

Center for Biomedical Imaging

Annual Report FY2024

(issued August 2024)

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.



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 2024, the CBI provided imaging support and resources for a total of 55 grants, 28 of which were NIH grants to MUSC (Appendix III). The CBI also supports MUSC faculty by allowing development time to qualified investigators for collaborations and the collection of pilot data. In fiscal year 2024, the CBI underwrote approximately \$149K 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 FY24, 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 FY24 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

October 10, 2023
February 13, 2024
June 11, 2024

Town Hall

September 19, 2023
January 16, 2024
May 21, 2024

Business Management:

In FY24, 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 FY24:

Bennett, Joseph	Administrative Manager II
Clark, Emily	Grants Administrator 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
Spampinato, Vittoria	Professor, Radiologist
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 17 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, 3 funded studies utilized this resource, two of which are NIH grants.

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 FY24, these were held on 8/14/23, 9/13/23, 10/10/23, 11/14/23, 12/13/23, 1/10/24, 2/13/24, 3/13/24, 4/8/24, 5/8/24, and 6/12/24.

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 FY24, 2 new ancillary devices were approved for operation with the 3T MRI system.

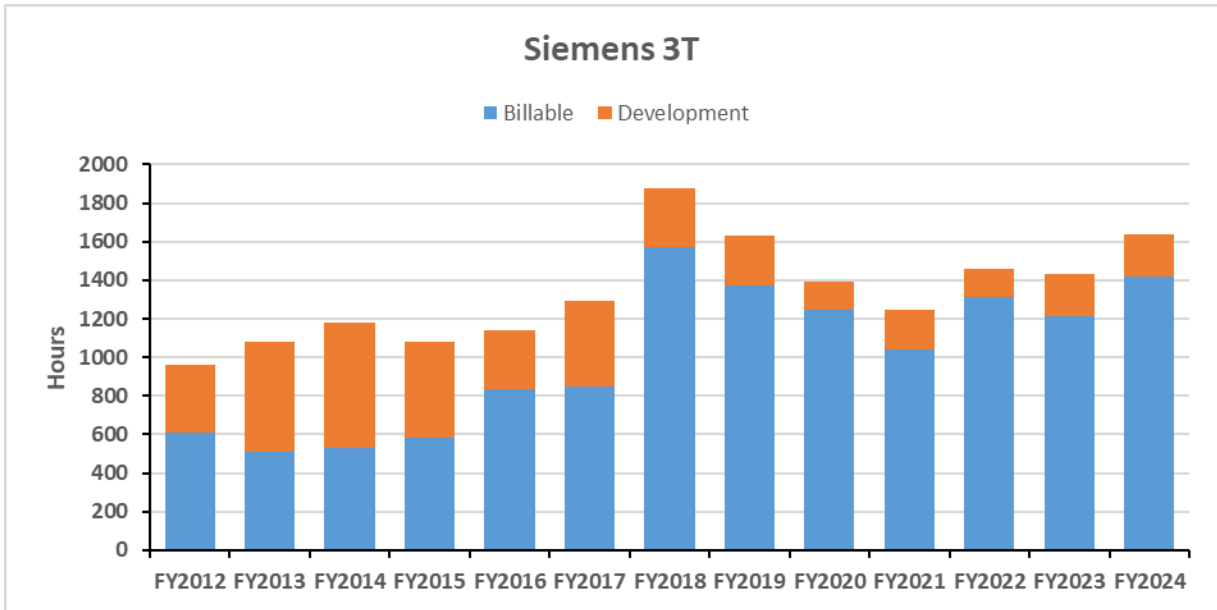
Scheduling:

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.

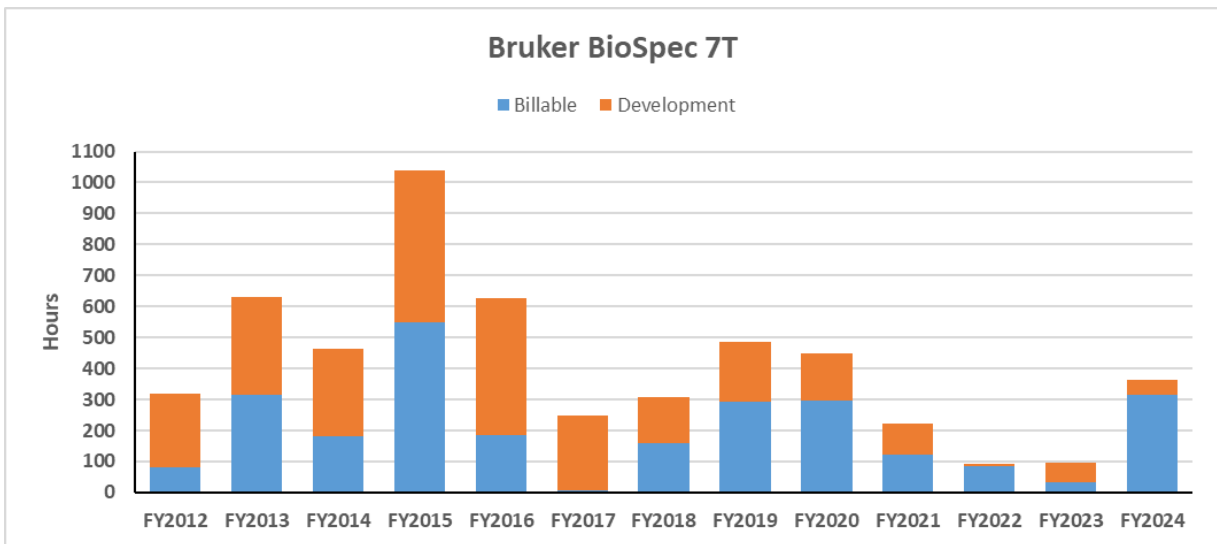
Cancellation Reduction Incentive Scheduling Program:

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. Until December 31, 2023, CRISP provided credits for principal investigators based on their "last minute" (i.e., less than 72 hrs prior to scheduled scan time) cancellation rate. In FY24, CRISP credits totaled \$2881.96. As of January 1, 2024, CRISP was restructured to eliminate credits. Instead, PIs having low cancellation rates are now awarded scheduling vouchers for extra slots during Prime Time hours (See Appendix II). This change is intended to improve engagement of research study teams, who typically manage participant scheduling and appreciate having greater access to Prime Time hours. In FY24, 22 scheduling vouchers were awarded.

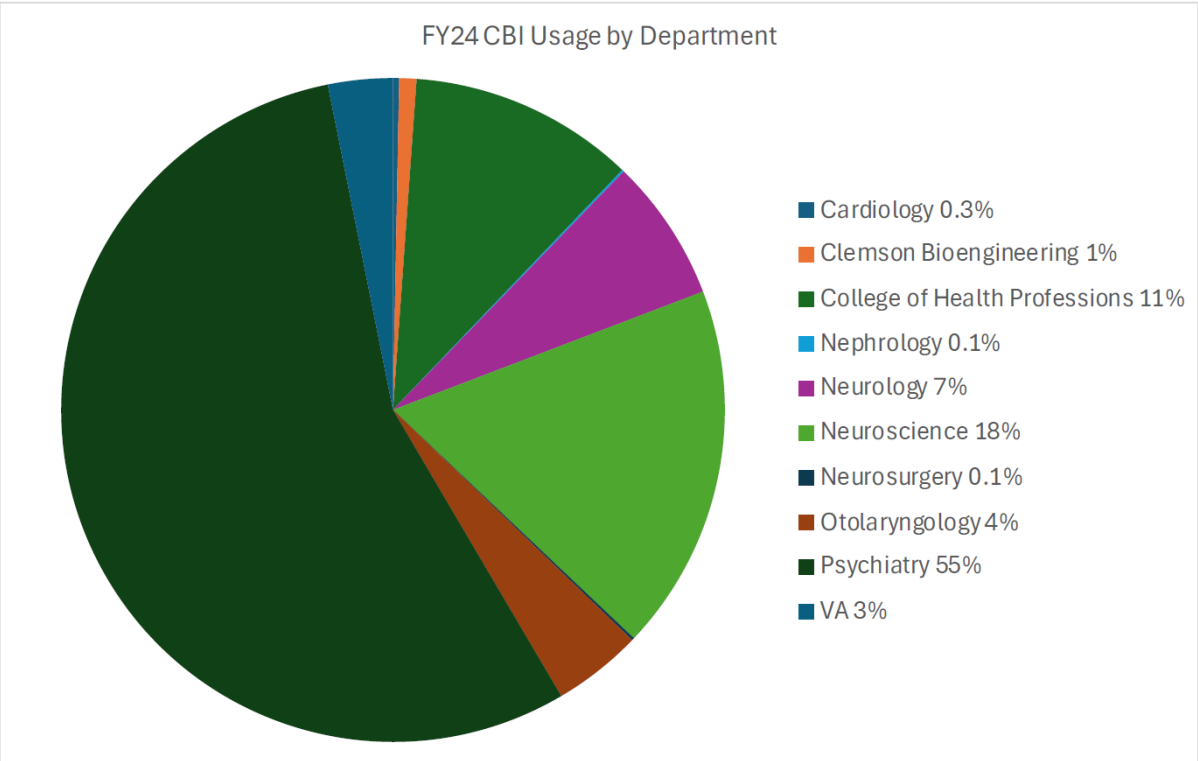
Equipment Usage:



Annual scanner hours used by researchers from FY12 through FY24 on 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 FY24 on the Bruker 7T MRI system.



Breakdown of scanner usage (combined 3T and 7T) by MUSC College of Medicine department or other affiliation. In FY24, the largest user of CBI resources was the Department of Psychiatry and Behavioral Sciences 55%.

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 FY24, the CBI provided a total of \$90,756.25 in ESI subsidies to 18 MUSC faculty and postdocs. This program allows young imaging scientists with limited financial resources to pursue studies that would otherwise be cost prohibitive.

Help Requests:

To support the CBI user community, a web-based ticket system is used to manage help requests. In FY24, the CBI staff successfully responded to 70 individual tickets.

CBI Faculty

The CBI is supported by a multidisciplinary group of 22 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 expected to give lectures on their research to the CBI community every few years if requested. The CBI faculty for FY24 are listed below:

Aghamoosa, Stephanie, PhD	Assistant Professor	Health Sci. & Research
Badran, Bashar, PhD	Associate Professor	Psychiatry
Benitez, Andreana, PhD	Associate Professor	Neurology
Borckardt, Jeffrey, PhD	Professor	Psychiatry
Kevin Caulfield, PhD	Assistant Professor	Psychiatry
Andrew Chen, PhD	Assistant Professor	Public Health Sciences
Dias, James, PhD	Assistant Professor	Otolaryngology
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	Professor	Psychiatry
Roberts, Donna, MD	Professor	Radiology
Rowland, Nathan, MD/PhD	Associate Professor	Neurosurgery
Spampinato, Vittoria, MD	Professor	Radiology
Squeglia, Lindsay, PhD	Professor	Psychiatry

Education

CBI Seminars:

The CBI regularly hosts lectures given by both visiting speakers and MUSC investigators. For the past year, these were organized by Drs. Kelly Harris and Lisa McTeague. CBI seminars for FY24 are listed below:

Date	Presenter	Title	Institution
9/13/23	Dr. Caterina Gratton	Studying Individual Human Brain Networks	Florida State University
10/11/23	Dr. Xialong Peng	Explore Dynamic Brain States at the Individual Level	MUSC
11/8/23	Dr. Andrew Chen	Novel Methods for Statistical Analysis of Covariance Structures	MUSC
12/13/23	Dr. Kevin Caulfield	Imagining-informed Personalized Brain Stimulation	MUSC
1/10/24	Dr. Hunter Moss	Investigating White Matter Microstructure Using Advanced Diffusion MRI and the Fiber Orientation Density Function	MUSC
3/13/24	Dr. Jyrki Ahveninen	Multimodal Studies on Attention, Working Memory, and Cross-modal Influences in Auditory Networks	Harvard Medical School, Massachusetts General Hospital
4/10/24	Dr. James Dias	Age-Related Changes in Cortical Structure and Function Modulating Audiovisual Speech Perception	MUSC
5/22/24	Dr. Lucia Navarro de Lara	Concurrent TMS/fMRI/EEG: Towards Non-invasive High-Resolution Causal Mapping of Human Brain Function	Harvard Medical School, Massachusetts General Hospital

CBI Featured Images:

The [CBI website](#) periodically features images that highlight research by MUSC investigators. For FY24, CBI featured images were contributed by Josh Voltin (Falangola and Jensen labs), Mark Eckert, Jens Jensen, and Kirstin-Friederike Heise.

MRI Safety Lab for Medical Students:

On October 31, 2023, the CBI hosted an all-day MRI Safety Lab for 3rd year medical students. Small groups of students were brought into the scanner room to experience this environment firsthand and were instructed in MRI safety by CBI staff. There were 14 groups with approximately 14 students each.

Appendix I: End-of-Year Budget FY24

FY24 EOY Budget				
Budget Category	Admin	3T	7T	TOTAL
Revenue				
Operating Revenue	2,340	932,065	53,750	988,155
42010:Sales and Services	4,615	929,790	53,750	
44010:Other Operating Revenues	-2,275	2,275	0	
Non-Operating Revenue	0	0	0	0
45090:Internal Transfers	0	0	0	
Other Revenue	0	0	0	0
Total Revenue	2,340	932,065	53,750	988,155
Expenses				
Salaries and Fringe Benefits	45,749	392,479	52,905	491,133
60010:Payroll - Earnings	31,099	272,057	39,026	
60020:Payroll - Benefits	14,650	120,421	13,879	
Materials, Supplies and Services	117,843	157,385	37,620	312,849
61010:Services	117,807	138,942	36,671	
61020:Medical/Pharmaceutical Supplies	0	12,947	949	
61030:Supplies	36	5,497	0	
Facility Related Expenses	25,519	661	290	26,470
61040:Insurance	183	0	0	
61060:Leases	17,123	0	0	
61080:Utilities	8,212	661	290	
Other Expenses	920	14,780	1,072	16,773
61050:Other	1,271	14,780	1,072	
Total Expenses	190,032	565,305	91,887	847,224
<i>% of Total Expenses</i>	22%	67%	11%	
Net Income	(\$187,692)	\$366,760	(\$38,137)	\$140,931

Appendix II: Operating Hours for Prisma 3T

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8:00						
8:30						
9:00		Off Peak Time				
9:30						
10:00						
10:30						
11:00						
11:30						
12:00						
12:30						
1:00		Prime Time				
1:30						
2:00						
2:30						
3:00						
3:30		JIT		JIT	JIT	
4:00						
4:30						
5:00						
5:30						
6:00		Off Peak Time				
6:30						
7:00						
7:30						
8:00						
8:30						

PRIME TIME	JUST-IN-TIME (JIT)	OFF-PEAK TIME
Mon & Wed, 10:00am - 5:00pm; Tue, Thur & Fri, 10:00am - 3:30pm	Tue, Thur, & Fri, 3:30 – 5:00pm	Mon - Fri, 8:30 - 10:00 am Mon - Fri, 5:00 - 8:00 pm Sat, 9:00 am – 6:00 pm
Maximum of two bookings per week per study. ¹	Maximum of two (Prime Time + Just-In-Time) bookings per week per approved study. ¹	No limits on scheduling billable scans.
Can only be used for billable scans. ¹	Can only be used for billable scans. ²	Max of 2 hours of Dev Time per week per PI. ^{4,5}
	Requires preapproval to utilize. ³	

- 1) Any scan that begins or ends during Prime Time and JIT hours will count toward the two bookings/week limit. If not booked within one week of table time, Prime Time slots will be made available to any study. If JIT slots are not booked within 72 hours of table time, these will be made available to any billable study. The use of scan time under these conditions will not count toward weekly booking limits for billable studies.
- 2) Just-In-Time may also be used for Development Time, but only if scheduled on the same day as the scan.
- 3) Approval may be requested by emailing cbi@muscc.edu. Your request must explain why your protocol needs Just-In-Time scheduling based upon the specific requirements of your protocol and not just a desire to use this mechanism for the sake of convenience.
- 4) PI must be approved by CBI. More information may be obtained by emailing cbi@muscc.edu.
- 5) Two-hour weekly limit on Development Time also includes time scheduled under notes 1) and 2) above.

Appendix III: Grants Supported by CBI for FY24

†7T study

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	MUSC Blue Sky Award	Ehlers-Danlos Syndrome - tAN
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	NIA	Transcranial Magnetic Stimulation for MCI: A Phase II Dose-Response Study
Andreana Benitez	NIA	Quantitative Neuroimaging Assessment of White Matter Integrity in the Context of Aging and AD
Olga Brawman-Mintzer	VA	Alzheimer's Disease Neuroimaging Initiative 3
Olga Brawman-Mintzer	VA	Alzheimer's Disease Neuroimaging Initiative 4
James Dias	Hearing Health Foundation	Neural Determinants of Age-Related Change in Auditory-Visual Speech Processing
Mark Eckert	NIDCD	Experimental and Clinical Studies of Presbycusis
Jens Jensen/Fatima Falangola	NIA	†Diffusion and Functional MRI Monitoring of Therapy Response in AD Mouse Model
Wayne Fitzgibbon	Other	†Treatment of PKD1 RC/RC Mice with Formoterol
Mark George	The George Institute	The Randomized Controlled Trial of Frontal and Temporal Electroconvulsive Therapy (ECT) for Severe Depression (The RAFT ECT Study)

Mark George	Other	Clinical Feasibility of Low Intensity Focused Ultrasound Pulsation for the Treatment of Generalized Anxiety Disorder
Chris Gregory	NINDS	TRANScranial direct current stimulation for POrt-stroke motor Recovery - a phase II sTudy (TRANSPORT 2)
Parneet Grewal	National Center for Neuromodulation for Rehabilitation	Accelerated rTMS for Post-Stroke Apathy: Targeting Amotivation Toward Improving Whole Health and Rehabilitation Engagement
Kelly Harris	NIDCD	Experimental and Clinical Studies of Presbycusis
Kirstin-Friederike-Heise	NIGMS	Eural Circuitries Of Motor Learning As A Target To Modulate Sensorimotor Recovery After Stroke
Kirstin-Friederike-Heise	SCTR Institute Pilot Project Program	Probing Mechanisms Of Procedural Memory Transformation With Cross-Frequency Transcranial Alternating Current Stimulation (Cf-Tacs) As An Avenue To Sculpt Sensorimotor Behavior
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
Jane Joseph	NIA	Using Connectomics to Characterize Risk for Alzheimer's Disease
John Kindred	VA	Neuromodulation for Rehabilitation of Post-stroke Fatigue: An rTMS Pilot Study
Daniel Lench	NINDS	A Neural Basis for Cognitive Decline Following Deep Brain Stimulation
Andrew Manett	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
Lisa McTeague	NIAAA	ARC: Targeting the Shared Substrates of Alcohol Misuse and Cognitive Impairment: Accelerated rTMS for Older Adults with Alcohol Use Disorder
Lisa McTeague	Department of Defense	RECOVERS – Realigning Emotion and COgnition Via prEcision Regulation networkS
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	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	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
Charles Palmer	NIDA	Clinical Feasibility of Low Intensity Focused Ultrasound Pulsation for the Treatment of Treatment Resistant Major Depressive Disorder

James Prisciandaro	NIDA	Gabapentin for Restoring GABA/Glutamate Homeostasis in Co-occurring Bipolar and Cannabis Use Disorders: A Randomized, Double-blind, Placebo-controlled, Parallel-Group, Clinical MRI Study
Gonzalo Revuelta	Other	Combined Deep Brain Stimulation and Functional Magnetic Resonance Imaging
Gonzalo Revuelta	Ono Pharmaceutical	A Phase 2, Double-Blind, Placebo-Controlled, Parallel-Group Study to Assess the Safety, Tolerability, Pharmacokinetics, Pharmacodynamics, and Potential Efficacy of Multiple Doses of ONO-2808 in Patients with Multiple System Atrophy (MSA)
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
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
Chris Sege	Brain & Behavior Research Foundation	Modulating Escape in the Anxiety Disorder Spectrum: Targeting the Direct Neural Mediator Using Transcranial Focused Ultrasound
Na Jin Seo	NICHHD	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
Aiko Thompson	The Doscher Neurorehabilitation Research Program	Operant Conditioning of Motor Evoked Potential to Transcranial Magnetic Stimulation to Improve Motor Function Recovery after Spinal Cord Injury
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	NIGMS	†Estrogen Effect on Beak Ligament Structure-Function Relationship in Thumb Basal Joint



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