

Center for Biomedical Imaging

Annual Report FY2017

(issued 16 November 2017)

The Center for Biomedical Imaging provides the resources to enable basic and clinical scientists to collaborate to discover new insights into normal and disease processes and to apply this knowledge to clinically relevant research.



Introduction & Background

The Center for Biomedical Imaging (CBI) was established by the Board of Trustees in 2010 as a University Designated center. This decision has enabled MUSC to remain competitive with other academic institutions and to establish the infrastructure and environment to reach the next level in this crucial research area.

The CBI is a resource for basic and clinical scientists collaborating to discover new information about normal and disease processes and how to apply this knowledge to clinically relevant research. Central to the mission objectives of the CBI are 1) service to the MUSC imaging research community, 2) training and mentorship of graduate students and future leaders in biomedical imaging, 3) recruitment of outstanding senior and young investigators, 4) discovery of new clinical applications of imaging and their practice in the clinical arena and 5) promotion of basic research in medical imaging and related fields. The CBI's website can be found at: <http://academicdepartments.musc.edu/cbi/>

The CBI central offices are located on the 2nd floor of the Bioengineering Building (BEB) at 68 President Street. In FY2017, the CBI managed two research dedicated advanced imaging devices including a 3T human MRI system and a 7T animal MRI system. The other animal imaging systems including the PET/CT, bioluminescence and fluorescence, were moved to the Hollings Cancer Center. The CBI is open to all investigators in SC and serves as a foundation for the development of numerous applications that benefit from the use of biomedical imaging.

In fiscal year 2017, the CBI provided imaging support and resources for a total of 63 grants, 48 of which were federal grants to MUSC. The CBI also supports MUSC faculty by offering development time to be used for collaborations and the collection of pilot data. In fiscal year 2017, the CBI underwrote approximately \$366,600 of this development time for MUSC researchers.

Mission Statement:

The mission of the CBI is to provide the leadership and infrastructure in the imaging sciences necessary for basic and clinical scientists to collaborate, discover new ways to study normal and disease processes, develop and apply this knowledge to clinically relevant research, and to translate these advances to the patient community while providing a quality graduate education environment.

Vision Statement:

The vision of the CBI is to be recognized as an integrated and multidisciplinary center for biomedical imaging research with mutually supportive and valued interactions among basic science and clinical departments, to recruit outstanding faculty and educate the future leaders of the field.

Administration

General:

In FY2017, the leadership of the CBI included:

Dr. Joseph A. Helpern, Director
Dr. Truman R. Brown, Scientific Director
Dr. Jens Jensen, Associate Director

CBI Internal Advisory Committee:

The CBI's Internal Advisory Committee (IAC) comprises the CBI Directors as well as both early stage and senior researchers from across the University. Many of these individuals are experienced in participating in large research programs as well as in the management of shared facilities. The IAC advises the Director on the administrative operation of the CBI, coordinates resources, and ensures that the research conducted within the CBI is appropriately prioritized to reflect the overall goals of MUSC.

Current members of the IAC are:

Dr. Kathleen Brady	Dr. Ann-Marie Broome	Dr. Truman Brown
Dr. Phil Costello	Dr. Chris Davies	Dr. Mark Eckert
Ms. Anita Harrison	Dr. Joseph A. Helpern	Dr. Peter Kalivas (Chair)
Dr. Steven Kautz	Dr. Amanda LaRue	Dr. Vincent Pellegrini
Dr. Thomas Uhde		

In FY2017, CBI leadership continued to hold quarterly "town hall meetings" in which all users were able to express their views and opinions.

Scheduling:

Scheduling of time on imaging systems is performed through a web-based system called Calpendo (<https://musc.calpendo.com/>), that allows researchers with approved IRB or IACUC protocols to examine and schedule CBI equipment and facilities.

Operations

Staff:

The following full and part-time staff were employed by CBI in FY2017.

M. Van Horn	(0.50 FTE)	Computer Manager (1 month Q1)
T. Fluery	(1.00 FTE)	Laboratory Manager
J. Doose, M. Eng.	(0.50 FTE)	Biomedical Engineer
J. Purl	(1.00 FTE)	MRI Technologist (Siemens 3T)
J. Coatsworth	(1.00 FTE)	MRI Technologist (Siemens 3T)
R. Deardorff, M.S.	(0.50 FTE)	Lab Manager
D. Montgomery	(0.15 FTE)	Program Coordinator I (IRB compliance) (1 month Q1)
A. McMichael	(0.20 FTE)	Program Coordinator I (IRB compliance)
K. Hildreth	(0.20 FTE)	Fiscal Manager (1 month Q1)
T. Huggins	(0.20 FTE)	Fiscal Manager
C. Roylance	(0.20 FTE)	Administrative Assistant
X. Nie, MD.	(1.00 FTE)	Research Specialist (Animal Imaging – 7T MRI)

Preclinical (Small Animal) Imaging:

Bruker 7T MRI: The BioSpec 70/30 MRI scanner is a multipurpose system for high-resolution MR spectroscopy and imaging operating at 7 Tesla (T). The 7T MRI is ideal for 2D and/or 3D high-resolution anatomical imaging as well as diffusion and diffusion tensor, flow, cardiac, dynamic contrast, functional MRI and chemical shift imaging.

Surgery Room: The Surgery Room is booked concurrently with the 7T MRI and is available for pre-imaging preparation.

As of October 1, 2016 the Maestro 2 *In Vivo* Imaging, the Xenogen IVIS 200 Bioluminescence Preclinical Imaging System and the Siemens Micro-CT/PET were physically and administratively moved to the Hollings Cancer Center.

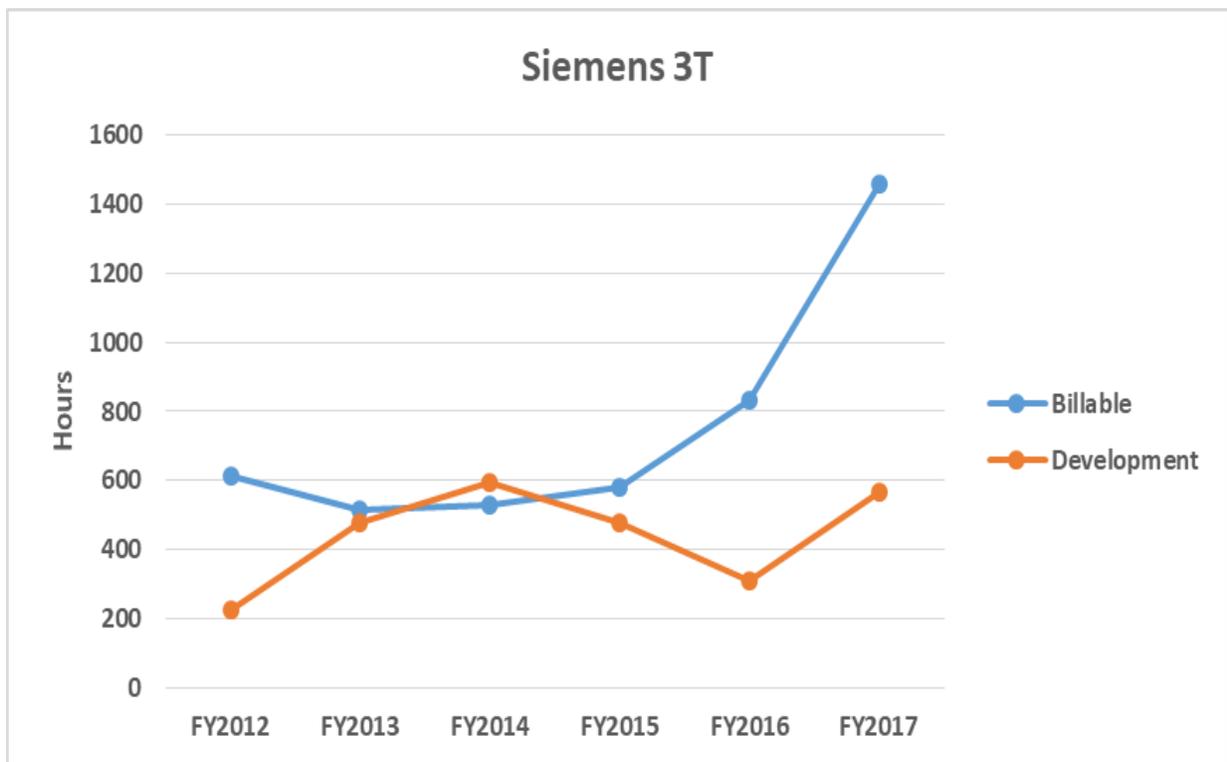
Human imaging Resources:

Siemens 3T Prisma MRI Scanner: In April of 2017, the 3T MRI was upgraded to a state-of-the-art Siemens Prisma system. The system is equipped with integrated fMRI paradigm presentation equipment and offers visual, auditory and olfactory stimulus delivery with tactile and verbal feedback. The scanner and fMRI set-up have been designed to integrate seamlessly with other research MR scanners in SC to allow for multi-center studies. The scanner operates with a 100% mandate for research use and is covered under a Siemens master research agreement.

Mock Scanner: The Mock Scanner is a full-size replica of the 3T MRI made from plywood and other building materials to look and sound like the real MRI. The Mock Scanner is available to be used for 'trial runs' with patients who are wary of undergoing the full scanning procedure and can be also booked for use as a training or demonstration tool.

Equipment Usage:

Shown in the figure below is the hourly usage from FY2012 through FY2017 for the Siemens 3T MRI. To alleviate the scheduling pressure, consideration is being made to expand the CBI's hours of operation into nights and weekends. CBI Faculty are currently provided two hours of development time per week to be used for the collection of pilot data and for collaboration with other researchers. The CBI also assists Junior Faculty members across all Colleges at MUSC in developing imaging methodology in their research. Junior Faculty are faculty at the Assistant Professor rank who are not currently, and have never been, the Principle Investigator (PI) of an NIH R01, R21, Program Project or Center (P41) grant proposal. To help defray the costs of scanning, the CBI offers matching development time to Junior Faculty members.



Faculty:

Faculty of the CBI come from all Colleges at MUSC who are using and developing imaging in their research. There are currently 27 faculty members representing various Departments including Radiology and Radiological Sciences, Neurosciences, Health Professions, Otolaryngology, Psychiatry and Behavioral Sciences, Pathology and Laboratory Medicine and Microbiology and Immunology. Collaboration among faculty in the development of new and cross-disciplinary methodologies is strongly encouraged, and faculty members are expected to take part in Study Group meetings, contribute to teaching CBI courses and generally support the overall well-being of the CBI. Each faculty member must give a lecture to the CBI every other year on their research.

Andreana Benitez, Ph.D.	Assistant Professor	Neurology
Leonardo Bonilha, M.D., Ph.D.	Assistant Professor	Neurology
Ann-Marie Broome, Ph.D.	Associate Professor	Radiology
Truman R. Brown, Ph.D.	Professor	Radiology
Dean Connor, Jr., Ph.D.	Assistant Professor	Radiology
Mark Eckert, Ph.D.	Associate Professor	Otolaryngology
Maria Falangola, M.D., Ph.D.	Assistant Professor	Radiology
Mark George, M.D.	Distinguished University Professor	Psychiatry
Colleen Hanlon, Ph.D.	Assistant Professor	Psychiatry
Joseph A. Helpern, Ph.D.	Professor	Radiology
Jens Jensen, Ph.D.	Professor	Radiology
Jane Joseph, Ph.D.	Professor	Neuroscience
Thomas Naselaris, Ph.D.	Professor	Neuroscience
James Prisciandaro, Ph.D.	Assistant Professor	Psychiatry
Donna Roberts, M.D.	Assistant Professor	Radiology
Joseph Schacht	Assistant Professor	Psychiatry
Vittoria Spampinato, M.D.	Associate Professor	Radiology
Sameer Tipnis, Ph.D.	Assistant Professor	Radiology
Mark Van Horn, Ph.D.	Assistant Professor	Radiology
Xue-Zhong Yu, M.D., M.S.	Professor	Microbiology
DeAnna Adkins, Ph.D.	Assistant Professor	Neuroscience
Jeffrey Borckardt, Ph.D.	Associate Professor	Psychiatry
Brett Froeliger, Ph.D.	Assistant Professor	Neuroscience
Xingbao Li, M.D.	Assistant Professor	Psychiatry
Andy Shih, Ph.D.	Associate Professor	Neuroscience

Education

Biomedical Imaging Ph.D. Program

In 2014, the CBI received full approval for the Ph.D. in Biomedical Imaging curriculum. The mission of the program is to train students in a basic core of knowledge and skills that will prepare them to become leaders in the application of biomedical imaging technology to problems in basic and clinical research. The program provides a strong foundation in the fundamentals of image acquisition technologies and data analysis methods, while exposing students to the application of specific imaging modalities through a series of individual electives in their chosen area of interest.

Due to budget constraints at the University level, the Biomedical Imaging PhD Program has suspended the enrollment of new students until further notice.

Study Groups

Addiction - Leader: Joseph Schacht, Ph.D.

The Addiction Study Group is a forum for discussion of neuroimaging of addictive disorders. Topics include 1) discussion of the clinical presentation of disorders including alcohol, nicotine, cocaine, heroin, and prescription opioid abuse and dependence; 2) application of a broad spectrum of neuroimaging modalities, including functional and structural MRI, diffusion tensor and kurtosis imaging, and MRS, and methods, including network connectivity analysis; and 3) opportunities for collaboration among investigators for grant submissions. Meetings have varied formats, including journal club discussion, data presentation, grant ideas forums, and practice job or conference talks. Both clinical and basic science investigators currently involved with addiction neuroimaging projects or hoping to pursue such projects are encouraged to attend.

User Group Meeting (Nuts & Bolts)

The CBI Nuts and Bolts User Group meets twice a month and provides a forum for in-depth discussions by researchers about imaging, statistical methods, data analysis techniques and administrative issues. The first portion of the meeting is dedicated to discussion of CBI equipment and administrative issues, and the remainder of the meeting typically consists of a presentation of a discussion topic chosen by the group.

Lectures

The CBI regularly hosts lectures given by both visiting speakers and CBI faculty. Past lectures have included the following:

09/23/2016	Sook-Lei Liew, OTR/L	Big Data Neuroimaging and Neuromodulation to Promote Motor Recovery after Stroke	University of Southern California
10/18/2016	Andy Shih, PhD	Vasomotion as a Link Between Neuronal and Resting State Functional Connectivity	MUSC
11/21/2016	Hanzhang Lu, PhD	Magnetic Resonance Imaging of Brain Physiology	John Hopkins University
12/2/16	Dorian Pustina, PhD	Building predictive models from multimodal neuroimaging: examples from epilepsy and post-stroke aphasia	The University of Pennsylvania
1/23/17	Ravi Menon, PhD, FCAHS	Structure and function of the human and non-human primate brain at ultra-high magnetic fields	The University of Western Ontario Canada
2/16/17	Keith Thulborn, MD, PhD	Quantitative metabolic ^{23}Na and ^{17}O MRI imaging at ultra-high field: cell volume fraction and cerebral metabolic rate of oxygen consumption	University of Illinois Chicago
3/21/17	Dieter Haemmerich, PhD, DrSci, FHRS		MUSC

Appendix I: Budget

FY17 Actual

Category	Admin 44750	3T 49751	7T 49752	PET-CT 49753	IVIS 49754	Maestro 49755	Totals	% of Category Total
Revenue								
Scan Revenue	\$0	\$497,675	\$2,180	\$8,325	\$738	\$1,038	\$509,955	71.74%
Dean's Office Funding	\$50,240	\$9,965	\$140,696	\$0	\$0	\$0	\$200,901	28.26%
Revenue Total	\$50,240	\$507,640	\$142,876	\$8,325	\$738	\$1,038	\$710,856	100.00%
Expenses								
Total Payroll (salary + fringe)	\$101,276	\$327,704	\$110,127	\$0	\$0	\$0	\$539,108	100.00%
Direct Costs								
Service Contracts		\$109,976	\$39,603				\$149,579	82.38%
Equipment		\$5,452					\$5,452	3.00%
Study Participant Fees		\$630					\$630	0.35%
Shipping	\$42						\$42	0.02%
Xerox Service and Maintenance Agreemen	\$5,058						\$5,058	2.79%
Calpendo Licenses	\$5,523						\$5,523	3.04%
Software Licenses	\$413						\$413	0.23%
Office Supplies	\$528	\$449					\$977	0.54%
Educational Supplies		\$54					\$54	0.03%
Med/Sci/Lab Supplies	\$297	\$7,993	\$1,045	\$211	\$497	\$386	\$10,429	5.74%
Animal Per Diem			\$681				\$681	0.38%
Travel	\$2,737						\$2,737	1.51%
Total Direct Costs	\$14,597	\$124,555	\$41,329	\$211	\$497	\$386	\$181,574	100.00%
Indirect Costs								
30 Bee Street Lease		\$29,354					\$29,354	47.57%
30 Bee Street Security System		\$443					\$443	0.72%
Utilities		\$10,591					\$10,591	17.16%
Commercial Insurance		\$221					\$221	0.36%
General Repairs	\$7	\$70	\$84				\$161	0.26%
Environmental Sanitation (Steritech)		\$266					\$266	0.43%
Telephone (Centrex)	\$2,466	\$920	\$243	\$100			\$3,728	6.04%
Cellular Charges	\$424						\$424	0.69%
Simon paging service	\$100						\$100	0.16%
Building Maintenance (CBVCAIR)		\$10,643					\$10,643	17.25%
Hazard & Flood Insurance		\$5,779					\$5,779	9.37%
Total Indirect Costs	\$2,998	\$58,288	\$327	\$100	\$0	\$0	\$61,712	100.00%
Total Expenses	\$118,871	\$510,547	\$151,783	\$310	\$497	\$386	\$782,394	
% of Total Expenses	15.2%	65.3%	19.4%	0.0%	0.1%	0.0%	100.0%	
Total Revenue less Total Expenses	(\$68,631)	(\$2,907)	(\$8,907)	\$8,015	\$240	\$652	(\$71,538)	

Appendix II: Grants Supported by CBI

User	Grant Title	Funding Agency
Back, Sudie	Glial Regulators for Treating Comorbid Posttraumatic Stress Disorder and Substance Use Disorders	DOD
Mintzer, Jacobo	Effects of Traumatic Brain Injury and Post-Traumatic Stress Disorder and Alzheimer's Disease on Brain Tau in Vietnam Veterans using ADNI	DOD
LaRue, Amanda	Hematopoietic Stem Cell-Derived Carcinoma Associated Fibroblasts in Tumor	NCI
O'Carroll, Kevin Staveley	An Orthotopic Murine Model of HCC: Immunotolerance and Prevention	NCI
Naselaris, Thomas	Representation of Visual Features in Mental Images of Complex Scenes	NEI
Benitez, Anya	White Matter Tract Integrity Biomarkers of Neurodegeneration in Aging and MCI	NIA
Mintzer, Jacobo	Longitudinal Evaluation of Amyloid Risk and Neurodegeneration - the LEARN Study. A Companion Observational Study to Anti-Amyloid Treatment in Asymptomatic Alzheimer's Disease (A4) Trial	NIA
Mintzer, Jacobo	Anti-Amyloid Treatment in Asymptomatic Alzheimer's study	NIA
Anton, Raymond	Gabapentin for Relapse Prevention: Alc. Withdrawal-Brain Gaba/Glutamate Effects	NIAAA
Anton, Raymond	RC4 Impulsivity and Drinking/Craving: Effect of a Dopamine Stabilizer Medication	NIAAA
Hanlon, Colleen	Cortical rTMS as a Tool to Change Craving and Brain Reactivity to Alcohol Cues	NIAAA
Prisciandaro, James	Neuroimaging Mechanisms of Overlap between Alcoholism and Bipolar Disorder	NIAAA
Schacht, Joe	Neural Connectivity and the Transition to Alcohol Dependence	NIAAA
Schacht, Joe	Effects of Cortical Dopamine Regulation on Drinking, Craving, and Cognitive Control	NIAAA
Flanagan, Julianne	Examining the effects of intranasal oxytocin on the corticolimbic connectivity among couples with substance abuse	NICHD
Adams, Zachary	ORWH: SCOR on Sex and Gender Factors Affecting Women's Health	NIDA
Borckardt, Jeffery	RCT of TDCS-Augmented CBT for Veterans with Pain and Opiod Misuse	NIDA
Brady, Kathleen	ORWH: SCOR on Sex and Gender Factors Affecting Women's Health	NIDA

Froeliger, Brett	Neuroimaging of Nicotine Dependence, Depression, and Emotion Regulation	NIDA
Froeliger, Brett	Translational Neuropsychopharmacology Research of Nicotine Addiction	NIDA
Hanlon, Colleen	Theta Burst TMS as a tool to change smoking behavior	NIDA
Hanlon, Colleen	Longitudinal Study of Functional Connectivity Among Cocaine Users in Treatment	NIDA
Li, Xingbao	Developing rTMS as a Potential Treatment for Nicotine Addiction	NIDA
McRae-Clark, Aimee	Neural Substrates of Emotion: Impact of Childhood Trauma and cocaine dependency	NIDA
McRae-Clark, Aimee	Advancing Varenicline as a Treatment for Cannabis Use Disorder	NIDA
Moran, Megan	Neural Substrates of Emotion: Impact of Childhood Trauma and Cocaine Dependence	NIDA
Sahlem, Gregory	Effect of TMS on Cannabis Use	NIDA
Squeglia, Lindsay	The Adolescent Brain Cognitive Development (ABCD) Study	NIDA
Bonilha, Leo	Center for the Study of Aphasia Recovery: (C-STAR)	NIDCD
Eckert, Mark	Neuroimaging of Age-Related Changes in Speech Recognition	NIDCD
Harris, Kelly	Neural Determinants of Sound Encoding in the Aging Ear and Brain	NIDCD
McTeague, Lisa	TMS fMRI	NIMH
Bowden, Mark	SC Research Center for Recovery from Stroke: Project 2 - Excitatory and Inhibitory RTMS as Mechanistic Contributors to Walking Recovery	NIGMS
Feng, Wayne	SC Research Center for Recovery from Stroke: Project 3 - Optimizing Transcranial Direct Current Stimulation Current and Electrode Montage for Stroke Patients	NIGMS
Gregory, Chris	Treating Depression and Enhancing Locomotor Recovery Post-Stroke	NIGMS
Hanlon, Colleen	SC Research Center for Recovery from Stroke: Project 1 - Investigating the Neurobiologic Basis for Loss of Cortical Laterality in Chronic Stroke Patients	NIGMS
Li, Xingbao	South Carolina Research Center for Recovery from Stroke: Pilot 4 - Paired Associative Stimulation Modulates Motor Excitability and Plasticity in Chronic Stroke Patients	NIGMS

Roberts, Donna	SC Research Center for Recovery from Stroke: fMRI Bold Signal as a Biomarker for Optimal Dosing of rTMS of Rehabilitation in Chronic Stroke Patients	NIGMS
Brown, Truman	EEG/fMRI Controlled TMS Real-Time Neural Feedback in Anti-Depressive Treatment	NIMH
Cortese, Bernadette	Trauma-Related Olfactory Cues in Posttraumatic Stress Disorder	NIMH
Bonilha, Leo	Presurgical applications of FMRI in Epilepsy	NINDS
Revuelta, Gonzalo	Identification of Gait and Imaging Markers for Freezing of Gait in Parkinson's Disease	NINDS
Turan, Tanya	Characterization of Intracranial Atherosclerotic Stenosis Using High Resolution MRI	NINDS
Back, Sudie	CAP - Doxazosin in the Treatment of Co-Occurring PTSD and Alcohol Use Disorders	VA
Gregory, Chris	Contract for Neuro-Rehabilitation Engineering Services: Skeletal Muscle Plasticity as an Indicator of Functional Performance Post Stroke	VA
Gregory, Chris	Development of a Rehabilitation Research Program to Study the Biomechanics of Walking Following Incomplete Spinal Cord Injury	VA
Marriott, Bernadette	Reduction in Suicide Risk: A Double-Blind, Placebo-Controlled Trial of Omega3 Fatty Acid Supplementation among Military Veterans	VA
George, Mark	MRI Analysis of Coil Position to Improve the rTMS Treatment of Depression	VA MIRECC
Bonilha, Leo	Wide Spectrum Investigation of Stroke Outcome Disparities on Multiple Levels (WISSDOM)	AHA
Prisciandaro, James	A Longitudinal Investigation of Glutamate Dysregulation in Early Stage Alcoholics	Alcoholic Bec. Med Re
Holmstedt, Christine	Navigate Embolic Stroke of Unknown Source	Bayer HealthCare
Clark, David	Efficacy of monthly doses of Aducanumab in slowing cognitive and functional impairment as measured by changes in the CDR-SB score as compared with Placebo in subjects with early AD	Biogen
Squeglia, Lindsay	Neural Correlates of Behavioral Treatment Targets in Teens with Substance Use Problems and Post-Traumatic Stress	Chairman's Research Development Fund
Feng, Wayne	S-STREAM: A Multicenter Observational Study to Evaluate the Simplified-Stroke Rehabilitation Assessment of Movement	Daiichi Sankyo
Feng, Wayne	Motor Stroke Rehabilitation Clinical Trial	Halo Neuroscience Corp
Vaden, Kenneth	Adaptive control of auditory representations in listeners with central auditory processing disorder	Hearing Health Foundation

Adisetiyo, Vitria	Differential and Predictive Brain Biomarkers of ADHD with High Risk Substance Use Disorders	Klingenstein Third Generation Foundation
Turan, Tanya	Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial (CREST-2) Trial	Mayo Clinic
George, Mark	A Randomized, sham-controlled trial of the safety and effectiveness of Neurostar Transcranial Magnetic Stimulation (TMS) Therapy in depressed adolescents.	Neuronetics
Froeliger, Brett	fMRI to investigate cognitive and emotional response during chronic pain treatment with opioids	Other
George, Mark	Focal Electrically-Administered Seizure Therapy (FEAST)	Other
Mintzer, Jacobo	A Double Blind, Randomized, Placebo Controlled, Parallel Group Study to Simultaneously Qualify a Biomarker Algorithm for Prognosis of Risk of Developing MCI Due to Alzheimer's Disease and to Test the Safety and Efficacy of Pioglitazone	Takeda
Bachman, David	Trans-Cranial Direct Current Stimulation to Treat Aphasia: Phase II Trial	University of SC



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