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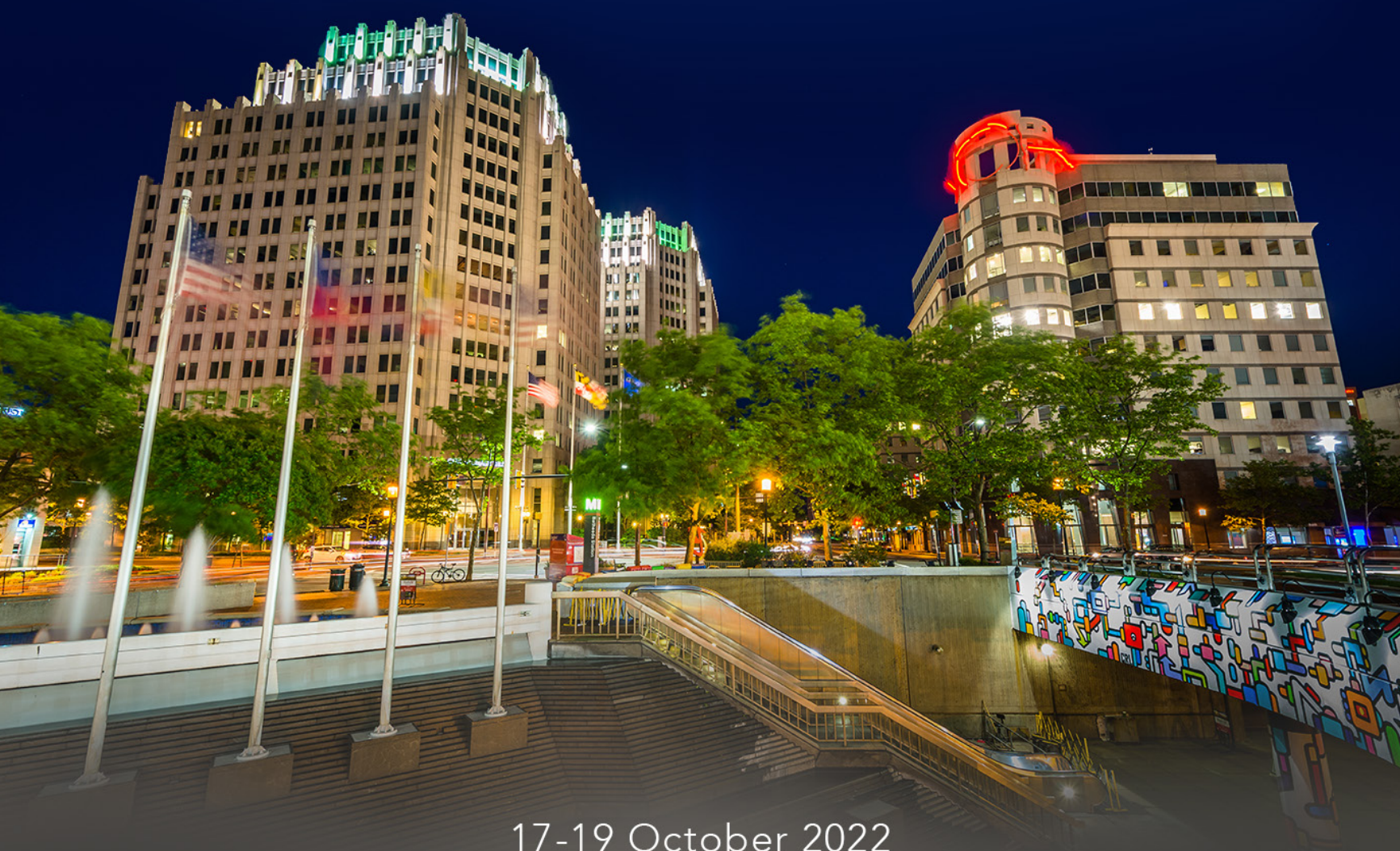
International Society for Magnetic Resonance in Medicine • www.ismrm.org

ISMRM Workshop on

MRI of Neuromodulation:

Target Engagement, Neural Mechanism & Biomarker Development



17-19 October 2022
Ruth Kirschstein Auditorium, NIH Building 45
Bethesda, MD, USA

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ORGANIZING COMMITTEE

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OVERVIEW

During recent years, neuromodulation techniques such as transcranial direct current stimulation (tDCS), transcranial magnetic stimulation (TMS), and deep brain stimulation (DBS), as well as alternative methods using optical and ultrasonic modulations, have become an important means to study how complex neural circuits interact in the brain, to manipulate human cognition, and to treat brain disorders. Magnetic resonance imaging (MRI) can now be performed either concurrently with or pre- and post-these neuromodulation techniques to visualize their effects on the human brain, to understand the neurophysiological mechanism, and to improve their efficacy. The workshop will bring together a diverse group of scientists and clinicians as well as industry partners who are interested in developing and applying advanced MRI techniques to visualize, understand, and quantify neuromodulation effects on the human brain. This workshop will be the first of its kind on the topic of MRI in neuromodulation in ISMRM history and will integrate presentations with ample discussion periods covering advances in various MRI techniques for neuromodulation (electromagnetic field mapping, functional connectivity, arterial spin labeled perfusion and permeability, temperature and acoustic radiation force imaging, etc.), preclinical animal models and cellular-level mechanisms of neuromodulation, and safety issues related to MRI with neuromodulation devices. Existing and emerging clinical applications for MRI in neuromodulation and biomarker development will be discussed between academic and industry partners.

TARGET AUDIENCE

MRI scientists interested in developing novel methods for in-vivo imaging of neuromodulation effects on human brain using MRI; neuroscientists, neurologists, psychiatrists, and neurosurgeons interested in the application of in-vivo imaging of neuromodulation effects on human brain using MRI; and manufacturers of MRI and/or neuromodulation devices interested in latest advances of MRI in neuromodulation.

EDUCATIONAL OBJECTIVES

Upon completion of this activity, participants should be able to:

- Explain the state-of-the-art and latest developments of concurrent MRI and neuromodulation techniques including tDCS, TMS, DBS, and emerging optical and ultrasonic modulations;
- Define the biophysical and neurophysiological parameters that can be measured by MRI of neuromodulation;
- Recognize the potentials and challenges of in-vivo MRI mapping of neuromodulation; and
- Identify the suitable clinical applications and associated barriers need to be overcome for the translation of MRI in neuromodulation.

SPEAKER UPLOAD INFORMATION (Audiovisual Preview)

The audio-visual staff will be located in the back of the meeting room.

Uploading presentations is available on a first-come, first-served basis. Hours are:

- Monday, 17 October 2022: 06:00-07:00
- Tuesday, 18 October 2022: 07:00-08:00
- Wednesday, 19 October 2022: 07:00-08:00

Please see program for additional times (breaks & lunch).

PROGRAM CREDIT DESIGNATION

The International Society for Magnetic Resonance in Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The International Society for Magnetic Resonance in Medicine designates this live activity for a preliminary maximum of 16.00* *AMA PRA Category 1 Credits™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

CERTIFICATE OF PARTICIPATION

To claim your credit or certificate of participation for this workshop, log into the ISMRM membership portal at www.ismrm.org, then click on "My Meeting Evaluations" on the menu, select "View Meeting Evaluation" by the appropriate meeting name, and follow the instructions provided.

Funding for the ISMRM workshop on MRI of Neuromodulation was made possible (in part) from the National Institute of Biomedical Imaging and Bioengineering. The views expressed in written conference materials or publications and by speakers and moderators do not necessarily reflect the official policies of the NIH; nor does mention by trade names, commercial practices, or organizations imply endorsement by the U.S. Government.

DECLARATION OF FINANCIAL RELATIONSHIPS

The ISMRM is committed to:

1. Ensuring balance, independence, objectivity, and scientific rigor in all Continuing Medical Education programs; and
2. Presenting CME activities that promote improvements or quality in healthcare and are independent of commercial interests.

Therefore, it is the policy of the Society that any person who has influence over the content of a program designated for *AMA PRA Category 1 Credits*™ must disclose any real or apparent financial interest or other relationship (i.e., grants, research support, consulting fee, royalty, honorarium for promotional speakers' bureau, ownership interest) that they or their spouse/partner have had in the last 12 months with "any entity producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients."

The ISMRM does not imply that such financial interests or relationships are inherently improper or that such interests or relationships would prevent the speaker or organizer from making an objective contribution. However, it is imperative that such financial interests or relationships be identified so that potential conflicts can be resolved before the program, and participants at the CME activity may have these facts fully disclosed in advance. It then remains for the audience to determine whether an individual's outside interests may reflect a possible bias in either the exposition or the conclusions presented.

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A SECTION OF THE ISMRM

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ISMRM & ISMRT Annual Meeting & Exhibition

TORONTO | 03-08 June **2023**

ABSTRACT DEADLINE: **09 NOVEMBER 2022**

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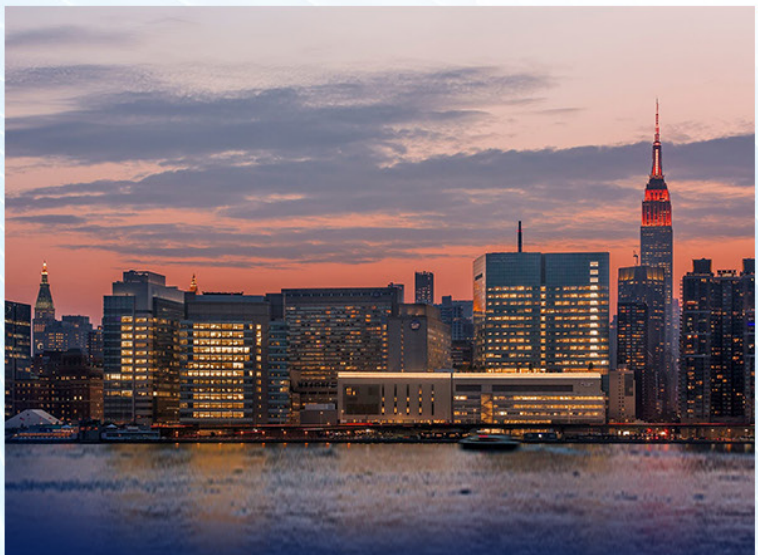
Day 1: Monday, 17 October 2022 *(5.50 CME Available)*		
06:00	Registration & Speaker Upload Available	
07:30	Breakfast	
08:00	*Welcome Address & Remarks*	Organizing Committee & Local Hosts
Session 1: MRI for Neurophysiological Mechanism of Neuromodulation		
Moderators: Wynn Legon, Ph.D. & Yihong Yang, Ph.D.		
08:15	*Toward a Better Understanding of fMRI Signals Using Neuromodulation & Recording*	Yen-Yu Ian Shih, Ph.D. University of North Carolina at Chapel Hill Chapel Hill, NC, USA
08:40	*Focal Transcranial Magnetic Stimulation(TMS): Translation & Back Translation*	Hanbing Lu, Ph.D. National Institute on Drug Abuse Baltimore, MD, USA
09:05	*Mechanism of Transcranial-Focused US*	Jan Kubanek, Ph.D. University of Utah Salt Lake City, UT, USA
10:00	Break & Speaker Upload Available	
10:30	Keynote Speaker	Sarah Lisanby, M.D. National Institute of Mental Health Bethesda, MD, USA
Session 2: MRI in TMS		
Moderator: Desmond Oathes, Ph.D.		
11:00	*Concurrent TMS/MRI*	Olivier Reynaud, Ph.D. Fondation Campus Biotech Genève Genève, Switzerland
11:25	*MRI & TMS*	Dogu Baran Aydogan, Ph.D. Aalto University Espoo, Finland
11:50	*Specialized Hardware for Concurrent TMS/fMRI & TMS/fMRI/EEG, Interactions Between the Systems & Safety*	Lucia I. Navarro de Lara, Ph.D. A.A. Martinos Center For Biomedical Imaging, Harvard Medical School Charlestown, MA, USA
Proffered Papers - Oral Session		
12:15	*Twisted-Pair Receiver Coils for a Combined TMS/EEG/fMRI System*	Julian Maravilla, B.Sc. University of California, Berkeley Berkeley, CA, USA
12:25	*MRI-Guided Targeting & Interpretation of TMS Assessments in the Lesioned Motor Network: A Case Report in Chronic Stroke*	Lisa Krishnamurthy, Ph.D. Atlanta Veterans Affairs Medical Center Stone Mountain, GA, USA
12:35	*Molecular Mechanisms Underlying Disrupted Brain Circuits: Multimodal Neuroimaging & Brain Stimulation Approaches*	Fei Du, Ph.D. Harvard Medical School Boston, MA, USA
12:45	Group Photo Lunch & Speaker Upload Available	

Session 3: Emerging MRI in Optical & Ultrasonic Neuromodulation (rs-fMRI & Temperature & Acoustic Radiation Force Imaging of Optical & US Modulation)		
Moderators: Bastien Guerin, Ph.D. & Jan Kubanek, Ph.D.		
14:15	*MRI-Guided Transcranial Focused US in Addiction & Pain*	Wynn Legon, Ph.D. Fralin Biomedical Research Institute at VTC Roanoke, VA, USA
14:40	*MRI of Near-Infrared Optical Modulation*	Jacek P. Dmochowski, Ph.D. The City College of New York New York, NY, USA
15:05	*MR-Based Verification of Transcranial Ultrasound Simulation Targeting with MR-ARFI &/or MR-Bone Imaging-Based Simulation*	Kim Butts Pauly, Ph.D. Stanford University Stanford, CA, USA
Proffered Papers - Oral Session		
15:30	*MRI-Guided Transcranial Focused Ultrasound for Anesthetic Delivery in the Brain*	Harriet Lea-Banks, D.Phil Sunnybrook Research Institute Toronto, ON, Canada
15:40	*Low-Intensity Focused Ultrasound to the Left Human Dorsal Anterior Insula Alters Salience Network BOLD Signals During Resting & Pain Evoked States in an Intensity Dependent Fashion*	Andrew Strohman, M.Ph. Fralin Biomedical Research Institute at VTC Roanoke,VA, USA
15:50	*An Implantable Optoelectronic Neurostimulator Designed for Safe Full-Body MRI & Active Stimulation During MRI/fMRI*	Aurore Nieuwenhuys, M.Sc. Synergia Medical Mont-Saint-Guibert, Belgium
16:00	Break & Speaker Upload Available	
Session 4: Oral Presentations of Abstracts		
Moderators: Dogu Baran Aydogan, Ph.D. & Lysianne Beynel, Ph.D.		
16:30	*Optimization of a Deep Learning Strategy for Estimation of Cortical Porosity Map from MRI T1-Weighted Images*	Matthieu Dagommer, M.Sc. École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris Paris, France
16:40	*Engagement of Deep Brain Network as a Predictor Biomarker for Clinical Response to TMS*	Noreen Bukhari-Parlakturk, M.D., Ph.D. Duke University School of Medicine Durham, NC, USA
16:50	*Towards the Validation of a Biomarker in the Diagnosis of Periodic Catatonia*	Clément de Crespin de Billy, Ph.D. Centre Hospitalier Universitaire de Strasbourg Strasbourg, France
17:00	*Personalizing Targeting in rTMS Using ASL in Depression*	Ludovic Dormegny-Jeanjean, M.D. Les Hôpitaux Universitaires de Strasbourg Strasbourg, France
17:10	*Accurate Electric Field Modeling by Self Supervised Deep Learning for Fast Optimization of TMS Coil Placement*	Hongming Li, Ph.D. University of Pennsylvania Philadelphia, PA, USA
17:20	Adjourn	

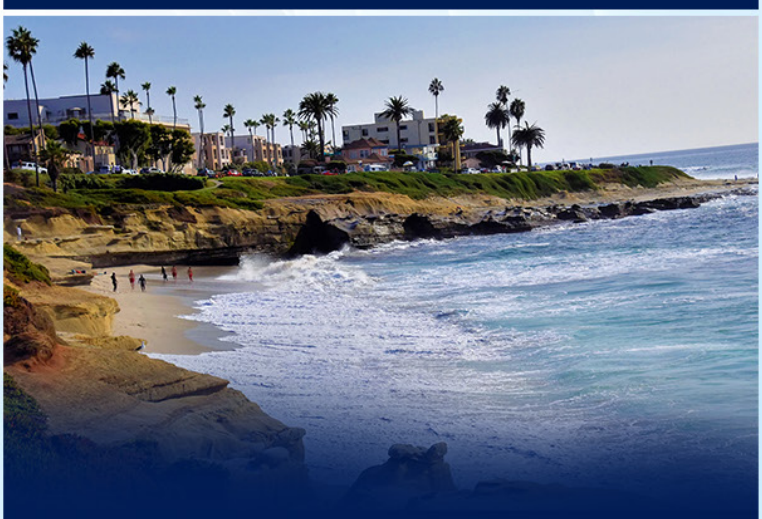
Upcoming **ISMRM** Workshops



ISMRM Workshop on MR Safety: From Physics & Physiology to Policies & Practice
21-23 October 2022
New York, NY, USA

ISMRM Workshop on Cancer Imaging: From Discovery to Diagnosis
01-04 November 2022
Pacific Grove, CA, USA

ISMRM Workshop on Data Sampling & Image Reconstruction
08-11 January 2023
Sedona, AZ, USA



SCMR-ISMRM Co-Provided Workshop on Cutting-Edge Metabolic & Endogenous Contrast CMR
25-26 January 2023
San Diego, CA, USA

**Dates and locations subject to change.*

Visit **www.ismrm.org** for more information.

Day 2: Tuesday, 18 October 2022 *(5.50 CME Available)*		
07:00	Registration & Speaker Upload Available	
07:30	Breakfast	
Session 5: MRI in Transcranial Electrical Stimulation (TES)		
Moderators: Silvina G. Horovitz, Ph.D. & Yu (Andy) Huang, Ph.D.		
08:00	*MR Current Density Imaging (MRCDI)*	Axel Thielscher, Ph.D. Technical University of Denmark & Danish Research Centre for Magnetic Resonance Copenhagen, Denmark
08:25	*Current Mapping for tDCS/tACS*	Rosalind Sadleir, Ph.D. Arizona State University Tempe, AZ, USA
08:50	*Magnetic Field Mapping, rs-fMRI & ASL for tDCS*	Danny JJ. Wang, Ph.D. University of Southern California Los Angeles, CA, USA
09:15	*How to Integrate tES with fMRI: Quality Standards, Challenges & Hopes*	Hamed Ekhtiari, M.D., Ph.D. Laureate Institute for Brain Research Tulsa, OK, USA
Proffered Papers - Oral Session		
09:40	*Perivascular Space Morphological Changes in Response to Transcranial Direct Current Stimulation*	Andrew Minager, High School Intern Harvard Medical School Boston, MA, USA
09:50	*Modulation Effects of Transcranial Direct Current Stimulation on the Dorsal Attention & Frontal Parietal Networks & its Association with the Placebo Effect*	Valeria Sacca, Ph.D. Harvard Medical School Boston, MA, USA
10:00	Break & Speaker Upload Available	
Session 6: MRI in DBS		
Moderators: Elizabeth Ankudowich, Ph.D. & Sayim Gokyar, Ph.D.		
10:30	*Concurrent MRI & DBS in PD*	Alexandre Boutet, M.D., Ph.D. University of Toronto Toronto, ON, CA
10:55	*Concurrent MRI & DBS (Technical Basic, Safety for Real Time Active DBS)*	Ken Sakaie, Ph.D. The Cleveland Clinic Cleveland, OH, USA
11:20	*DBS Targets for Neurologic Disorders (Epilepsy, Real-Time)*	Erik H. Middlebrooks, M.D. Mayo Clinic Jacksonville, FL, USA
Proffered Papers - Oral Session		
11:45	*The MRDust: An Implantable Neural Interface with Data Communication via MRI*	Biqi Zhao, B.Sc. University of California, Berkeley Berkeley, CA, USA
11:55	Lunch & Speaker Upload Available	
Session 7: Modeling and Safety Issues of MRI in Neuromodulation		
Moderator: Lucia I. Navarro de Lara, Ph.D.		
13:25	*ROAST: An Open-Source Platform for Modeling Transcranial Electrical Stimulation & its Validation*	Yu (Andy) Huang, Ph.D. Memorial Sloan Kettering Cancer Center New York, NY, USA

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The **ISMRM Research & Education Fund** was established to support the next generation of specialists in the field of magnetic resonance regardless of scientific discipline, geography, country of origin and resources available.

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Matthieu Dagommer, M.Sc.

Natalie Ferris B.Sc.

Harriet Lea-Banks, D.Phil

Hsin-Ju Lee, Ph.D.

Maggie Pecsok, A.B.

Andrew Strohman, M.Ph.

Biqi Zhao, B.Sc.

13:50	*Modeling of TMS*	Zhi-De Deng, Ph.D. National Institute of Mental Health Bethesda, MD, USA
14:15	*SimNIMS*	Oula Puonti, DRCMR & Technical University of Denmark Kongens Lyngby, Denmark
14:40	*MRI Safety Issues for Neuromodulation Systems*	Frank G. Shellock, Ph.D. USC Stevens Neuroimaging & Informatics Institute Keck School of Medicine, University of Southern California Los Angeles, CA, USA
Proffered Papers - Oral Session		
15:05	*Feasibility of a Simplified Virtual Human Anatomy for Determining RF-Induced Heating of Active Implantable Medical Devices*	Grant Baker, M.Sc. MED Institute, Inc. West Lafayette, IN, USA
15:15	*CNN-Based RF Safety Analysis of Passive Neuromodulation Implants for Parallel Transmission Systems at 7T*	Sayim Gokyar, Ph.D. University of Southern California Los Angeles, CA, USA
15:25	Break & Speaker Upload Available	
Session 8: Oral Presentations of Abstracts		
Moderators: Olivier Reynaud, Ph.D. & A. Duke Shereen, Ph.D.		
15:55	*A Preliminary Meta-Analysis of the Effect of Repetitive TMS on Brain Neurometabolites Measured Using Proton Magnetic Resonance Spectroscopy*	Maggie Pecsok, A.B. University of Pennsylvania Philadelphia, PA, USA
16:05	*Augmented Reality Visualization of Transcranial Magnetic Stimulation with 3DSlicer & WebXR*	Loraine Franke, M.Sc. University of Massachusetts Boston Boston, MA, USA
16:15	*Enhancing the Efficiency of Focal TMS Coils with Magnetic Cores*	Hieu Nguyen, Ph.D. National Institute on Drug Abuse Intramural Research Program Baltimore, MD, USA
16:25	*High-Density Theta Burst Paradigm Augments the After Effect of Transcranial Magnetic Stimulation in Rodents*	Charlotte Qiong Li, M.Sc. National Institute on Drug Abuse Intramural Research Program Baltimore, MD, USA
16:35	*Task-fMRI Identifies State-Dependent Changes in Brain Networks in WC Dystonia: Implications for Transcranial Magnetic Stimulation Targeting*	Noreen Bukhari-Parlakturk, M.D., Ph.D. Duke University School of Medicine Durham, NC, USA
16:45	Adjourn	

Day 3: Wednesday, 19 October 2022 *(3.50 CME Available)*

07:00	Registration & Speaker Upload Available	
07:30	Breakfast	
Session 9: Applications of MRI Neuromodulation in Neurologic Disorders		
Moderators: Alexandre Boutet, M.D., Ph.D. & Hamed Ekhtiari, M.D., Ph.D.		
08:00	*Combining Neuroimaging, Computational Modeling & Machine Learning to Predict tDCS Treatment Response & Customize Dosing*	Adam Woods, Ph.D. University of Florida Gainesville, FL, USA

08:25	*TMS & fMRI in Movement Disorders*	Silvina G. Horovitz, Ph.D. National Institute of Neurological Disorders & Stroke Bethesda, MD, USA
08:50	*MRI Guided fUS*	Li Min Chen Vanderbilt University Medical Center Nashville, TN, USA
Proffered Papers - Oral Session		
09:15	*Concurrent Brain Stimulation & fMRI Approach to Elucidate Real-Time tDCS-Induced Modulatory Mechanisms: A Pilot Study in a Chronic Stroke Model*	Venkatagiri Krishnamurthy, Ph.D. Emory University & Atlanta Veterans Affairs Medical Center Decatur, GA, USA
09:25	*Combined E-Field Modeling & Diffusion Tractography May Identify Individualized Anatomical Targets for Antidepressant rTMS*	Lipeng Ning, Ph.D. Harvard Medical School Boston, MA, USA
09:35	*Neuroimaging Based Target Prescreening: Stage One of a Two-Staged Approach for Target Selection of Non-Invasive Neuromodulation Treatment for Cocaine Use Disorder*	Tianye Zhai, Ph.D. National Institute on Drug Abuse Intramural Research Program Baltimore, MD, USA
09:45	Break & Speaker Upload Available	
Session 10: Applications of MRI Neuromodulation in Psychiatric Disorders		
Moderators: Danny JJ Wang, Ph.D. & Yihong Yang, Ph.D.		
10:15	*TMS/fMRi in Depression & Stress*	Desmond Oathes, Ph.D. University of Pennsylvania Perelman School of Medicine Philadelphia, PA, USA
10:40	*Toward Connectomic Deep Brain Stimulation in OCD*	Andreas Horn, Ph.D. Brigham & Women's Hospital Boston, MA, USA
11:05	*Concurrent MRI & TMS of Drug Addiction*	Yihong Yang, Ph.D. National Institute on Drug Abuse Intramural Research Program Baltimore, MD, USA
Session 11: Panel Discussion MRI Biomarker Development in Neuromodulation (Academic-Industry Partnership for Biomarker Discovery & Development) *(No CME Available)*		
11:30	Future Directions & Open Discussion	
12:00	Awards Ceremony & Closing Remarks	
12:15	Adjournment & Box Lunches	

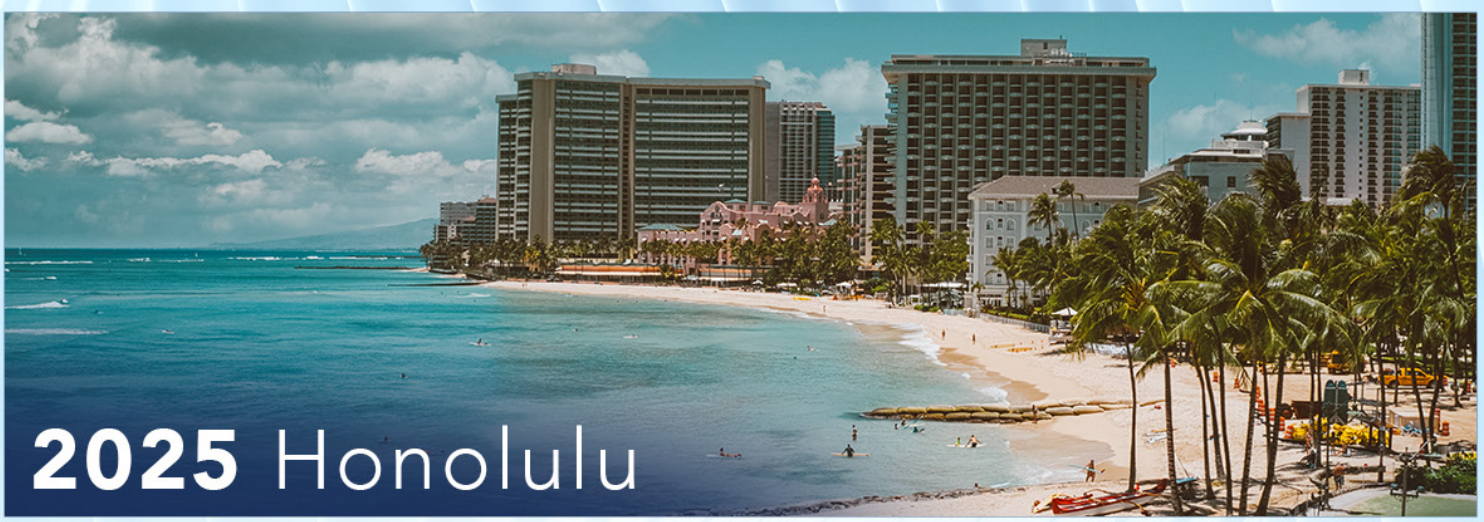
Take the 5-minute on-site survey!

See the registration desk for questions.

This survey is not for CME credits.

FOLLOW THE CONVERSATION:

Future **ISMRM** Annual Meetings



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