (QBAR) Core of the Stroke Recovery Research Center is a one of a kind Virtual Environment, an interactive computer game called Duck Duck Punch. The system was recently featured on MUSC's News Center and ETVRadio, both highlighting the potential in utilizing this virtual environment to retrain post-stroke arm movement.

The design and development for Duck Duck Punch began here at MUSC with Dr. Michelle Woodbury's desire to positively impact therapeutic outcomes for stroke survivors through video game play. In collaboration with Clemson's Dr. Larry Hodges and his student, Austen Hayes, they combined their expertise in stroke rehabilitation and computer science to create a game which has been shown to improve the number of exercise repetitions by stroke patients up to five times. Dr. Hodges and Austen co-founded RecoVR, a platform to develop and market numerous occupational and physical therapy games, and were recently named a Concepts to Companies' portfolio company. Check out the following links to learn more:



[www.musc.edu/pr/newscenter/2015/duck-duck-punch.html](http://www.musc.edu/pr/newscenter/2015/duck-duck-punch.html)



<http://etvradio.org/post/stroke-victims-punch-their-way-back>

**Concepts to  
Companies**

<http://www.greenvillebusinessmag.com/View-Article/ArticleID/8130/Concepts-to-Companies-Launch.aspx#sthash.YfZaUEP3.dpuf>

## Professional Milestones

**Dr. Mark Bowden** was selected as an Elite Reviewer for the *Archives of Physical Medicine and Rehabilitation*, the official journal of the American Congress of Rehabilitation Medicine (ACRM). This designation reflects the number, timeliness, and critical thinking provided in the process of peer review. Approximately one percent of reviewers were judged to be deserving of this recognition. Congratulations Dr. Bowden!

**Dr. Robert Adams** will serve as the Director of the newly funded Strategically Focused Disparities in Cardiovascular Disease Research Network. This represents the third Strategically Focused Research Network funded by AHA, and brings together MUSC, Morehouse School of Medicine, Northwestern University, and the University of Colorado. Congratulations Dr. Adams!

# Publication Highlight

One of the goals of the COBRE is provide an infrastructure for better translational research by bringing together basic scientists and clinicians. The following publication represents a nice translational collaboration between a basic science researcher and human clinical science researchers.

## Motor Cortex and Motor Cortical Interhemispheric Communication in Walking After Stroke: The Roles of Transcranial Magnetic Stimulation and Animal Models in Our Current and Future Understanding

**Charalambos C. Charalambous, MS<sup>1</sup>, Mark G. Bowden, PhD<sup>1,2</sup>, and DeAnna L. Adkins, PhD<sup>1,3</sup>**

### Abstract

Despite the plethora of human neurophysiological research, the bilateral involvement of the leg motor cortical areas and their interhemispheric interaction during both normal and impaired human walking is poorly understood. Using transcranial magnetic stimulation (TMS), we have expanded our understanding of the role upper-extremity motor cortical areas play in normal movements and how stroke alters this role, and probed the efficacy of interventions to improve post-stroke arm function. However, similar investigations of the legs have lagged behind, in part, due to the anatomical difficulty in using TMS to stimulate the leg motor cortical areas. Additionally, leg movements are predominately bilaterally controlled and require interlimb coordination that may involve both hemispheres. The sensitive, but invasive, tools used in animal models of locomotion hold great potential for increasing our understanding of the bihemispheric motor cortical control of walking. In this review, we discuss 3 themes associated with the bihemispheric motor cortical control of walking after stroke: (a) what is known about the role of the bihemispheric motor cortical control in healthy and poststroke leg movements, (b) how the neural remodeling of the contralesional hemisphere can affect walking recovery after a stroke, and (c) what is the effect of behavioral rehabilitation training of walking on the neural remodeling of the motor cortical areas bilaterally. For each theme, we discuss how rodent models can enhance the present knowledge on human walking by testing hypotheses that cannot be investigated in humans, and how these findings can then be back-translated into the neurorehabilitation of poststroke walking.

### Keywords

walking, interhemispheric motor cortical communication, stroke, rehabilitation, rodent models, translational science

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# Welcome to the Team!

## Na Jin Seo, Assistant Professor



The OT Division, Department of Health Professions and Department of Health Sciences and Research recently hired Dr. Na Jin Seo as an Assistant Professor. Dr. Seo is coming from the Department of Industrial & Manufacturing Engineering, Department of Electrical Engineering and Computer Science, and Department of Occupational Science and Technology at the University of Wisconsin-Milwaukee. She received a Ph.D. from the University of Michigan-Ann Arbor in biomechanics and ergonomics, and completed postdoctoral training at the Rehabilitation Institute of Chicago affiliated with the Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine, Northwestern University, in the area of neuromechanics and neurorehabilitation for patients with stroke.

Dr. Seo is an accomplished researcher with a focus on developing advanced therapeutic and assistive devices via biomechanical modeling and neurophysiologic investigation. She received a COBRE Pilot Project award for “Sensory Stimulation to Enhance Hand Function Post Stroke”. This project will allow her to collect necessary proof of concept data for an NIH R01 application. Specifically, she will assess the impact of subthreshold vibrotactile stimulation applied to the wrist during the course of a therapy on hand function in chronic stroke survivors. We welcome her to our growing team of COBRE investigators and look forward to her contributions in stroke recovery research.

## Aphasia Awareness

June was **National Aphasia Awareness Month**, the platform for a national campaign to increase public education around the language disorder and to recognize the numerous people who are living with or caring for people with aphasia. When communicating with an individual with aphasia:



- Always assume they can hear. Check understanding with yes/no questions.
- Use sentences that are short and to the point.
- Keep the noise level down and stand where the individual can see you.
- Remember to treat the individual as an adult and let him or her share in decision-making.
- Be patient with the person with aphasia. Give them the time they need to try to speak and get their point across to you.

Visit <http://www.strokeassociation.org> & <http://www.aphasia.org/> for Aphasia Resources, or to continue the campaign for greater public awareness and understanding of aphasia





## COBRE Funded Grants

Investigator	Title
<b>Awgulewitsch, Alexander</b>	Exploring Potential Roles of Hox Genes in Stroke Recovery
<b>Bowden, Mark</b>	Excitatory and Inhibitory rTMS as Mechanistic Contributors to Walking Recovery
<b>Dean, Jesse</b>	Application of Ultrasound Technology to Enhance the Quantitative Measurement of Post-stroke Behavior and Function
<b>Feng, Wayne</b>	Optimizing Transcranial Direct Current Stimulation Current and Electrode Montage for Stroke Patients
<b>Gregory, Chris</b>	Treating Depression and Enhancing Locomotor Recovery Post-Stroke
<b>Hanlon, Colleen</b>	Investigating the Neurobiologic Basis for Loss of Cortical Laterality in Chronic Stroke Patients
<b>Li, Xingbao</b>	Paired Associative Stimulation Modulates Motor Excitability and Plasticity in Chronic Stroke Patients
<b>Roberts, Donna</b>	fMRI BOLD Signal as a Biomarker for Optimal Dosing of rTMS of Rehabilitation in Chronic Stroke Patients
<b>Seo, Na Jin</b>	Sensory Stimulation to Enhance Hand Function Post Stroke
<b>Shih, Andy</b>	Microvascular Function and Neuroplasticity after Stroke
<b>Tomlinson, Stephen</b>	Complement-dependent Inflammation and Experience-dependent Neural Plasticity after Stroke

## COBRE Affiliated - New Grant Applications

Faculty/PI Name	Title	Funding Agency
<b>Adkins, DeAnna</b>	Enhance Mitochondrial Function to Increase Effectiveness of Post-stroke Rehabilitation	VA Rehab
<b>Dean, Jesse</b>	Improving Post-stroke Function through Restoration of a Control Strategy for Gait	VA Rehab
<b>Gregory, Chris</b>	Optimizing Exercise Prescription in Young Stroke Survivors to Improve Walking	VA Rehab
<b>Kautz, Steve</b>	Relationship between Impaired Post-stroke Coordination and Dynamic Balance and Mobility	VA Rehab
<b>Kautz, Steve</b>	National Center of Neuromodulation for Rehabilitation (NC NM4R)	NIH/NICHD and NINDS

## COBRE Affiliated - New Awards

Faculty/PI Name	Title	Funding Agency	Project Dates	Funding
<b>Adams, Robert</b>	Strategically Focused Disparities in Cardiovascular Disease Research Network	American Heart Association	6/1/15-5/31/19	\$3.7 million
<b>Charalambous, Bobby</b>	The Associations between the Motor Cortical Control and the Task-Specific Biomechanics of the Paretic Soleus after a Stroke	American Association of Biomechanics	5/1/15-4/30/16	\$2,000
<b>Seo, Na Jin</b>	Altering Activation Patterns in the Distal Upper Extremity after Stroke (Subaward; Yr 1)	Rehabilitation Institute of Chicago/NIH	2/9/15-5/31/15	\$49,939

## COBRE Affiliated - Active Grants

Faculty/PI Name	Title	Funding Agency	Project Dates	Funding
<b>Bonilha, Leo</b>	Trans-Cranial Direct Current Stimulation to Treat Aphasia: Phase II Trial	NIH/NIDCD	4/17/12-4/1/17	\$904,029
<b>Bowden, Mark</b>	Augmentation of Locomotor Adaptation Post-Stroke	VA/RRD	7/1/13-6/30/18	\$907,000
<b>Dean, Jesse</b>	Post-Stroke Contributors to Increased Energetic Cost and Decreased Gait Stability	VA/RRD	October 2012 – September 2016	\$ 639,100
<b>Feng, Wayne/ Woodbury, Michelle</b>	The Halo-MUSC Motor Stroke Rehabilitation Clinical Trial	Halo Neurosciences	2/1/15-1/30/16	\$286,770
<b>Finetto, Christian</b>	Biomechanical Assessment of the Relationship between Postural Control and Fine Motor Skills in People with Stroke	MUSC Inter-Professional	1/1/15-12/31/15	\$20,000
<b>Gregory, Chris</b>	Rural Veterans Telerehabilitation Initiative: RVTRI Stroke	Veterans Administration	10/1/14-9/30/15	\$275,050
<b>Gregory, Chris</b>	Skeletal Muscle Plasticity as an Indicator of Functional Performance Post-Stroke	VA/RRD	10/1/13-9/30/17	\$1,100,000
<b>Kautz, Steve</b>	Research Career Scientist	Veterans Administration	October 2014 – September 2019	\$530,000
<b>Woodbury, Michelle</b>	Patient-Targeted Upper Extremity	VA/RRD	4/1/13-3/31/17	\$1,100,00

## Year 2 Pilot Projects

On June 1<sup>st</sup> the Stroke Recovery Research Center released the Request for Applications (RFA) for its Pilot Project Program. Eligible investigators are invited to submit proposals in the field of stroke recovery research, which will promote utilization of the scientific cores, develop new collaborations and mentoring relationships, and stimulate new programmatic activities to build long-term sustainability of programmatic stroke recovery research at MUSC.

For detailed information please visit:

<http://academicdepartments.musc.edu/srrc>

or the SCTR Pilot Project Program Web page:

[http://academicdepartments.musc.edu/sctr/programs/pilot\\_projects](http://academicdepartments.musc.edu/sctr/programs/pilot_projects).



## Upcoming Events

**July 9, 2015**

**Executive Committee Meeting**

**July 14, 2015**

**COBRE Journal Club**

**July 15, 2015**

**Pilot Project Program  
Application Due Date**

**August 13, 2015**

**Executive Committee Meeting**

**September 8, 2015**

**External Advisory Board Meeting**

**September 10, 2015**

**Executive Committee Meeting**

## National Rehabilitation Awareness Week September 20-26, 2015

During the third week in September, we are provided the opportunity to applaud the efforts of rehab professionals and focus the nation's attention on the possibilities and powers of rehabilitation. Everyday, we witness the positive impact of rehabilitation on long-term outcomes for individuals post stroke. SRRRC remains committed to identifying the best and most individualized treatment approaches to assist clinicians in having the greatest impact on quality of life.

**STROKE SYMPTOMS**  
[www.stroke.org](http://www.stroke.org)

<b>SUDDEN</b> numbness or weakness of face, arm or leg, especially on one side of the body	<b>SUDDEN</b> confusion, trouble speaking or understanding	<b>SUDDEN</b> trouble seeing in one or both eyes	<b>SUDDEN</b> trouble walking, dizziness, loss of balance or coordination	<b>SUDDEN</b> severe headache with no known cause

**Act FAST and CALL 9-1-1 IMMEDIATELY**



## Word Scramble

rsoket

rkis

irgeaevcr

apetttrshi

crreevyo

Visit <http://www.strokesmart.org/brain-food-52915> for more Brain Food Puzzles

Visit [www.SCresearch.org](http://www.SCresearch.org) or call (843)792-1589 to learn more about current stroke recovery studies



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