Center for Biomedical Imaging

Annual Report
FY2023

(issued August 2023)

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

MUSC
MEDICAL UNIVERSITY of SOUTH CAROLINA

Introduction & Background

The Center for Biomedical Imaging (CBI) was established by the Board of Trustees in 2010 as a *University Designated Center* under the direction of the Vice President for Research. This initiative has enabled MUSC to be competitive with other leading academic institutions by developing and maintaining the infrastructure and collaborative environment needed to support advanced biomedical imaging research.

The CBI facilities are located in the 30 Bee Street Building and on the second floor of the Bioengineering Building at 68 President Street. It is administered through the Department of Neuroscience, with administrative offices located on the fourth floor of the Basic Science Building. The CBI is a resource for basic and clinical scientists to discover new information about normal and disease processes and 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 postdocs to help develop future leaders in biomedical imaging, 3) recruitment of outstanding biomedical investigators, 4) discovery of new clinical applications of imaging and their practice in the clinical arena, and 5) promotion of basic research in biomedical imaging and related fields. The CBI's website can be found here.

In fiscal year 2023, the CBI provided imaging support and resources for a total of 58 grants, 34 of which were NIH grants to MUSC (Appendix II). The CBI also supports MUSC faculty by allowing development time to qualified investigators for collaborations and the collection of pilot data. In fiscal year 2023, the CBI underwrote approximately $155K 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, to discover new ways to study normal and disease processes, to develop and apply this knowledge to clinically relevant research, and to translate these advances to the patient community while fostering a quality education and training environment.

Vision Statement:

The vision of the CBI is to serve the MUSC community as an integrated and multidisciplinary center for biomedical imaging research with mutually supportive and valued interactions among basic science and clinical departments.

Administration

Leadership:

In FY23, the leadership of the CBI consisted of:

Dr. Jens H. Jensen, Director
Dr. Maria Fatima Falangola, Associate Director of Preclinical MRI

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 goals of the CBI reflect the overall priorities of MUSC.

Members of the IAC in FY23 were:

Mr. Joseph Bennett	Dr. Lori McMahon
Dr. Christopher Cowan (Chair)	Dr. Lisa McTeague
Dr. Maria Fatima Falangola	Dr. Anand Mehta
Dr. Jens Jensen	Dr. Lindsay Squeglia
Dr. Steven Kautz	Dr. Thomas Uhde

CBI leadership holds regular "Advisory Committee Meetings", as well as "Town Hall Meetings" in which all users are able to express their views and opinions. These meetings were held on:

CBI Advisory Committee	**Town Hall**
September 26, 2022	September 20, 2022
February 1, 2023	January 17, 2023
June 17, 2023	May 16, 2023

Business Management:

In FY23, business operations for the CBI were managed by Emily Clark under the supervision of Joseph Bennett, who is the administrative manager for the Department of Neuroscience.

Operations

Faculty & Staff:

The following faculty & staff were fully or partially supported by the CBI in FY23:

Bennett, Joseph	Administrative Manager
Clark, Emily	Administrative Coordinator II
Coatsworth, James	3T MRI Program Manager
Doose, Jayce	Biomedical Engineer
Falangola, Fatima	Assistant Professor, Associate Director of Preclinical MRI
Fleury, Tom	Facilities/Information Manager
Henderson, Scott	3T MRI Program Manager
Jensen, Jens	Professor, Director
Roberts, Donna	Professor
Voltin, Josh	7T MRI Research Specialist
Smalls, Vonetta	Administrative Assistant

Human imaging Resources:

Human MRI studies take place in the CBI's 30 Bee St. facility, which houses a 3 Tesla (T) Prisma^{fit} MRI system, six interview rooms, office space, a mock scanner, an electronics lab, and a waiting area for subjects. In FY17, the CBI upgraded the Siemens MAGNETOM Trio 3T MRI system to a Siemens MAGNETOM Prisma^{fit} 3T MRI system. This upgrade has significantly benefited a multitude of National Institutes of Health (NIH) funded researchers, as well as researchers funded from other sources, in the fields of substance abuse, addiction, aging, Alzheimer's disease, Parkinson's disease, attention-deficit hyperactivity disorder, stroke, and basic neuroscience. The scanner operates with a 100% mandate for research and is covered by a Master Research Agreement with Siemens.

The current system is the only human MRI research-dedicated scanner at MUSC, and one of only two human research-dedicated scanners in South Carolina. The mock scanner is a full-size replica of the 3T MRI made from plywood and other building materials designed to look and sound like a real system. It is available 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.

Preclinical (Small Animal) Imaging Resources:

The Bruker BioSpec 70/30 MRI scanner is a multipurpose system for high-resolution MR spectroscopy and imaging of small animals. This magnet operates at a field level of 7T and is located on the second floor of the Bioengineering Building. The 7T MRI is ideal for 2D and/or 3D high-resolution anatomical imaging as well as diffusion, flow, cardiac, dynamic contrast,

functional, and chemical shift imaging. Adjacent to the scanner is a surgery room that is available to support imaging studies.

The 7T system is 16 years old and no longer fully supported by the manufacturer. The cold head was upgraded in FY20, but the electronics are now past end-of-life and would be difficult to repair. A major upgrade of the electronics may be needed within a few years in order to keep the scanner in operation. During the past year, 2 funded studies and 4 pilot projects utilized this resource. Recently, 3 NIH grants have been funded that have plans to utilize the 7T system.

MRI Safety Training:

The CBI staff conducts regular safety training classes for researchers who use CBI resources. Completion of this course is required of all personnel before they are allowed to work in the scanning areas. In FY23, these were held on 7/12/22, 8/14/22, 9/13/22, 10/11/22, 11/7/22, 12/13/22, 1/10/23, 2/6/23, 3/14/23, 4/11/23, 5/12/23, and 6/14/23.

MRI Safety Committee:

The CBI has established an MRI Safety Committee for approving and overseeing safety procedures for both scanners. In particular, ancillary equipment must be evaluated by this committee prior to being used within the scanner suites. The committee members are Jayce Doose (Chair), James Coatsworth, Scott Henderson, and Tom Fleury. In FY23, 6 new ancillary devices were approved for operation with the 3T MRI system.

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 protocols to reserve time for using CBI resources including scanners and interview rooms.

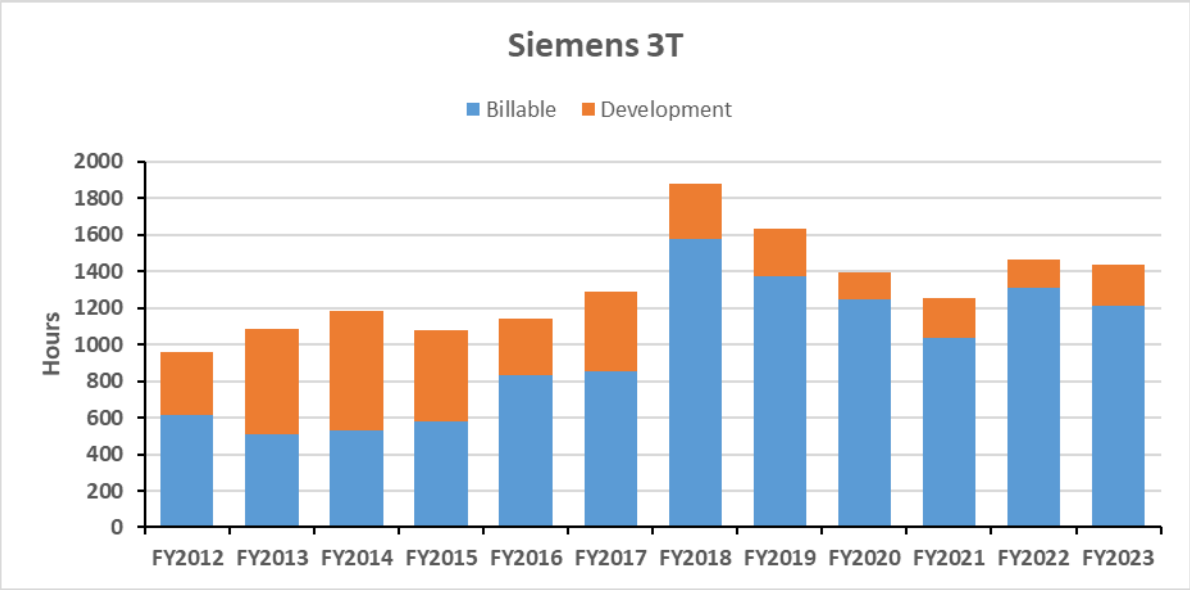
Early Stage Investigator Program:

MUSC researchers who qualify as early stage investigators (ESI), according to criteria established by the NIH, are eligible to receive subsidies that partially defray the cost of MRI scans for certain types of small grants. In FY23, the CBI provided a total of $72,312.50 in ESI subsidies to 12 MUSC faculty and postdocs. This program allows young imaging scientists with limited financial resources to pursue studies that would otherwise be cost prohibitive.

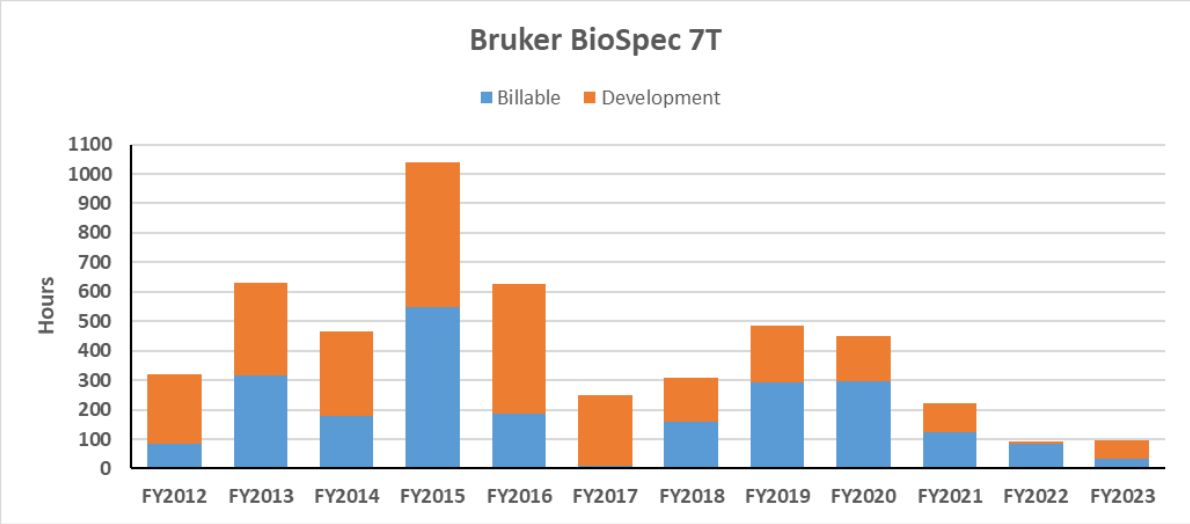
Cancellation Reduction Incentive Scheduling Program:

In order to encourage responsible scheduling practices for scans on the 3T MRI system, a Cancellation Reduction Incentive Scheduling Program (CRISP) was introduced in January of 2020. CRISP provides credits for principal investigators based on their “last minute” (i.e., less than 72 hrs prior to scheduled scan time) cancellation rate. In FY23, CRISP credits totaled $4,410.26.

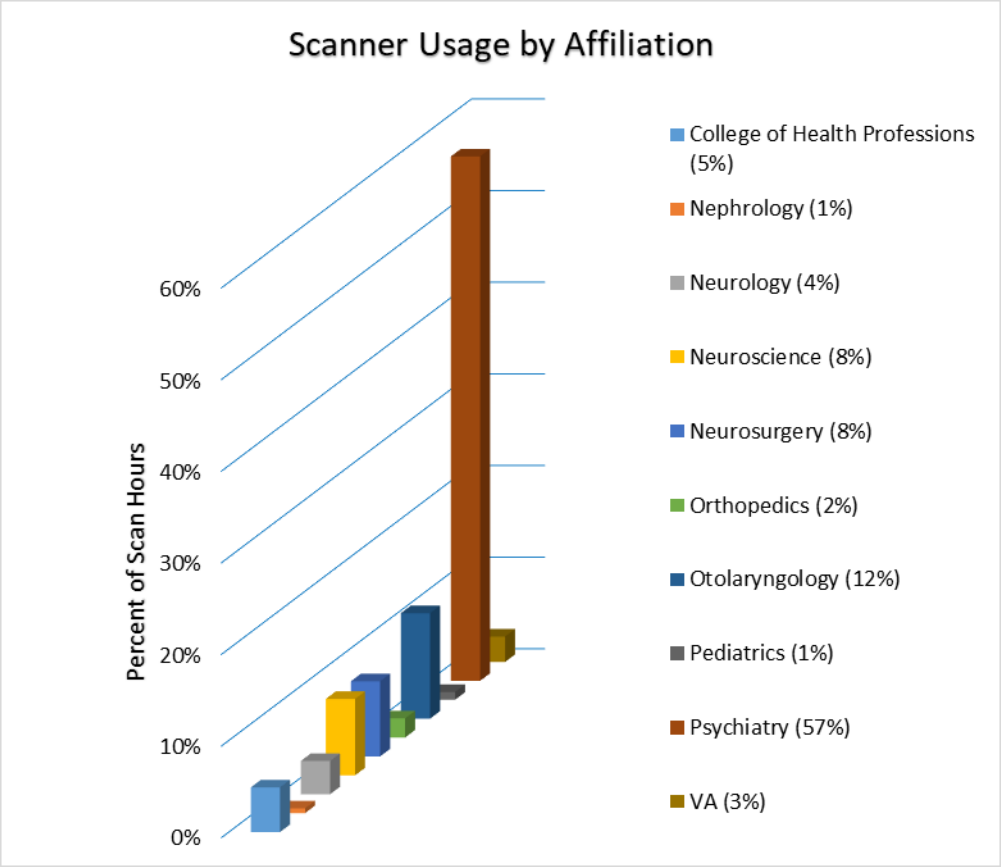
Equipment Usage:



Annual scanner hours used by researchers from FY12 through FY23 for the Siemens 3T MRI system. Development time is free of charge but only for restricted purposes.



Annual scanner hours used by researchers from FY12 through FY23 for the Bruker 7T MRI system.



Breakdown of scanner usage (combined 3T and 7T) by MUSC College of Medicine department or other affiliation. In FY23, the largest user of CBI resources was the Department of Psychiatry and Behavioral Sciences (57%).

Help Requests:

To support the CBI user community, a web-based ticket system is used to manage help requests. In FY23, the CBI staff successfully responded to 68 individual tickets.

CBI Faculty

The CBI is supported by a multidisciplinary group of 19 faculty members and 7 staff representing various clinical and basic science departments at MUSC. Collaboration among faculty in the development of new and cross-disciplinary methodologies is strongly encouraged.

Faculty members contribute imaging-related seminar lectures, provide advice to the CBI leadership, and generally promote the overall well-being of the CBI. They are expected to take part in regularly scheduled CBI seminars, which provide a forum for researchers to have in-depth technical discussions. Faculty members are expect to give lectures on their research to the CBI community every few years if requested. The CBI faculty for FY23 are listed below:

Aghamoosa, Stephanie, PhD	Assistant Professor	Health Sci. & Research
Badran, Bashar, PhD	Assistant Professor	Psychiatry
Benitez, Andreana, PhD	Associate Professor	Neurology
Borckardt, Jeffrey, PhD	Professor	Psychiatry
Eckert, Mark, PhD	Professor	Otolaryngology
Falangola, Maria, MD/PhD	Assistant Professor, Assoc. Dir.	Neuroscience
George, Mark, MD	Distinguished University Prof.	Psychiatry
Harris, Kelly, PhD	Professor	Otolaryngology
Heise, Kirstin-Friederike, PhD	Assistant Professor	Health Sci. & Research
Jenkins, Dorothea, MD	Professor	Pediatrics
Jensen, Jens, PhD	Professor, Director	Neuroscience
Joseph, Jane, PhD	Professor	Neuroscience
Li, Xingbao, MD	Associate Professor	Psychiatry
McTeague, Lisa, PhD	Associate Professor	Psychiatry
Prisciandaro, James, PhD	Associate Professor	Psychiatry
Roberts, Donna, MD	Professor	Radiology
Rowland, Nathan, MD/PhD	Associate Professor	Neurosurgery
Spampinato, Vittoria, MD	Professor	Radiology
Squeglia, Lindsay, PhD	Associate Professor	Psychiatry

Education

CBI Seminars:

The CBI regularly hosts lectures given by both visiting speakers and MUSC investigators. For the past five years, these have been organized by Drs. Kelly Harris and Lisa McTeague. CBI seminars for FY23 are listed below:

Date	Presenter	Title	Institution
9/14/2022	Dr. Anna Kirkland	The Effects of N-Acetylcysteine on Brain Metabolite Levels in Adolescent Binge Drinkers	MUSC
10/1/2022	Dr. Bashar Badran	Multi-modal Functional Neuroimaging to Understand and Optimize Electrical and Ultrasonic Stimulation Therapies	MUSC
11/9/2022	Siddhartha Dhiman, MS	Diffusion MRI Processing with PyDesigner	MUSC
12/14/2022	Dr. Christopher Sege	Multi-Modal Measurement of Escape/Avoidance Dispositions: Toward Precision Modulation of Fear and Anxiety	MUSC
1/11/2023	Dr. Laura Jonkman	A Multi-Scale Approach in Neurodegenerative Disease: from MRI to Microscope	UMC - Amsterdam
3/8/2023	Dr. Stephanie Zaragoza	Leveraging Functional Connectivity to Detect Cognitive Change in Aging and Alzheimer's Disease: Implications for Cognitive Rehabilitation	MUSC
4/12/2023	Dr. Andreana Benitez	Advanced Diffusion MRI of Aging and Alzheimer's Disease	MUSC
5/10/2023	Dr. Francesco Versace	Leveraging Neuroaffective Biomarkers to Personalize Treatments for Substance Use Disorders	The University of Texas - Houston
6/14/2023	Dr. Logan Dowdle	Higher, Better, Faster...Noisier: Using Techniques, Task Demands and 7T fMRI to Understand Visual Processing	University of Minnesota

CBI Featured Images:

The CBI website periodically features images that highlight research by MUSC investigators. For FY23, CBI featured images were contributed by Stephanie Aghamoosa (née Zaragoza), Daniel Lench (Revuelta lab), Siddhartha Dhiman (Benitez and Jensen labs), and Bashar Badran.

Appendix I: End-of-Year Budget FY23

Budget Category	Admin	3T	7T	TOTALS	% of Category
Revenue					
Operating Revenue	0.00	897,050.00	5,800.00	902,850.00	
Non-Operating Revenue	0	-258.31	0	(258.31)	
Total Revenue	**0.00**	**896,791.69**	**5,800.00**	**902,591.69**	
Expenses					
Salaries and Fringe Benefits	48,286.42	477,408.56	58,624.07	584,319.05	62%
60010:Payroll - Earnings	*33,326.55*	*329,624.21*	*45,534.39*	*418,341.37*	
60020:Payroll - Benefits	*14,959.87*	*134,984.88*	*13,089.68*	*165,977.68*	
Materials, Supplies and Services	74,448.04	171,645.44	38,764.88	284,858.36	30%
61010:Services	*74,104.03*	*44,872.82*	*36,074.00*	*275,712.56*	
61020:Medical/Pharmaceutical Supplies	*130.71*	*833.13*	*2,095.72*	*3,012.05*	
61030:Supplies	*213.3*	*5265.02*	*595.16*	*6,133.75*	
Facility Related Expenses	2,002.42	64,621.13	1,594.50	68,218.05	7%
61040:Insurance	*0.00*	*7,183.35*	*1,033.65*	*18,242.59*	
61060:Leases	*0.00*	*22,015.81*	*0.00*	*29,354.41*	
61080:Utilities	*1,782.77*	*2,487.71*	*530.75*	*13,396.39*	
61050:Other	*219.65*	*236.92*	*30.10*	*7,224.66*	
Total Expenses	**124,736.88**	**713,675.13**	**98,983.45**	**937,395.46**	
% of Total Expenses	*13%*	*76%*	*11%*		
Net Income	**(124,736.88)**	**183,116.56**	**(93,183.45)**	**(34,803.77)**	

Appendix II: Grants Supported by CBI for FY23

PI	Funding Source	Grant Title
Sudie Back	**NIAAA**	Oxytocin to Enhance Integrated Exposure-Based Treatment of Co-occurring Alcohol Use Disorder and PTSD
Bashar Badran	**NIGMS**	Optimization of Closed-loop Transcutaneous Auricular Vagus Nerve Stimulation (taVNS) as a Neurorehabilitation Tool
Bashar Badran	**NIDA**	Neurocircuit Strategy to Decrease Cocaine Cue Reactivity
Bashar Badran	**NINDS**	Understanding the Mechanistic, Neurophysiological, and Antinociceptive Effects of Transcutaneous Auricular Neurostimulation for Treatment of Chronic Pain
Kelly Barth	**NIAMS**	The BEST Trial: Biomarkers for Evaluating Spine Treatments
Andreana Benitez	**NIDA**	MUSC Specialized Center of Research Excellence (SCORE) on Sex Differences: Stress-Reactivity and Cannabis Use in Cannabis-Using Older Adults
Andreana Benitez	**NIA**	Quantitative Neuroimaging Assessment of White Matter Integrity in the Context of Aging and AD
Olga Brawman-Mintzer	**VA**	ADNI3
Jessica Broadway	**F. Hoffmann-La Roche Ltd**	A Phase III, Multicenter, Randomized, Parallel-Group, Double-Blind, Placebo-Controlled Study To Evaluate The Efficacy And Safety Of Gantenerumab In Participants At Risk For Or At The Earliest Stages Of Alzheimer's Disease
James Dias	**Hearing Health Foundation**	Neural Determinants of Age-Related Change in Auditory-Visual Speech Processing
Mark Eckert	**NIDCD**	Experimental and Clinical Studies of Presbyacusis
Wayne Fitzgibbon	**Other**	Treatment of PKD1 RC/RC Mice with Formoterol
Julianne Flanagan	**NIAAA**	Oxytocin to enhance alcohol behavioral couple therapy

Mark George	**Tiny Blue Dot Foundation**	T1 structural scan for TMS-EEG project
Mark George	**Other**	Clinical Feasibility of Low Intensity Focused Ultrasound Pulsation for the Treatment of Generalized Anxiety Disorder
Kelly Harris	**NIDCD**	Experimental and Clinical Studies of Presbyacusis
Dieter Haemmerich	**NCI**	Computational model of targeted drug delivery
Vanessa Hinson	**UCB SA**	A double-blind, placebo-controlled, randomized, 18 month Phase 2a study to evaluate the efficacy, safety, tolerability, and pharmacokinetics of oral UCB0599 in study participants with early Parkinson's Disease
Amber Jarnecke	**SCTR**	Examining the Neural Processes Underlying Social Reward for Individuals with PTSD and Trauma-resilient Individuals
Amber Jarnecke	**NIAAA**	Identifying the neurobehavioral signature of individuals with AUD and comorbid PTSD
Jens Jensen	**NIDA**	Establishing the Neurostructural and Clinical Impact of Brain Iron Dysregulation in Cocaine Use Disorder
Jens Jensen/ M. Fatima Falangola	**NIA**	Assessing brain microstructure in Alzheimer's disease with advanced diffusion MRI
Jane Joseph	**NIA**	Using connectomics to characterize risk for Alzheimer's Disease
Jane Joseph	**DOD**	Connectome biomarkers for predicting Alzheimer's risk in traumatic brain injury
Steven Kautz	**Other**	Cortical network connectivity and impaired coordination
John Kindred	**NICHD**	Effects of tDCS on post-stroke fatigue and inflammation
Daniel Lench	**NINDS**	A Neural Basis for Cognitive Decline Following Deep Brain Stimulation
Xingbao Li	**NIDA**	RTMS targets to neural circuity for smoking cessation
Andrew Mannett	**Psychiatry Chairman's Research Development Fund**	Tracking Brain Biomarkers and Renormalization Associated with Antidepressant Transcranial Magnetic Stimulation Therapy
Carolyn McClaskey	**Hearing Health Foundation**	Age and hearing-loss effects on subcortical envelope encoding

Lisa McTeague	**NIAA**	MPFC Theta Burst Stimulation as a Treatment Tool for Alcohol Use Disorder: Effects on Drinking and Incentive Salience
Lisa McTeague	**Brain and Behavior Research Foundation**	Accelerated Repetitive TMS for Affective Dysfunction: Establishing the Dose-Response Curve
Lisa McTeague	**Attune Neurosciences**	Attune CMT tFUS
Lisa McTeague	**VA**	Developing a Novel rTMS Intervention for Transdiagnostic Psychosocial Rehabilitation: A Dose-finding Study
William Mellick	**NIAAA**	An investigation of reward brain circuitry structure and function in individuals with co-occurring alcohol use disorder and bipolar disorder and their unaffected offspring
William Mellick	**NIAAA**	Imaging Framework for Testing GABAergic/glutamatergic Drugs in Bipolar Alcoholics
William Mellick	**NIAAA**	Effects of a Novel mGluR5 Negative Allosteric Modulator on Alcohol Drinking, Neurochemistry, and Brain Reactivity to Alcohol Cues in Alcohol Use Disorder
Nicholas Milano	**Biogen**	Multicenter, Safety Study of BIIB037 (aducanumab) in Subjects with Alzheimer's disease Who Had Previously Participated in the Aducanumab Studies 221AD103, 221AD301, 221AD302 and 221AD205
Jacobo Mintzer	**Eisai Inc.**	A Placebo-Controlled, Double-Blind, Parallel-Treatment Arm, 216 Week Study to Evaluate Efficacy and Safety of Treatment With BAN2401 in Subjects With Preclinical Alzheimer's Disease and Elevated Amyloid (A45 Trial) and in Subjects With Early Preclinical Alzheimer's Disease and Intermediate Amyloid (A3 Trial)
Jacobo Mintzer	**VA**	Long-Term Nicotine Treatment of Mild Cognitive Impairment
Jacobo Mintzer	**NIA**	Anti-amyloid treatment in asymptomatic Alzheimer's Disease (A4)
Jacobo Mintzer	**VA**	Observational study of cognitively normal, non-amyloidopathic subjects parallel to the A4 Study

Jacobo Mintzer	**National Endowment for the Arts & AARP**	To support a randomized experiment testing music's impact on the brains of older adults with moderate-to-severe Alzheimer's disease
James Prisciandaro	**Milken Institute Center For Strategic Philanthropy**	Experimentally Evaluating the Hypothesized Mechanism of Action of N-acetylcysteine for Bipolar Disorder
James Prisciandaro	**NIDA**	Gabapentin for Restoring GABA/gultamate Homeostasis in Co-occurring Bipolar and Cannabis Use Disorders: A Randomized, Double-blind, Placebo-controlled, Parallel-group,
James Prisciandaro	**NIAAA**	Imaging Framework for Testing GABAergic/glutamatergic Drugs in Bipolar Alcoholics
John Rhodes	**NHLBI**	Does the mind have ability to resist damage of brain after CHD
Nathan Rowland	**Other**	Combining noninvasive brain stimulation and functional neuroimaging in patients with stroke
Nathan Rowland	**Other**	Effect of transcranial direct current stimulation on cortical oscillations during a virtual reality task
Michael Saladin	**NIDA**	Behavioral & Integrative treatment development program
Rodney Schlosser	**NIDCD**	Olfactory Dysfunction in Aging Adults
Chris Sege	**NIMH**	Modeling and Modulating Mechanisms of Escape, Avoidance, and Approach in the Anxiety Disorder Spectrum
Na Jin Seo	**NICHD**	Concomitant sensory stimulation during therapy to enhance hand functional recovery post stroke
Lindsay Squeglia	**NIAA**	Neurobehavioral effects of cannabidiol in youth alcohol use disorder
Lindsay Squeglia	**NIDA**	The Adolescent Brain Cognitive Development (ABCD) Study
Lindsay Squeglia/ Anna Kirkland	**SCORE**	Investigating Neural and Microbiome Sex Differences in Adolescent Alcohol Use
Janina Wilmskoetter	**NIDCD**	To assess comparable efficacy of aphasia therapy administered via telerehab (aphasia remote therapy; ART) to aphasia therapy administered in clinic (in-clinic therapy; I-CT).
Yongren Wu	**NIDCR**	Improvement of animal models for stem cell-based TMJ regeneration

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