

# STROKE RECOVERY RESEARCH CENTER

A Center of Biomedical Research Excellence (COBRE) in Stroke Recovery at the Medical University of South Carolina

## CHANGING THE FACE OF RESEARCH



### COBRE STRATEGIC MEETING

COBRE news and updates discussed at the Strategic Meeting in October of 2019. What does COBRE's future look like?

*More on Page 3*

### COBRE PI PUBLICATIONS

COBRE's Principal Investigators are always working hard, whether it's within the SRRC or not. See some of their newer 2019 publications.

*More on page 7-9*

### RESTORE UPDATES

Find out new and exciting RESTORE updates.

*More on Page 10*

## FROM THE DIRECTOR

*Reprinted below are the Director's comments from COBRE PHASE II CEREMONY in June, 2019*

Good afternoon. It is so nice to be with you today and see so many familiar faces – those who have helped the COBRE get to where we are today. This includes all of those wearing the blue Stroke Recovery Research Center shirts, who include our scientists and our amazing research staff.

Our mission is to enable translational research into neural recovery from stroke in order to provide clinicians with optimal tools for diagnosing and treating individuals, because we want to improve the recovery and long-term quality of life of those who have survived a stroke. We serve two distinct groups, both of who have helped tremendously with the success of COBRE.

First and foremost, we exist to serve those who have survived a stroke and for whom our science can have real impact. As you know, stroke is one of the most debilitating conditions in the United States with limited treatment options – and South Carolina is in the buckle of the Stroke Belt. One-in-fifty of the 7 million stroke survivors across the country live in South Carolina. Each year, stroke-related expenses total more than \$1 billion per year in South Carolina.

Second, we also serve the scientists at MUSC and especially the more junior researchers who will be the future leaders in this field. We were charged to build a world class research center here at MUSC – and that only happens by providing the infrastructure to allow MUSC researchers to grow and flourish – Phase I has been extraordinary, and Phase II will build upon this foundation.

I'm very glad to have Dr. Robert Adams as my Associate Program Director. Dr. Adams is the SmartState Endowed Chair in Stroke in the College of Medicine. I am also extremely grateful to have Drs. Mark George and Truman Brown as our other core leaders. I also would like to thank our institutional leaders for their support and commitment – Drs. Cole, Saladin, Kapasi, Brady and Mark Sothmann.

Phase I of the grant has been incredibly successful. The number of stroke recovery researchers increased from 9 pre-COBRE award to 27 during Phase I. These investigators have successfully competed for more than \$43 Million in grant awards. All 5 COBRE-supported junior faculty have launched successful independent research careers with more than \$17 Million in grant awards from NIH and the US Department of Veterans Affairs. Over 1,000 participants have consented to take part in research studies, with 120+ publications generated from research activities.

Recognition of the center's extraordinary achievements and unique environment was demonstrated by award of a rehabilitation research infrastructure center grant from the NIH, one of only six in the nation – the National Center of Neuromodulation for Rehabilitation (NM4R). The NM4R makes training and resources developed in the COBRE available nationwide and puts COBRE researchers in the forefront of the field of neuromodulation. In April 2019, MUSC and the College of Health Professions hosted an international conference dedicated to neuromodulation; and earlier this month, our research center was visited by the US Secretary of Veterans Affairs.

Most importantly, we have overcome all of the usual barriers to multidisciplinary research and created a cohesive team of College of Health Professions and College of Medicine researchers working together to produce significant achievements in the field of stroke recovery. I believe the coming years will be even more productive as the seeds planted in Phase I will reach the point of maturity in Phase II. We will continue to launch independent research careers in stroke recovery and grow the number of clinical trials in stroke recovery. We will become leaders in archiving stroke recovery research data for use by investigators and international teams. And finally, we will plan for an independent and sustainable, multidisciplinary stroke recovery research program at the end of COBRE funding.

I am asking for all of your support. To achieve all that we want to achieve it will take the whole community – our participants, our scientists, our great research staff, and the support of our institutional leaders and our donors.

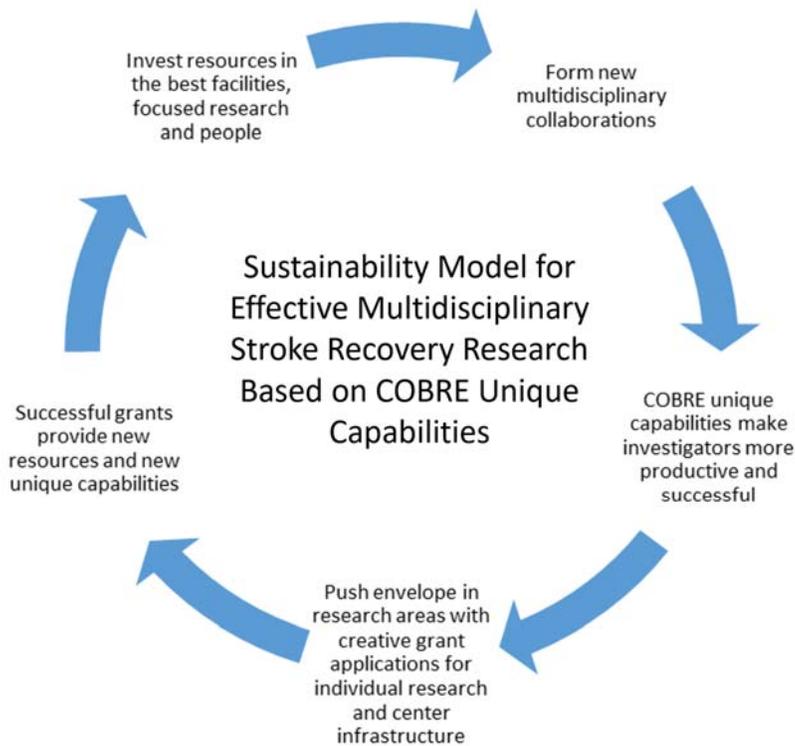
- Steve Kautz, Ph.D.



**Steve Kautz, Ph.D.**

Director of the Stroke Recovery  
Research Center

# COBRE Strategic Planning Meeting October 2019



## What are the unique capabilities that sets the COBRE in Stroke Recovery apart?

1. Processes and resources that make life easier and increase productivity of all COBRE investigators.
2. Combine insights from multiple disciplines and systems through team meetings and collaborations.
3. Provide easy inclusion of advanced technology and measurement from multiple disciplines and systems into grant applications.
4. Synthesize results into an interdisciplinary database for maximal data reuse and sharing.



## MEET THE EDITOR

“My name is Brenna and I am the new program coordinator for COBRE and NM4R. I recently graduated from UNC Greensboro in May and completed a year internship at The National Crime and Victims Center at the Institute of Psychiatry here at MUSC. I currently have my Bachelor of Science in Public Health and plan on beginning my Masters in Public Health sometime next year. Before working at MUSC, I was a medical massage therapist for over 11 years so rehabilitation has always been a passion of mine.

A little peek into my personal life; I have two big dogs, one special needs 85lbs long-coat Akita (Woolie) and one 95lbs Pitbull/Rottweiler mix. They are both rescues from the Carolinas. I’m also a millennial wanderlust and love traveling around the world. I got engaged in Japan, married in Mexico, and honeymooned in Cuba. Our next adventure will be spending two weeks in Thailand and Vietnam in March of 2020.

I am extremely excited to be a part of The Stroke Recovery and Research Center and COBRE team here at MUSC.”



**Brenna Baker-Vogel**

**COBRE & NM4R  
Program Coordinator**

## WELCOME THE NEW COBRE TEAM MEMBERS

“My name is Jamie and I was born and raised in Charleston, SC. I received a B.S. in Biology from the College of Charleston and a B.S. in Mechanical Engineering from The Citadel. As a Systems Engineer, I provide engineering support for research studies focusing on neurorehabilitation and lower extremity movement. This includes collecting data and developing, fabricating, and programming devices specific to the needs of each research study. My goal is to be able to independently provide engineering solutions for the COBRE investigators that throttle the research studies.”



**Jamie Rodriguez**  
Systems Engineer

“My name is Changki and I am a new postdoctoral associate here at the SRRC. I started working with Dr. Na Jin Seo in August of 2019. My research interests span motor control and neuromuscular physiology. During my PhD training, my research focused on the effects of visual information processing on motor control in aged-population, and demonstrated underlying neuromuscular mechanisms using surface EMG. During my first postdoc, I focused on characterizing neural control in different hand motor tasks using motor unit decomposition technique. Findings and experience during the trainings led me to question motor control in stroke populations and rehabilitation. I am excited to be a part of the COBRE team here at MUSC.”



**Changki Kim, Ph.D.**  
Postdoctoral Associate

## COBRE Junior PI Highlight

Dr. Badran is a neuroscientist junior investigator that has developed transcutaneous auricular vagus nerve stimulation (taVNS) here at MUSC since 2013. After completing a series of parametric optimization studies, he is now moving the technology into the clinic, where he is investigating the use of taVNS for neuropsychiatric disorders. Dr. Badran currently has two active COBRE/NM4R funded studies:

*Motor-Activated Auricular Vagus Nerve Stimulation (MAAVNS) to enhance upper limb function post-stroke-* We have developed a noninvasive form of VNS known as transcutaneous auricular VNS (taVNS). For paired taVNS to succeed as a clinical treatment, it is critical to develop and refine a closed-loop taVNS platform that delivers stimulation concurrently during specific movements of the motor rehabilitation training. Aim 1 develops this novel motor-activated closed-loop system that delivers taVNS in synchrony with specific upper limb motor activation.

*Boosting motor cortex excitability by combining repetitive transcranial magnetic stimulation (rTMS) with transcutaneous auricular vagus nerve stimulation-* There is a new noninvasive form of brain stimulation known as transcutaneous auricular vagus nerve stimulation (taVNS) which may facilitate plasticity and is being investigated in the enhancement of motor learning and recovery in a specific paired fashion. The timing of the paired VNS is critical to the desired neuroplastic changes as the behavioral effects of paired therapy disappear when behavior is not intricately synchronized with stimulation. Could pairing taVNS with TMS boost the effects of TMS on cortex, and potentially emerge as a stroke recovery tool? As a first step in this direction, we are conducting a mechanistic pilot study exploring the use of paired taVNS/TMS to further enhance motor cortex excitability.



**Bashar Badran, Ph.D.**  
**Assistant Professor**  
**Department of Psychiatry and**  
**Behavioral Sciences**

Dr. Robinson's lab focuses on understanding the impact of metabolic disorders on both normal and pathological brain aging. Her lab is particularly interested in the impact of diet-induced metabolic risk factors on cognitive function, Alzheimer's disease onset and progression, and stroke recovery. Metabolic risk factors such as diabetes, obesity, insulin resistance, and high cholesterol alters brain function and has negative consequences on learning and memory. These factors likely induce changes in various pathways years prior to any noticeable symptom. Hence, the goal of her laboratory is to identify these early changes in order to develop novel therapeutic targets to delay or prevent disease progression.

Dr. Robinson's COBRE study, "Effects of insulin on neuroplasticity and cognitive rehabilitation". Insulin resistance, which is a common comorbidity among stroke survivors, leads to a deficiency of insulin in the brain. Brain insulin promotes neuroplasticity, synaptogenesis, has anti-inflammatory, anti-thrombotic, vasodilatory, anti-apoptotic properties, and is involved in cognition. Hence, the goal of this project is to investigate the role of reduced brain insulin and the therapeutic potential of intranasal insulin on long-term functional stroke recovery.



**Catrina Robinson, Ph.D.**  
**Assistant Professor**  
**Department of Neurology**



## 2019 COBRE Publications

- Badran, B. W., Ly, M., DeVries, W. H., Glusman, C. E., Willis, A., Pridmore, S., & George, M. S. (2019). Are EMG and visual observation comparable in determining resting motor threshold? A reexamination after twenty years. *Brain Stimul*, 12(2), 364-366. doi:10.1016/j.brs.2018.11.003
- Badran, B. W., Yu, A. B., Adair, D., Mappin, G., DeVries, W. H., Jenkins, D. D., . . . Bikson, M. (2019). Laboratory Administration of Transcutaneous Auricular Vagus Nerve Stimulation (taVNS): Technique, Targeting, and Considerations. *J Vis Exp*(143). doi:10.3791/58984
- Brough, L. G., Kautz, S. A., Bowden, M. G., Gregory, C. M., & Neptune, R. R. (2019). Merged plantarflexor muscle activity is predictive of poor walking performance in post-stroke hemiparetic subjects. *J Biomech*, 82, 361-367. doi:10.1016/j.jbiomech.2018.11.011
- Campagnoli, R. R., Wieser, M. J., Gruss, L. F., Boylan, M. R., McTeague, L. M., & Keil, A. (2019). How the visual brain detects emotional changes in facial expressions: Evidence from driven and intrinsic brain oscillations. *Cortex*, 111, 35-50. doi:10.1016/j.cortex.2018.10.006
- Charalambous, C. C., Liang, J. N., Kautz, S. A., George, M. S., & Bowden, M. G. (2019). Bilateral Assessment of the Corticospinal Pathways of the Ankle Muscles Using Navigated Transcranial Magnetic Stimulation. *J Vis Exp*(144). doi:10.3791/58944
- Dean, J. C., Bowden, M. G., Kelly, A. L., & Kautz, S. A. (2019). Altered post-stroke propulsion is related to paretic swing phase kinematics. *Clin Biomech (Bristol, Avon)*, 72, 24-30. doi:10.1016/j.clinbiomech.2019.11.024
- Fridriksson, J., Basilakos, A., Stark, B. C., Rorden, C., Elm, J., Gottfried, M., . . . Bonilha, L. (2019). Transcranial direct current stimulation to treat aphasia: Longitudinal analysis of a randomized controlled trial. *Brain Stimul*, 12(1), 190-191. doi:10.1016/j.brs.2018.09.016
- Grattan, E. S., Velozo, C. A., Skidmore, E. R., Page, S. J., & Woodbury, M. L. (2019). Interpreting Action Research Arm Test Assessment Scores to Plan Treatment. *OTJR (Thorofare N J)*, 39(1), 64-73. doi:10.1177/1539449218757740
- Johnson, L., Basilakos, A., Yourganov, G., Cai, B., Bonilha, L., Rorden, C., & Fridriksson, J. (2019). Progression of Aphasia Severity in the Chronic Stages of Stroke. *Am J Speech Lang Pathol*, 28(2), 639-649. doi:10.1044/2018\_ajslp-18-0123
- Kindred, J. H., Kautz, S. A., Wonsetler, E. C., & Bowden, M. G. (2019). Single Sessions of High-Definition Transcranial Direct Current Stimulation Do Not Alter Lower Extremity Biomechanical or Corticomotor Response Variables Post-stroke. *Front Neurosci*, 13, 286. doi:10.3389/fnins.2019.00286
- Roelker, S. A., Bowden, M. G., Kautz, S. A., & Neptune, R. R. (2019). Paretic propulsion as a measure of walking performance and functional motor recovery post-stroke: A review. *Gait Posture*, 68, 6-14. doi:10.1016/j.gaitpost.2018.10.027
- Roelker, S. A., Kautz, S. A., & Neptune, R. R. (2019). Muscle contributions to mediolateral and anteroposterior foot placement during walking. *J Biomech*, 95, 1093-110. doi:10.1016/j.jbiomech.2019.08.004
- Seo, N. J., Enders, L. R., Fortune, A., Cain, S., Vatinno, A. A., Schuster, E., . . . Feng, W. (2019). Phase I Safety Trial: Extended Daily Peripheral Sensory Stimulation Using a Wrist-Worn Vibrator in Stroke Survivors. *Transl Stroke Res*. doi:10.1007/s12975-019-00724-9
- Seo, N. J., Lakshminarayanan, K., Lauer, A. W., Ramakrishnan, V., Schmit, B. D., Hanlon, C. A., . . . Nagy, T. (2019). Use of imperceptible wrist vibration to modulate sensorimotor cortical activity. *Exp Brain Res*, 237(3), 805-816. doi:10.1007/s00221-018-05465-z

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Srivastava, S., Patten, C., & Kautz, S. A. (2019). Altered muscle activation patterns (AMAP): an analytical tool to compare muscle activity patterns of hemiparetic gait with a normative profile. *J Neuroeng Rehabil*, 16(1), 21. doi:10.1186/s12984-019-0487-y

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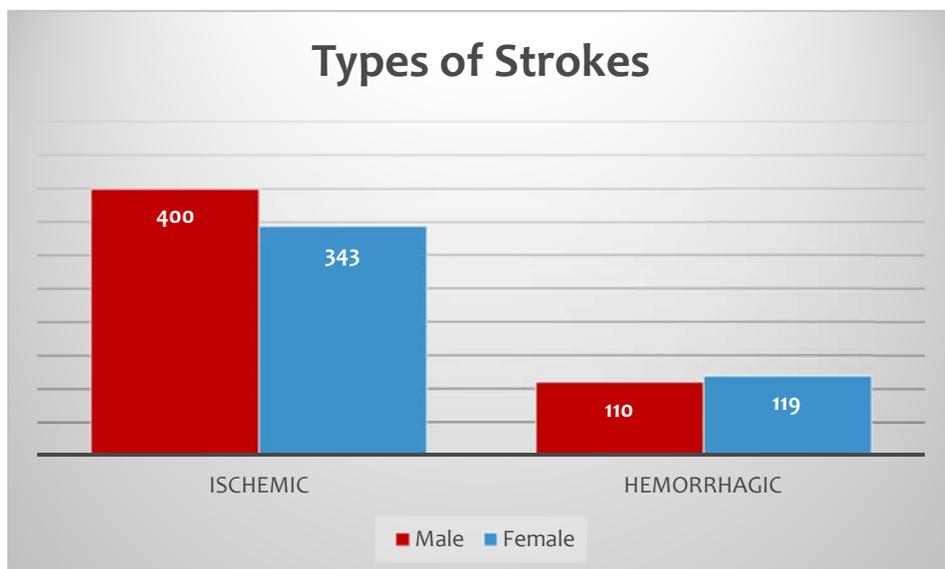
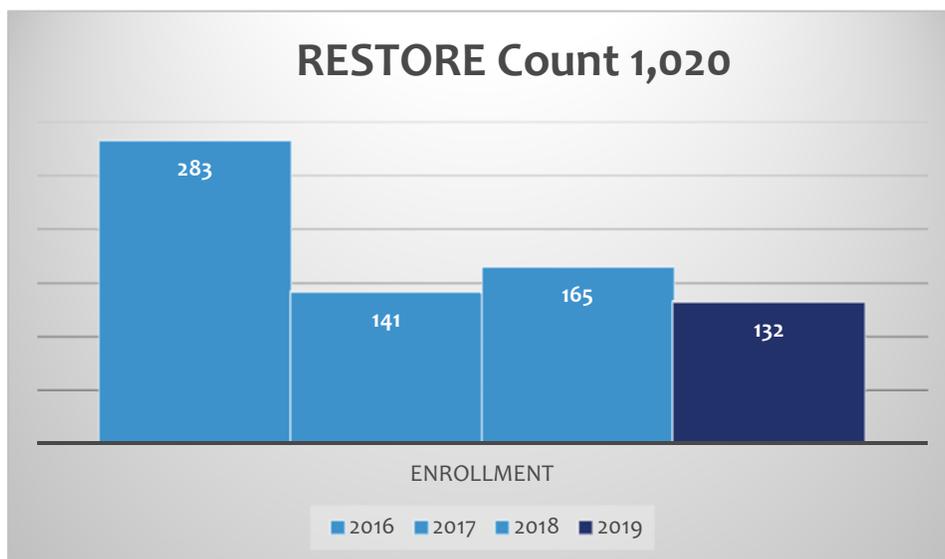
# Patient Data in RESTORE

The Stroke Search & Recovery Center has a robust database named RESTORE where all stroke patient's data is consolidated for multi data uses such as recruitment within Stroke studies, data analysis, graduate pilot data, data linkage and custom reporting.



## We have enrolled over 1,000+ participants!

### RESTORE at a Closer Look



## UPCOMING EVENTS

- Stroke Survivor Support Group- January 13<sup>th</sup> at 6:30pm

### **National Center for Neuromodulation for Rehabilitation Events**

- [Advanced Transcutaneous Auricular Vagus Nerve Stimulation \(taVNS\) Symposium](#)- March 12<sup>th</sup> & 13<sup>th</sup>
- [Spinal Cord Plasticity in Motor Control Meeting](#)- March 23<sup>rd</sup>
- [Advanced Operant Conditioning of EMG Evoked Potential Workshop](#)- March 24<sup>th</sup> through 26<sup>th</sup>

## SAVE THE DATE

- Participant Appreciation Day- Sunday March 22<sup>nd</sup> at [The Cooper River Room at Mt. Pleasant Waterfront Park](#)
- Stroke Survivor Support Group:
  - Tuesday February 11<sup>th</sup>
  - Tuesday March 10<sup>th</sup>
  - Tuesday April 14<sup>th</sup>
  - Tuesday May 12<sup>th</sup>
- 4<sup>th</sup> Annual Stroke Caregivers Summit- June 2020



More than 859,000 Americans die of heart disease, stroke, or other cardiovascular diseases every year—that's one-third of all US deaths. Leading risk factors for heart disease and stroke are high blood pressure, high low-density lipoprotein (LDL) cholesterol, diabetes, smoking and secondhand smoke exposure, obesity, unhealthy diet, and physical inactivity (CDC 2019).



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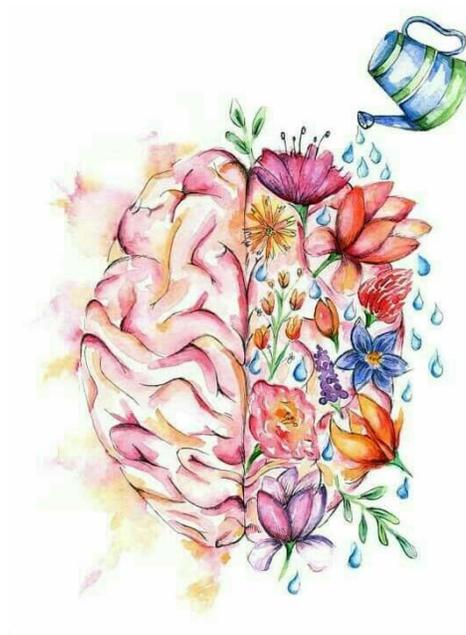
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*“Keep going, keep growing.”*

*-Patty*