STROKE RECOVERY RESEARCH CENTER

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

A FRIENDS OF RESEARCH E-NEWSLETTER

IN THIS ISSUE:

Welcome to the first bi-annual issue of the Friends of Research e-newsletter for 2020! We plan to send two issues each year to highlight our research accomplishments, showcase on-going research studies, and promote resources related to stroke.

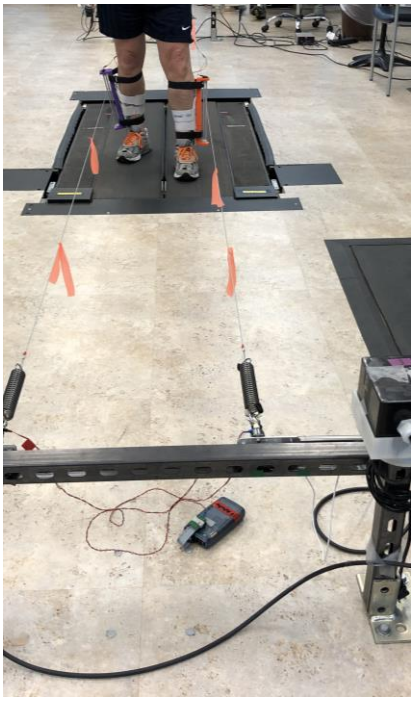
The Stroke Recovery Research Center (SRRC) currently supports approximately **25 research studies** which seek to better understand the process of recovery after stroke. We offer a variety of research studies for stroke survivors including walking, balance, and strength training, arm and hand function, language and speaking disorders, depression, visual neglect, and cognitive and memory function.

Our warmest regards,

Alyssa & Brenna

Alyssa Chesnutt, PTA
Research Assistant

Brenna Baker-Vogel
Program Coordinator



What Have We Learned?

The results of a recent study from Dr. Jesse Dean's research team provide a better understanding of balance problems in people who have had a stroke. Investigators observed **35 stroke survivors** performing a range of tasks and found that balance-related changes in walking were predicted by a reduced ability to accurately move the leg from side-to-side. The results of this study suggest that improving foot placement accuracy may also improve walking balance. Dr. Dean and other investigators at the Stroke Recovery Research Center are now working to apply these results to the development of new therapies to improve balance during walking.

Stroke Resources:

Young Stroke Survivors Support Group

When: 2nd Tuesday of each month at 6:30 PM
Where: Locations alternate between learning meetings at St. Francis Hospital and social outings at area restaurants.
Contact: Alyssa Chesnutt at 834-792-8171 or hydar@musc.edu

Stroke Support Group

Encompass Rehabilitation Hospital
When: 3rd Tuesday of each month at 4:00 PM
Where: 9181 Medcom St, Charleston, SC 29406
Contact: Julia Martens at: Julia.martens@encompasshealth.com
OR Briana Tucker Briana.tucker@encompasshealth.com

Stroke Support Group

Roper Rehabilitation Hospital
When: 3rd Tuesday of each month at 4:00 PM
Where: 316 Calhoun St 8th Floor, Charleston, SC 29401
Meetings are held on the 3rd floor
Contact: Katie Hall at Kaitlyn.hall@rsfh.com

Aphasia Community Support Group

The group meets on the last Wednesday of each month (time and location vary).
For more information please contact Anna Doyle: doylean@musc.edu **or 843-792-3678**

CARES

CARES is a free, student run clinic that provides physical, occupational, and speech therapy services to under insured patients. The clinic treats patients with orthopedic to neurological problems ranging from mechanical body issues to traumatic brain injuries and strokes.
To contact the CARES clinic call: 843-792-8019 OR
email: cares-patientschedulers-chp@musc.edu

Upcoming Events:

Annual Participant Appreciation Picnic

Sunday March 22, 2020
11:00 AM—2:00 PM
Memorial Waterfront Park, The Cooper River Room
99 Harry Hallman, Jr. Blvd., Mount Pleasant SC 29464

Thank you for supporting research! As a thank you for your participation in the Registry for Stroke Recovery (RESTORE), we would like to treat you and your family to lunch. RSVP to **Alyssa 843-792-8171 or hydar@musc.edu**

4th Annual Stroke Caregivers Summit

Saturday, June 6, 2020
9:00 AM—1:00 PM
Bon Secours St. Francis Hospital, Mall Classroom (behind café)
2095 Henry Tecklenburg Drive, Charleston SC 29414

This event is open to stroke survivors, caregivers, and family members who have been impacted by stroke. Breakfast will be provided. There is no cost to attend but registration is required and space is limited.
RSVP to Brenna at 843-792-0651 or bakebren@musc.edu

Featured Investigators:

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

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.

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

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.

Thank you stroke survivors, clinicians, and family members!

In 2019, many research investigators at the Stroke Recovery Research Center published results from dozens of research projects studying the stroke recovery processes. This could not have been possible without the loyalty and dedication of our stroke survivors and their family members who volunteer their time to participate in our research as well as area clinicians for referring research participants to us. On behalf of the Stroke Recovery Research Center, we would like to thank each one of our research participants, their families, and our local therapist, nursing, and other colleagues.

In 2019 we enrolled nearly 125 stroke survivors to our research database!

2019 Research Publications:

At least 17 of our research studies have been published in scholarly journals.

Authors	Title
Basilakos A., Stark B. C., Johnson L., Rorden C., Yourganov G., **Bonilha L.**, Fridriksson J.	Leukoaraiosis Is Associated With a Decline in Language Abilities in Chronic Aphasia.
Hunnicutt J. L., McLeod M. M., Slone H. S., **Gregory C. M.**.	Spatiotemporal Variables During Self-selected And Fastest-comfortable Walking Speeds In Individuals Following ACL Reconstruction.
Kim K., Adams L., Keator L. M., Sheppard S. M., Breining B. L., Rorden C., Fridriksson J., **Bonilha L.**, Rogalsky C., Love T., Hickok G., Hillis A. E..	Neural processing critical for distinguishing between speech sounds.
Stark B. C., Basilakos A., Hickok G., Rorden C., **Bonilha L.**, Fridriksson J..	Neural organization of speech production: A lesion-based study of error patterns in connected speech.
Badran, B. W., Yu, A. B., Adair, D., Mappin, G., DeVries, W. H., Jenkins, D. D., George, M. S., Bikson, M.	Laboratory Administration of Transcutaneous Auricular Vagus Nerve Stimulation (taVNS): Technique, Targeting, and Considerations.
Bashar W Badran, Martina Ly, William H DeVries, Chloe E Glusman, Angela Willis, Saxby Pridmore, Mark S George	Are EMG and visual observation comparable in determining resting motor threshold? A reexamination after twenty years.
Thompson, Aiko, Fiorenza, G., Smyth, L., Favale, B., Brangaccio, J., & Sniffen, J.	Operant conditioning of the motor-evoked potential and locomotion in people with and without chronic incomplete spinal cord injury
Thompson, Aiko, Mrachacz-Kersting, N., Sinkjær, T., & Andersen, J.	Modulation of soleus stretch reflexes during walking in people with chronic incomplete spinal cord injury.
Bonilha, Heather, Huda, W., Wilmskoetter, J., Martin-Harris, B., & Tipnis, S.	Radiation Risks to Adult Patients Undergoing Modified Barium Swallow Studies
Vistamehr A., **Kautz S. A.**, **Bowden M. G.**, Neptune R. R..	The influence of locomotor training on dynamic balance during steady-state walking post-stroke.
Seo N. J., Woodbury M. L., **Bonilha L.**, Ramakrishnan V., **Kautz S. A.**, Downey R. J., Dellenbach B. H. S., Lauer A. W., Roark C. M., Landers L. E., Phillips S. K., Vatinno A. A..	Long-term outcomes of acute ischemic stroke patients treated with endovascular thrombectomy: A real-world experience.
Roelker S. A., **Bowden M. G.**, **Kautz S. A.**, Neptune R. R..	Paretic propulsion as a measure of walking performance and functional motor recovery post-stroke: A review.
Kindred J. H., **Kautz S. A.**, Wonsetler E. C., **Bowden M. G.**.	Single Sessions of High-Definition Transcranial Direct Current Stimulation Do Not Alter Lower Extremity Biomechanical or Corticomotor Response Variables Post-stroke.
Charalambous C. C., Liang J. N., **Kautz S. A.**, **George M. S.**, **Bowden M. G.**.	Bilateral Assessment of the Corticospinal Pathways of the Ankle Muscles Using Navigated Transcranial Magnetic Stimulation.
Brough L. G., **Kautz S. A.**, **Bowden M. G.**, **Gregory C. M.**, Neptune R. R.	Merged plantarflexor muscle activity is predictive of poor walking performance in post-stroke hemiparetic subjects.
Bonilha, H., Wilmskoetter, J., Tipnis, S., Horn, J., Martin-Harris, B., & Huda, W.	Relationships Between Radiation Exposure Dose, Time, and Projection in Videofluoroscopic Swallowing Studies
Seo N. J., Crocher V., Spaho E., Ewert C. R., Fathi M. F., Hur P., Lum S. A., Humanitzki E. M., Kelly A. L., Ramakrishnan V., Woodbury M. L.	Capturing Upper Limb Gross Motor Categories Using the Kinect (R) Sensor.

Publication Highlights:

Single Sessions of High-Definition Transcranial Direct Current Stimulation Do Not Alter Lower Extremity Biomechanical or Corticomotor Response Variables Post-stroke.

Kindred, John H., Kautz, Steve A., Wonsetler EC, Bowden, Mark G.

Abstract: Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique used to modulate cortical activity. However, measured effects on clinically relevant assessments have been inconsistent, possibly due to the non-focal dispersion of current from traditional two electrode configurations. High-definition (HD)-tDCS uses a small array of electrodes (N = 5) to improve targeted current delivery. The purpose of this study was to determine the effects of a single session of anodal and cathodal HD-tDCS on gait kinematics and kinetics and the corticomotor response to transcranial magnetic stimulation (TMS) in individuals post-stroke. We hypothesized that ipsilesional anodal stimulation would increase the corticomotor response to TMS leading to beneficial changes in gait. Eighteen participants post-stroke (average age: 64.8 years, SD: 12.5; average months post-stroke: 54, SD: 42; average lower extremity Fugl-Meyer score: 26, SD: 6) underwent biomechanical and corticomotor response testing on three separate occasions prior to and after HD-tDCS stimulation. In a randomized order, anodal, cathodal, and sham HD-tDCS were applied to the ipsilesional motor cortex for 20 min while participants pedaled on a recumbent cycle ergometer. Gait kinetic and kinematic data were collected while walking on an instrumented split-belt treadmill with motion capture. The corticomotor response of the paretic and non-paretic tibialis anterior (TA) muscles were measured using neuronavigated TMS. Repeated measures ANOVAs using within-subject factors of time point (pre, post) and stimulation type (sham, anodal, cathodal) were used to compare effects of HD-tDCS stimulation on measured variables. HD-tDCS had no effect on over ground walking speed ($P > 0.41$), or kinematic variables ($P > 0.54$). The corticomotor responses of the TA muscles were also unaffected by HD-tDCS (resting motor threshold, $P = 0.15$; motor evoked potential (MEP) amplitude, $P = 0.25$; MEP normalized latency, $P = 0.66$). A single session of anodal or cathodal HD-tDCS delivered to a standardized ipsilesional area of the motor cortex does not appear to alter gait kinematics or corticomotor response post-stroke. Repeated sessions and individualized delivery of HD-tDCS may be required to induce beneficial plastic effects. Contralesional stimulation should also be investigated due to the altered interactions between the cerebral hemispheres post-stroke.

Link to full article

Capturing Upper Limb Gross Motor Categories Using the Kinect® Sensor.

Seo, Na Jin, Crocher, Vincent, Spaho, Egli, Ewert, Charles R., Fathi, Mojtaba F., Hur, Pilwon, Lum, Sarah A., Humanitzki, Elizabeth M., Kelly, Abigail L., Ramakrishnan, Viswanathan, Woodbury, Michelle L.

Abstract: Along with growth in telerehabilitation, a concurrent need has arisen for standardized methods of tele-evaluation.
Objective: To examine the feasibility of using the Kinect sensor in an objective, computerized clinical assessment of upper limb motor categories.
Design: We developed a computerized Mallet classification using the Kinect sensor. Accuracy of computer scoring was assessed on the basis of reference scores determined collaboratively by multiple evaluators from reviewing video recording of movements. In addition, using the reference score, we assessed the accuracy of the typical clinical procedure in which scores were determined immediately on the basis of visual observation. The accuracy of the computer scores was compared with that of the typical clinical procedure.
Participants: Seven patients with stroke and 10 healthy adult participants. Healthy participants intentionally achieved predetermined scores.
Outcomes and Measures: Accuracy of the computer scores in comparison with accuracy of the typical clinical procedure (immediate visual assessment).
Results: The computerized assessment placed participants' upper limb movements in motor categories as accurately as did typical clinical procedures.
Conclusion and Relevance: Computerized clinical assessment using the Kinect sensor promises to facilitate tele-evaluation and complement telehealth applications.

Link to full article

Current Research Studies:

Study Category	Study Title & Principle Investigator	Recruitment Contact:
Attention & Visual Neglect	Improving measurement and treatment of post-stroke neglect – Dr. Emily Grattan	Dr. Emily Grattan Phone: 792-3435
Arm	Concomitant sensory stimulation during therapy to enhance hand functional recovery post stroke – Dr. Na Jin Seo	Dr. Na Jin Seo Phone: 843-792-0084 or seon@musc.edu
Arm	Effect of transcranial direct current stimulation on cortical oscillations during a virtual reality task – Dr. Nathan Rowland	Brenna Baker-Vogel Phone: 792-0651 or bakebren@musc.edu
Arm	Novel training environment to normalize altered finger force direction post stroke – Dr. Na Jin Seo	Dr. Na Jin Seo Phone: 843-792-0084 or seon@musc.edu
Arm	TRANScranial direct current stimulation for post-stroke motor Recovery - a phase II study (TRANSPORT 2)	Dr. Michelle Woodbury Brenna Baker-Vogel Phone: 792-0651 or bakebren@musc.edu
Arm	A novel therapy + e-learning self-management program for stroke survivors – Dr. Michelle Woodbury	Brenna Baker-Vogel Phone: 792-0651 or bakebren@musc.edu
Balance	Integration of postural control measures to enhance the development of assessments and interventions for post-stroke functional mobility – Dr. Jesse Dean	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu
Brain-stimulation, Fatigue, & Walking	Fatigue and mobility in stroke: a biomechanical and neurophysiological investigation – Dr. John Kindred	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu
Brain-stimulation & Walking	Optimization of TMS Assessment after Stroke – Dr. Mark Bowden	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu
Cognition & Memory	Neuromodulation and Plasticity in Cognitive Control Neurocircuitry in Chronic Stroke – Dr. Lisa McTeague	Dr. Lisa McTeague Phone: 792-8274 or mcteague@musc.edu
Cognition & Memory	Neuromodulation of Cognitive Control Neurocircuits for Stroke Rehabilitation – Dr. Lisa McTeague	Dr. Lisa McTeague Phone: 792-8274 or mcteague@musc.edu
Depression & Walking	Age-related changes in neuroplasticity impede recovery in post-stroke depression: a novel exercise and brain stimulation paradigm to prime neuroplastic potential – Dr. Ryan Ross	Dr. Ryan Ross Phone: 792-3477 or rossre@musc.edu
Depression & Walking	Post-stroke Optimization of Walking using Explosive Resistance: Concurrent effects on Depression - Dr. Chris Gregory	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu
Tele-health of Arm & Leg	Remote Delivery of an Exercise Program during Post-Stroke Community Reintegration: A Pilot Study – Dr. Addie Middleton	Dr. Addie Middleton Phone: 792-0235 or middlja@musc.edu
Speech (Aphasia)	Center for the Study of Aphasia Recovery (C-STAR) - Project 1 (POLAR) Project 001: Modeling Treated Recovery from Aphasia- Dr. Leo Bonilha	Anna Doyle Phone: 792-03674 or doylean@musc.edu
Walking	Incline Training to Personalize Motor Control Interventions after Stroke – Dr. Mark Bowden	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu
Walking & Balance	A novel mechanics-based intervention to improve post-stroke gait stability – Dr Jesse Dean	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu
Walking & Balance	Development of sensory augmentation methods to improve post-stroke gait stability – Dr. Jesse Dean	Alyssa Chesnutt Phone: 792-8171 or hydar@musc.edu

Featured Research Study:

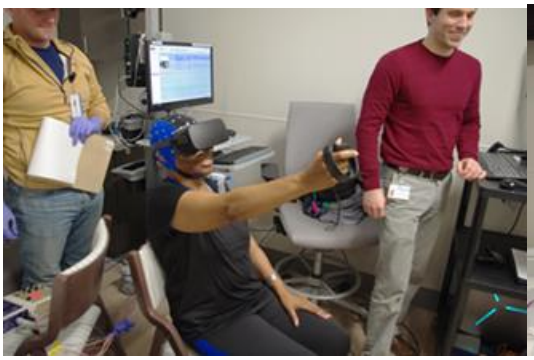
Dr. Nathan Rowland - Direct Measurement of Motor Cortical Responses to Transcranial Direct Current Stimulation

Dr. Nathan Rowland's current research interests include learning more about non-invasive brainstimulation. Over 6.5 million individuals in the US suffer from chronic stroke, however no standard therapeutic options for neuromodulation currently exist for this group. In contrast, much rarer forms of motor dysfunction, such as Parkinson's disease (PD, ~ 1 million diagnosed in the US), benefit from diverse neuromodulatory techniques, including invasive (e.g., deep brain stimulation, DBS) and noninvasive (e.g., MRI-guided focused ultrasound) approaches. Transcranial direct current stimulation (tDCS), a noninvasive form of neuromodulation, has shown potential to improve motor deficits following chronic stroke, however a detailed understanding of motor cortical response to tDCS is lacking. To address this problem, in a parallel IRB-approved study (Pro00073545), we have used tDCS in subjects with movement disorders undergoing DBS surgery to understand its effects on motor cortical oscillations.

In the current proposal, we will expand our investigation of tDCS effects on subjects with chronic stroke using noninvasive electroencephalographic (EEG) recordings. In this proposal, we also plan to recruit healthy controls as well as patients with movement disorders. All prospective participants will be recruited from databases in which patients have previously given consent to be contacted about future research studies such as this one. We will use two databases: the chronic stroke patients (n=20) and healthy controls (n=10) will be recruited from the Registry for Stroke Recovery (RESTORE) database; the movement disorders patients (n=10) will be recruited from the MUSC Movement Disorders Program patient database. This will allow us to compare cortical effects of tDCS between invasive and noninvasive approaches and determine how these signals might be used in future neuromodulation strategies for improving recovery in chronic stroke patients.

Aim 1**.** Quantify the change in primary motor cortical (PriMC) oscillations during cued arm reaching in relation to anodal tDCS activation. Question: Does tDCS differentially modulate movement preparation vs movement execution? In this aim, we will record beta and broadband gamma activity in PriMC in subjects undergoing EEG recording and high-density tDCS. *We hypothesize that cortical beta and broadband gamma spectral power changes will be enhanced more so during movement preparation than execution following anodal tDCS activation.*

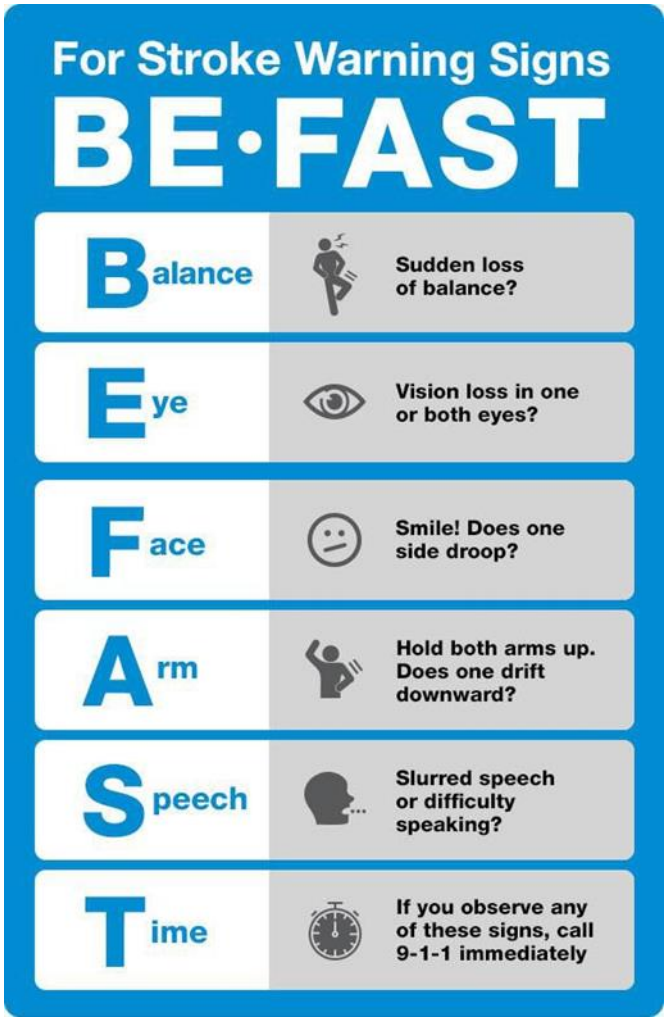
Aim 2. Quantify the change in PriMC oscillations during motor imagery in relation to anodal tDCS activation. Question: Does tDCS differentially modulate motor imagery of simple vs complex movements? Using the same subjects as Aim 1, cortical oscillatory changes will be recorded during imagery of arm flexion/extension (simple) versus randomly chosen variants of arm flexion/extension (complex). We hypothesize that cortical beta and broadband gamma spectral power changes will be enhanced more so during complex arm flexion/extension than simple arm flexion/extension following anodal tDCS activation.



To participate in Dr. Rowland's study please contact: **Brenna Baker-Vogel: 792-0651 or bakebren@musc.edu**

Learning Corner:

Did you know the American Heart Association has updated the warning signs of stroke? The new acronym to remember is **"BE FAST"**. If you or a loved one experience any <u>one</u> of these sudden changes, it *could* mean they are experiencing a stroke. Get help and **BE FAST!**



80 million people have <u>survived</u> stroke worldwide.

Some stroke risk factors include: uncontrolled diabetes, high blood pressure, obesity, high cholesterol, smoking, and alcohol consumption.

Did you know that some of these risk factors for stroke can be modified or reduced?

Exercise – just 30 minutes of exercise 5 times a week can reduce your risk of stroke by 25%.

Weight – being overweight is one of the top 10 risk factors for stroke and is **associated with 1 in 5 strokes**. Maintaining a healthy weight will help you reduce your risk for stroke.

Smoking – increases your risk of having a stroke. Someone who smokes 20 cigarettes a day is **6 times more likely to have a stroke**

Alcohol – drinking too much alcohol can increase your risk of stroke, globally excessive alcohol consumption is **linked to over 1 million strokes each year.**

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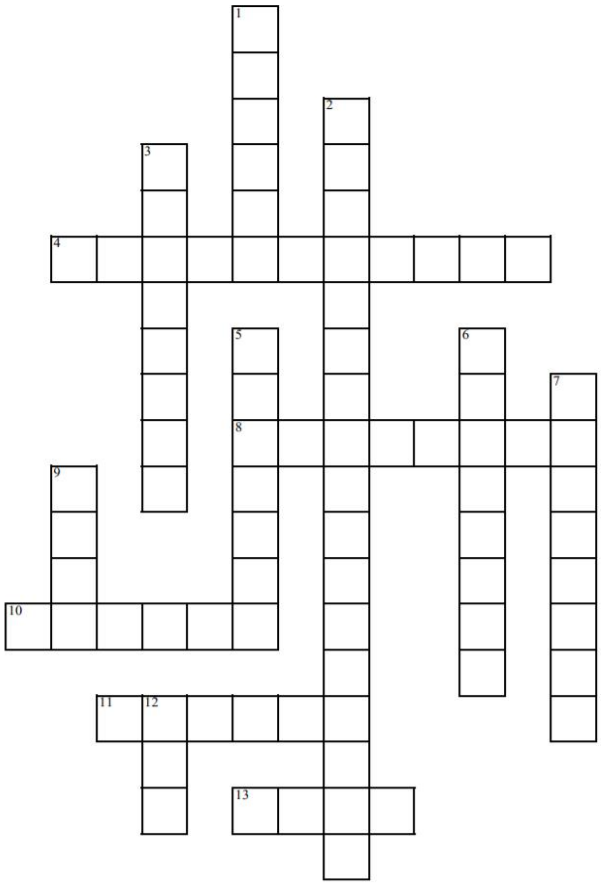
Test Your Stroke Knowledge:



Across

4. Type of stroke associated with blood vessel ruptures
8. Possible recovery time
10. Poor blood flow to brain resulting in cell death
11. A treatment for ischemic stroke
13. A common misconception about stroke prevelance

Down

1. Uncontrollable risk factor
2. Key risk factor
3. A sign or symptom of stroke
5. What may be a physical post stroke effect
6. A surgical treatment for Hemorrhagic stroke
7. A type of stroke resulting from an obstruction
9. Acronym for identifying onset of a stroke
12. How many times more likely are you to suffer from a stroke if you are black

Answers:

1. GENDER 2. HIGH BLOOD PRESSURE 3. NUMBNESS 4. HEMORRHAGIC 5. FATIGUE 6. CLAMPING 7. ISCHEMIC 8. TWO YEARS 9. FAST 10. STROKE
11. STENTS 12. TWO 13. RARE

Contact Friends of Research:

Partcipate in Research:

If you or someone you know has experienced a stroke and would like to learn more about participating in our research studies, please contact:

Holly Boggan
Program Coordinator
Phone: (843) 792-1728
E-Mail: bogganhl@musc.edu

Contact Friends of Research:

Alyssa Chesnutt, PTA
Research Assistant
Phone: 843-792-8171
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Brenna L. Baker-Vogel
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STROKE RECOVERY RESEARCH CENTER

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

WE'RE ON THE WEB!

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