Zhi-De Deng

Contact Information

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Research Specialties

Noninvasive brain stimulation: technology development, modeling, device safety, translational and clinical applications

Computational electromagnetics

Electrophysiological and neuroimaging biomarker development

Neural plasticity and translational neuromodeling

Nonlinear dynamics of physiological systems

Education

Columbia University New York, NY

Ph.D., Electrical Engineering 2013

Dissertation: *Electromagnetic Field Modeling of Transcranial Electric and Magnetic Stimulation: Targeting, Individualization, and Safety of Convulsive and Subconvulsive Applications*

M.Phil., Electrical Engineering 2011

Graduate concentration in Neuroscience

Massachusetts Institute of Technology Cambridge, MA

M.Eng., Electrical Engineering & Computer Science 2007

Thesis: *Stochastic Chaos and Thermodynamic Phase Transitions: Theory and Bayesian Estimation* Algorithms

S.B., Electrical Science & Engineering 2007

S.B., Physics 2006

Minor in Economics

Professional & Academic Appointments

National Institute of Mental Health Bethesda, MD

Staff Scientist 2019–
Division of Intramural Research Programs
Experimental Therapeutics & Pathophysiology Branch
Noninvasive Neuromodulation Unit

Director, Computational Neurostimulation Research Program

Research Fellow 2016–2019
Division of Intramural Research Programs
Experimental Therapeutics & Pathophysiology Branch
Noninvasive Neuromodulation Unit

Richard J. Wyatt Memorial Fellowship for Translational Research

Duke University School of Medicine — Durham, NC

Adjunct Assistant Professor — 2016–2024
Department of Psychiatry & Behavioral Sciences
Division of Behavioral Medicine & Neurosciences

Faculty Network Member — 2015–2024
Duke Institute for Brain Sciences

Medical Instructor — 2014–2016
Department of Psychiatry & Behavioral Sciences
Division of Brain Stimulation & Neurophysiology

Duke Translational Medicine Institute KL2 Fellow

Postdoctoral Associate — 2013–2014
Department of Psychiatry and Behavioral Sciences
Division of Brain Stimulation & Neurophysiology
Neurocognitive Research Lab

Visiting Graduate Research Assistant — 2010–2013
Department of Psychiatry & Behavioral Sciences
Division of Brain Stimulation & Neurophysiology
Brain Stimulation Engineering Lab

Columbia University College of Physicians & Surgeons — New York, NY
New York State Psychiatric Institute

Graduate Research Assistant — 2007–2010
Department of Psychiatry
Division of Brain Stimulation & Therapeutic Modulation
Technology Development Lab

Columbia Irving Institute for Clinical and Translational Research T32 Fellow

Harvard–MIT Division of Health Sciences & Technology — Cambridge, MA

Research Assistant — 2005–2007
Neurophysiology & Neuroengineering Lab

Nonprofit Leadership

Singula Institute — New York, NY

Co-founder, Scientific Advisor — 2017–

Internships

NewYork-Presbyterian/Weill Cornell Medical Center — New York, NY

Executive Intern, Anesthesiology — 2004

The New York Times Company, Inc. — New York, NY

Internship Coordinator — 2003
The New York Times Company Foundation/The Children's Aid Society

Newsroom Technology Intern — 2002

Awards & Honors

NIMH Director's Award 2024
For outstanding transdisciplinary scientific contributions to advance neuromodulation technologies for the study and treatment of psychiatric disorders, NIMH

High Five Award 2024
For excellent preparation for and presentation at the Noninvasive Neuromodulation Unit's Board of Scientific Counselors review, NIMH

Scholar, Advanced Research Institute in Geriatric Mental Health 2023–2024
Dartmouth College, supported by grant from NIH (R25MH068502)

NIMH Director's Award 2019
For scientific innovation at the interface of computation and psychiatry, NIMH

Richard J. Wyatt Memorial Fellowship Award for Translational Research 2018
NIMH Intramural Research Program

New Investigator Award 2018
American Society of Clinical Psychopharmacology

Early Career Investigator Travel Fellowship Award 2018
Society of Biological Psychiatry

Research Colloquium for Junior Investigators 2018
American Psychiatric Association

Alies Muskin Career Development Leadership Program 2018
Anxiety & Depression Association of America

NARSAD Young Investigator Award 2017
Brain & Behavior Research Foundation

Career Development Institute for Psychiatry 2017
Stanford University

New Investigator Award 2017
International Society for CNS Clinical Trials and Methodology

Certificate for Highly Cited Research 2016
Brain Stimulation, Elsevier

Young Investigator Memorial Travel Award 2015
American College of Neuropsychopharmacology

Scholar, Summer Research Institute in Geriatric Mental Health 2015
Weill Cornell Medical College, supported by grant from NIH (R25MH019946)

Chair's Choice Award 2014
Society of Biological Psychiatry

Innovative Research Poster Award 2014
National Network of Depression Centers

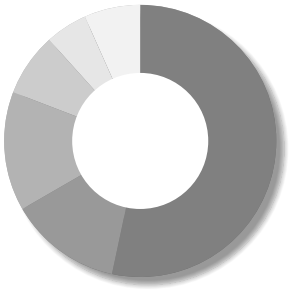
Best Abstract Award 2010
International Society for ECT and Neurostimulation

Presidential Teaching Award Finalist 2010
Columbia University

Student Paper Competition Finalist 2006
IEEE Engineering in Medicine and Biology Society

New York Times College Scholarship 2002
The New York Times Company Foundation

Research Output Summary



- **64** Refereed journal articles
- **16** Refereed engineering proceedings & letters
- **17** Reviews, protocols, & consensus papers
- **9** Book chapters
- **6** Editorials, correspondences, & commentaries
- **8** Patents, patent applications
- \+ **170** Abstracts

Refereed Journal Articles

*** Denotes first, joint first, or senior author**

S. M. McClintock, **Z.-D. Deng**, M. M. Husain, V. J. Thakkar, E. Bernhardt, R. D. Weiner, B. Luber, and S. H. Lisanby, "Comparing the neurocognitive effects of right-unilateral ultrabrief pulse electroconvulsive therapy and magnetic seizure therapy for the treatment of major depressive episode," *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, vol. 10, no. 2, Feb. 2025.
Journal cover

Z. Qi, G. M. Noetscher, A. Miles, K. Weise, T. R. Knösche, C. R. Cadman, A. R. Potashinsky, K. Liu, W. A. Wartman, G. C. Nuñez Ponasso, M. Bikson, H. Lu, **Z.-D. Deng**, A. R. Nummenmaa, and S. N. Makaroff, "Enabling electric field model of microscopically realistic brain," *Brain Stimulation*, in press.

N. I. Hasan, M. Dannhauer, D. Wang, **Z.-D. Deng**, and L. J. Gomez, "Real-time computation of brain E-field for enhanced transcranial magnetic stimulation neuronavigation and optimization," *Imaging Neuroscience*, online ahead of print, 2024.
Third Place in Best Student Paper (awarded to N. I. Hasan), *Photonics and Electromagnetics Research Symposium*, 2024.

N. Khadka, **Z.-D. Deng**, S. H. Lisanby, M. Bikson, and J. A. Camprodon, "Computational models of high-definition electroconvulsive therapy (ECT) for focal or multi-targeting," *The Journal of ECT*, online ahead of print, 2024.

B. Luber, L. Beynel, **Z.-D. Deng**, L. G. Appelbaum, T. Jones, A. Harrison, D. L. K. Murphy, E. Lo, R. A. McKinley, and S. H. Lisanby, "Site- and frequency-specific enhancement of visual search performance with online individual alpha frequency (IAF) repetitive transcranial magnetic stimulation (rTMS) to the inferior frontal junction," *Cerebral Cortex*, vol. 34, no. 9, bhae371, Sept. 2024.

M. Teferi, H. Gura, M. Patel, A. Casalvera, K. G. Lynch, W. Makhoul, **Z.-D. Deng**, D. J. Oathes, Y. I. Sheline, and N. L. Balderston, "Intermittent theta-burst stimulation to the right dorsolateral prefrontal cortex may increase potentiated startle in healthy individuals," *Neuropsychopharmacology*, vol. 49, no. 10, pp. 1619–1629, Sept. 2024.

* M. Dib, J. D. Lewine, C. C. Abbott, and **Z.-D. Deng**, "Electroconvulsive therapy modulates loudness dependence of auditory evoked potentials: A pilot MEG study," *Frontiers in Psychiatry*, vol. 15, 1434434, Aug. 2024.

H. Nguyen, C. Q. Li, S. Hoffman, **Z.-D. Deng**, Y. Yang, and H. Lu, "Ultra-high frequency repetitive TMS at subthreshold intensity induces suprathreshold motor response via temporal summation," *Journal of Neural Engineering*, vol. 21, no. 4, 046044, Aug. 2024.

L. Beynel, H. Gura, Z. Rezaee, E. C. Ekpo, **Z.-D. Deng**, J. O. Joseph, P. Taylor, B. Luber, and S. H. Lisanby, "Lessons learned from an fMRI-guided rTMS study on performance in a numerical Stroop task," *PLOS ONE*, vol. 19, no. 5, e0302660, May 2024.

S. K. Kar, A. Agrawal, A. Silva-dos-Santos, Y. Gupta, and **Z.-D. Deng**, "The efficacy of transcranial magnetic stimulation in the treatment of obsessive-compulsive disorder: An umbrella review of meta-analyses," *CNS Spectrums*, vol. 29, no. 2, pp. 109–118, Apr. 2024.

* B. Kadriu, **Z.-D. Deng**, C. Kraus, J. N. Johnston, A. Figtman, I. D. Henter, S. Kasper, and C. A. Zarate, Jr., "The impact of body mass index on clinical features of bipolar disorder: A STEP-BD study," *Bipolar Disorder*, vol. 26, no. 2, pp. 160–175, Mar. 2024.
Media coverage: *Psychiatric Times*, Feb. 2024.

* P. L. Robins, S. N. Makaroff, M. Dib, S. H. Lisanby, and **Z.-D. Deng**, "Electric field characteristics of transcranial rotating permanent magnetic stimulation," *Bioengineering*, vol. 11, no. 3, 258, Mar. 2024.
Part of the Special Issue on *Electric, magnetic, and electromagnetic fields in biology and medicine: From mechanisms to biomedical applications*
NIMH Intramural Research Program Trainee Travel Award (awarded to P. L. Robins), *NIMH IRP Fellows' Scientific Training Day*, 2023.

* **Z.-D. Deng**, B. Luber, S. M. McClintock, R. D. Weiner, M. M. Husain, and S. H. Lisanby, "Clinical outcomes of magnetic seizure therapy vs electroconvulsive therapy for major depressive episode: A randomized clinical trial," *JAMA Psychiatry*, vol. 81, no. 3, pp. 240–249, Mar. 2024.
Commentary: vol. 81, no. 7, pp. 736–737.
Reply: vol. 81, no. 7, pp. 737–738, July 2024.
Media coverage: *Pyschiatric News*, Feb. 2024. · *MedPage Today*, Feb. 2024. · *Brain & Behavior Research Foundation*, Jan. 2024. · *NIMH Research Highlight*, Dec. 2023.

* C. C. Abbott, J. Miller, D. Farrar, M. Argyelan, M. Lloyd, T. Squillaci, B. Kimbrell, S. Ryman, T. R. Jones, J. Upston, D. K. Quinn, A. V. Peterchev, E. Erhardt, A. Datta, S. M. McClintock, and **Z.-D. Deng**, "Amplitude-determined seizure-threshold, electric field modeling, and electroconvulsive therapy antidepressant and cognitive outcomes," *Neuropsychopharmacology*, vol. 49, no. 4, pp. 640–648, Mar. 2024.
Research highlight commentary: vol. 49, no. 4, pp. 635–636, Mar. 2024.

W. A. Wartman, K. Weise, M. Rachh, L. Morales, **Z.-D. Deng**, A. R. Nummenmaa, and S. N. Makaroff, "An adaptive h-refinement method for the boundary element fast multipole method for quasi-static electromagnetic modeling," *Physics in Medicine and Biology*, vol. 69, no. 4, 055030, Feb. 2024.
Third Place in International Student Competition (awarded to W. A. Wartman), *Brain & Human Body Modeling Conference*, 2023.

M. Argyelan, **Z.-D. Deng**, O. T. Ousdal, L. Oltedal, B. Angulo, M. Baradits, A. J. Spitzberg, U. Kessler, A. Sartorius, A. Dols, K. L. Narr, R. Espinoza, J. A. van Waarde, I. Tendolkar, P. van Eijndhoven, G. A. van Wingen, A. Takamiya, T. Kishimoto, M. B. Jørgensen, A. Jørgensen, O. B. Paulson, A. Yrondi, P. Péran, C. Soriano-Mas, N. Cardoner, M. Cano, L. van Diermen, D. Schrijvers, J.-B. Belge, L. Emsell, F. Bouckaert, M. Vandenbulcke, M. Kiebs, R. Hurlemann, P. C. R. Mulders, R. Redlich, U. Dannlowski, E. Kavakbasi, M. D. Kritzer, K. K. Ellard, J. A. Camprodon, G. Petrides, A. K. Malhotra, and C. C. Abbott, "Electroconvulsive therapy-induced volumetric brain changes converge on a common causal circuit in depression," *Molecular Psychiatry*, vol. 29, no. 2, pp. 229–237, Feb. 2024.

S. N. Makaroff, Z. Qi, M. Rachh, W. A. Wartman, K. Weise, G. M. Noetscher, M. Daneshzand, **Z.-D. Deng**, L. Greengard, and A. R. Nummenmaa, "A fast direct solver for surface-based whole-head modeling of transcranial magnetic stimulation," *Scientific Reports*, vol. 13, no. 8, 18657, Oct. 2023.

* **Z.-D. Deng**, P. L. Robins, M. Dannhauer, L. M. Haugen, J. D. Port, and P. E. Croarkin, "Optimizing TMS coil placement approaches for targeting the dorsolateral prefrontal cortex in depressed adolescents: An electric field modeling study," *Biomedicines*, vol. 11, no. 8, 2320, Aug. 2023.

✧ Part of the Special Issue on *Emerging trends in brain stimulation*
First Place in International Student Competition (awarded to P. L. Robins), *Brain & Human Body Modeling Conference*, 2022.

C. Kraus, A. Kautzky, V. Watzal, A. Gramser, B. Kadriu, **Z.-D. Deng**, L. Bartova, C. A. Zarate, Jr., R. Lanzenberger, D. Souery, S. Montgomery, J. Mendlewicz, J. Zohar, G. Fanelli, A. Serretti, and S. Kasper, "Body mass index and clinical outcomes in individuals with major depressive disorder: Finding from the GSRD European Multicenter Database," *Journal of Affective Disorder*, vol. 335, pp. 349–357, Aug. 2023.

M. Teferi, W. Makhoul, **Z.-D. Deng**, D. J. Oathes, Y. I. Sheline, and N. L. Balderston, "Continuous theta burst stimulation to the right dorsolateral prefrontal cortex may increase potentiated startle in healthy individuals," *Biological Psychiatry: Global Open Science*, vol. 3, no. 3, pp. 470–479, July 2023.

J. Miller, T. R. Jones, J. Upston, **Z.-D. Deng**, S. M. McClintock, E. Erhardt, D. Farrar, D. K. Quinn, and C. C. Abbott, "Electric field, ictal theta power, and clinical outcomes in electroconvulsive therapy," *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, vol. 8, no. 7, pp. 760–767, July 2023.

A. Guillen, C. C. Abbott, **Z.-D. Deng**, Y. Huang, P. Pascoal-Faria, D. Q. Truong, and A. Datta, "Impact of modeled field of view in electroconvulsive therapy current flow simulations," *Frontiers in Psychiatry*, vol. 14, 1168672, May 2023.

M. Alawi, P. F. Lee, **Z.-D. Deng**, Y. K. Goh, and P. E. Croarkin, "Modelling the differential effects of age on transcranial magnetic stimulation induced electric fields," *Journal of Neural Engineering*, vol. 20, no. 2, 026016, Mar. 2023.

X. Chen, R. Ma, W. Zhang, G. Q. Zeng, Q. Wu, A. Yimiti, X. Xia, J. Cui, Q. Liu, X. Meng, J. Bu, Q. Chen, Y. Pan, N. X. Yu, S. Wang, **Z.-D. Deng**, A. T. Sack, M. Mc Laughlin, and X. Zhang, "Alpha oscillatory activity is causally linked to working memory retention," *PLOS Biology*, vol. 21, no. 2, e3001999, Feb. 2023.

Z. Fu, C. C. Abbott, J. Miller, **Z.-D. Deng**, S. M. McClintock, M. S. E. Sendi, J. Sui, and V. D. Calhoun, "Cerebro–cerebellar functional neuroplasticity mediates the effect of electric field on electroconvulsive therapy outcomes," *Translational Psychiatry*, vol. 13, 43, Feb. 2023.

S. N. Makaroff, H. Nguyen, Q. Meng, H. Lu, A. Nummenmaa, and **Z.-D. Deng**, "Modeling transcranial magnetic stimulation coils with magnetic cores," *Journal of Neural Engineering*, vol. 20, no. 1, 016028, Jan. 2023.

S. Qi, V. D. Calhoun, D. Zhang, J. Miller, **Z.-D. Deng**, K. L. Narr, Y. I. Sheline, S. M. McClintock, R. Jiang, X. Yang, J. Upston, T. R. Jones, J. Sui, and C. C. Abbott, "Links between electroconvulsive therapy responsive and cognitive impairment multimodal brain networks in late-life major depressive disorder," *BMC Medicine*, vol. 22, 477, Dec. 2022.
◇ Correction: vol. 21, 113, Mar. 2023.

H. Li, **Z.-D. Deng**, D. Oathes, and Y. Fan, "Computation of transcranial magnetic stimulation electric fields using self-supervised deep learning," *NeuroImage*, vol. 264, 119705, Dec. 2022.

A. Richie-Halford, M. Cieslak, L. Ai, S. Caffarra, S. Covitz, A. R. Franco, I. I. Karipidis, J. Kruper, M. Milham, B. Avelar-Pereira, E. Roy, V. J. Sydnor, J. Yeatman, The Fibr Community Science Consortium [including **Z.-D. Deng**], T. D. Satterthwaite, and A. Rokem, "An analysis-ready and quality controlled resource for pediatric brain white-matter research," *Scientific Data*, vol. 9, 616, Oct. 2022.

J. Miller, T. Jones, J. Upston, **Z.-D. Deng**, S. M. McClintock, S. Ryman, D. Quinn, and C. C. Abbott, "Ictal theta power as an electroconvulsive therapy safety biomarker: A pilot study," *The Journal of ECT*, vol. 38, no. 2, pp. 88–94, June 2022.

H. Bagherzadeh, Q. Meng, **Z.-D. Deng**, H. Lu, E. Hong, Y. Yang, and F.-S. Choa, "Angle-tuned coils: Attractive building blocks for TMS with improved depth–spread performance," *Journal of Neural Engineering*, vol. 19, no. 2, 026059, May 2022.

B. Luber, S. W. Davis, **Z.-D. Deng**, D. Murphy, A. Martella, A. V. Peterchev, and S. H. Lisanby, "Using diffusion tensor imaging to effectively target TMS to deep brain structures," *NeuroImage*, vol. 249, 118863, Apr. 2022.

* **Z.-D. Deng**, M. Argyelan, J. Miller, D. Quinn, M. Lloyd, T. R. Jones, J. Upston, E. Erhardt, S. M. McClintock, and C. C. Abbott, "Electroconvulsive therapy, electric field, neuroplasticity, and clinical outcomes," *Molecular Psychiatry*, vol. 27, no. 3, pp. 1676–1682, Mar. 2022.
Commentary: vol. 27, no. 9, pp. 3571–3572, Sept. 2022.
Reply: vol. 29, no. 10, pp. 3289–3290, Oct. 2024.

N. L. Balderston, J. C. Beer, D. Seok, W. Makhoul, **Z.-D. Deng**, T. Girelli, M. Teferi, N. Smyk, M. Jaskir, D. J. Oathes, R. T. Shinohara, and Y. I. Sheline, "Proof of concept study to develop a novel connectivity-based electric-field modelling approach for individualized targeting of transcranial magnetic stimulation treatment," *Neuropsychopharmacology*, vol. 47, no. 2, pp. 588–598, Jan. 2022.

S. H. Lisanby, S. M. McClintock, W. V. McCall, R. G. Knapp, C. M. Cullum, M. Mueller, **Z.-D. Deng**, A. A. Teklehaimanot, M. V. Rudorfer, E. Bernhardt, G. Alexopoulos, S. H. Bailine, M. C. Briggs, E. T. Geduldig, R. M. Greenberg, M. M. Husain, S. Kaliora, V. Latoussakis, L. S. Liebman, G. Petrides, J. Prudic, P. B. Rosenquist, S. Sampson, K. G. Tobias, R. D. Weiner, R. C. Young, C. H. Kellner, Prolonging Remission in Depressed Elderly (PRIDE) Work Group, "Longitudinal neurocognitive effects of combined electroconvulsive therapy (ECT) and pharmacotherapy in geriatric major depressive disorder: Phase 2 of the PRIDE study," *American Journal of Geriatric Psychiatry*, vol. 30, no. 1, pp. 15–28, Jan. 2022.

B. Kadriu, C. A. Farmer, P. Yuan, L. T. Park, **Z.-D. Deng**, R. Moaddel, I. D. Henter, B. Shovestul, E. D. Ballard, C. Kraus, P. W. Gold, R. Machado-Vieira, and C. A. Zarate, Jr., "The kynurenine pathway and bipolar disorder: Intersection of the monoaminergic and glutamatergic systems and immune response," *Molecular Psychiatry*, vol. 26, no. 8, pp. 4085–4095, Aug. 2021.

A. Takamiya, F. Bouckaert, M. Laroy, J. Blommaert, A. Radwan, A. Khatoun, **Z.-D. Deng**, M. Mc Laughlin, W. Van Paesschen, F.-L. De Winter, J. Van den Stock, S. Sunaert, P. Sienaert, M. Vandenbulcke, and L. Emsell, "Biophysical mechanisms of electroconvulsive therapy-induced volume expansion in the medial temporal lobe: A longitudinal *in vivo* human imaging study," *Brain Stimulation*, vol. 14, no. 4, pp. 1038–1047, July–Aug. 2021.

E. A. Friðgeirsson, **Z.-D. Deng**, D. Denys, J. A. van Waarde, and G. A. van Wingen, "Electric field strength induced by electroconvulsive therapy may be associated with clinical outcome: A pilot study," *NeuroImage: Clinical*, vol. 30, 102581, Feb. 2021.

P. J. C. Suen, S. Doll, M. C. Battistuzzo, G. Busatto, L. B. Razza, F. Padberg, E. Mezger, L. Bulubas, D. Keeser, **Z.-D. Deng**, and A. R. Brunoni, "Association between tDCS computational modeling and clinical outcomes in depression: Data from the ELECT-TDCS trial," *European Archives of Psychiatry and Clinical Neuroscience*, vol. 271, no. 1, pp. 101–110, Feb. 2021.

C. C. Abbott, D. Quinn, J. Miller, E. Ye, S. Iqbal, M. Lloyd, T. R. Jones, J. Upston, **Z.-D. Deng**, E. Erhardt, and S. M. McClintock, "Electroconvulsive therapy pulse amplitude and clinical outcomes," *American Journal of Geriatric Psychiatry*, vol. 29, no. 2, pp. 166–178, Jan. 2021.

M. L. Cox, **Z.-D. Deng**, H. Palmer, A. Watts, L. Beynel, J. R. Young, S. H. Lisanby, J. Migaly, and L. G. Appelbaum, "Utilizing transcranial direct current stimulation to enhance laparoscopic technical skills training: A randomized controlled trial," *Brain Stimulation*, vol. 13, no. 3, pp. 863–872, May–June 2020.

S. Aronson Fischell, T. J. Ross, **Z.-D. Deng**, B. J. Salmeron, and E. A. Stein, "Transcranial direct current stimulation applied to the dorsolateral and ventromedial prefrontal cortices in smokers modifies cognitive circuits implicated in the nicotine withdrawal syndrome," *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, vol. 5, no. 4, pp. 448–460, Apr. 2020.

S. H. Lisanby, S. M. McClintock, G. Alexopoulos, S. H. Bailine, E. Bernhardt, M. C. Briggs, C. M. Cullum, **Z.-D. Deng**, M. Dooley, E. T. Geduldig, R. M. Greenberg, M. M. Husain, S. Kaliora, R. G. Knapp, V. Latoussakis, L. S. Liebman, W. V. McCall, M. Mueller, G. Petrides, J. Prudic, P. B. Rosenquist, M. V. Rudorfer, S. Sampson, A. A. Teklehaimanot, K. G. Tobias, R. D. Weiner, R. C. Young, C. H. Kellner, on behalf of the CORE/PRIDE Work Group, "Neurocognitive effects of combined electroconvulsive therapy (ECT) and venlafaxine in geriatric depression: Phase 1 of the PRIDE study," *American Journal of Geriatric Psychiatry*, vol. 28, no. 3, pp. 304–316, Mar. 2020.
Commentary: vol. 28, no. 3, pp. 317–319, Mar. 2020.

N. L. Balderston, E. M. Beydler, C. Roberts, **Z.-D. Deng**, T. Radman, T. Lago, B. Luber, S. H. Lisanby, M. Ernst, and C. Grillon, "Mechanistic link between right prefrontal cortical activity and anxious arousal revealed using transcranial magnetic stimulation in healthy subjects," *Neuropsychopharmacology*, vol. 45, no. 4, pp. 694–702, Mar. 2020.

L.-Z. Yang, W. Zhang, W. Wang, Z. Yang, H. Wang, **Z.-D. Deng**, C. Li, B. Qiu, D.-R. Zhang, R. Cohen Kadosh, H. Li, and X. Zhang, "Neural and psychological predictors of cognitive enhancement and impairment due to neurostimulation," *Advanced Science*, vol. 7, no. 4, 1902863, Feb. 2020.
Journal inside back cover

N. L. Balderston, E. M. Beydler, M. Goodwin, **Z.-D. Deng**, T. Radman, B. Luber, S. H. Lisanby, M. Ernst, and C. Grillon, "Low-frequency parietal repetitive transcranial magnetic stimulation reduces fear and anxiety," *Translational Psychiatry*, vol. 10, no. 1, 68, Feb. 2020.

T. Dufor, S. Grehl, A. D. Tang, M. Doulazmi, M. Traoré, N. Debray, C. Dubacq, **Z.-D. Deng**, J. Mariani, A. M. Lohof, and R. M. Sherrard, "Neural circuit repair by low-intensity magnetic stimulation requires cellular magnetoreceptors and specific stimulation patterns," *Science Advances*, vol. 5, no. 10, eaav9847, Oct. 2019.

M. Argyelan, L. Oltedal, **Z.-D. Deng**, B. Wade, M. Bikson, A. Joanlanne, S. Sanghani, H. Bartsch, M. Cano, A. M. Dale, U. Dannlowski, A. Dols, V. Enneking, R. Espinoza, U. Kessler, K. L. Narr, K. J. Oedagaard, M. L. Oudega, R. Redlich, M. L. Stek, A. Takamiya, L. Emsell, F. Bouckaert, P. Sienaert, J. Pugol, I. Tendolkar, P. van Eijndhoven, G. Petrides, A. K. Malhotra, and C. Abbott, "Electric field causes volumetric changes in the human brain," *eLife*, vol. 8, e49115, Oct. 2019.

* L. Beynel, L. G. Appelbaum, B. Luber, C. A. Crowell, S. A. Hilbig, W. Lim, D. Nguyen, N. A. Chrapliwy, S. W. Davis, R. Cabeza, S. H. Lisanby, and **Z.-D. Deng**, "Effects of online repetitive transcranial magnetic stimulation (rTMS) on cognitive processing: A meta-analysis and recommendations for future studies," *Neuroscience and Biobehavioral Reviews*, vol. 107, pp. 47–58, Dec. 2019.

S. M. Goetz, S. M. Madhi Alavi, **Z.-D. Deng**, and A. V. Peterchev, "Statistical model of motor evoked potentials," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 27, no. 8, pp. 1539–1545, Aug. 2019.

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D. Tang, W. Wartman, A. Nummenmaa, M. Daneshzand, G. Noetscher, H. Lu, **Z.-D. Deng**, and S. N. Makaroff, "A BEM-FMM TMS coil designer using MATLAB platform," *International Brain Stimulation Conference*, accepted 2025; also presented at *NYC Neuromodulation Conference*, 2024.

L. D. Oliver, D. M. Blumberger, C. Hawco, E. W. Dickie, J. Gallucci, J. Jeyachandra, S. Mansour, **Z.-D. Deng**, S. M. Hare, J. M. Gold, G. Foussias, M. Argyelan, Z. J. Daskalakis, R. W. Buchanan, A. K. Malhotra, and A. N. Voineskos, "Effects of individualized transcranial magnetic stimulation on social cognitive network functional connectivity in schizophrenia spectrum disorders: A target engagement study," *Neuropsychopharmacology*, vol. 49, supplement, p. 420, 2024.

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* **Z.-D. Deng**, J. Kim, B. A. Pritchard, R. H. Schor, G. R. Dold, and S. H. Lisanby, "Multichannel Individualized Stimulation Therapy (MIST): Precision through computational modeling and multitargeted stimulation," *Neuropsychopharmacology*, vol. 49, supplement, p. 192, 2024.

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* E. Bharti, S. Dey, V. Voon, S. M. Goetz, C. A. Zarate, Jr., S. H. Lisanby, and **Z.-D. Deng**, "Personalized brain modeling of psychiatric treatments," *NIMH IRP Fellows' Scientific Training Day*, 2024.

* S. Dey and **Z.-D. Deng**, "A robust state estimation strategy for brain stimulation," *NIMH IRP Fellows' Scientific Training Day*, 2024.

E. Greenstein, Z. Rezaee, **Z.-D. Deng**, L. Oberman, and S. H. Lisanby, "Exploring individual variability in TMS effects: The case for E-field modeling in research," *NIMH IRP Fellows' Scientific Training Day*, 2024.

Z. Qi, G. M. Noetscher, A. Miles, K. Weise, T. R. Knösche, C. R. Cadman, A. R. Potashinsky, K. Liu, W. A. Wartman, G. Nuñez Ponasso, M. Bikson, H. Lu, **Z.-D. Deng**, A. R. Nummenmaa, and S. N. Makaroff, "Enabling electric field model of microscopically realistic brain," *NYC Neuromodulation Conference*, 2024.

E. Ekpo, L. Beynel, **Z.-D. Deng**, B. Luber, W. T. Regenold, E. Jones, and S. H. Lisanby, "Functional connectivity in depression: Task-based vs resting state fMRI," *Annual Biomedical Research Conference for Minoritized Scientists*, 2024.

N. I. Hasan, M. Dannhauer, D. Wang, **Z.-D. Deng**, and L. J. Gomez, "Real-time computation of E-field for transcranial magnetic stimulation," *National Radio Science Meeting*, 2025.
Third Place in Best Student Paper (awarded to N. I. Hasan), *Photonics and Electromagnetics Research Symposium*, 2024.

S. M. Francis, S. N. Menon, L. Beynel, P. L. Robins, **Z.-D. Deng**, A. Thurm, T. White, F. Pereira, L. M. Oberman, and S. H. Lisanby, "Identifying domain-specific nodes using network controllability to determine potential TMS targets for ASD," *Annual Meeting of the International Society for Autism Research*, 2024.

L. Beynel, B. Luber, H. Gura, Z. Rezaee, E. Ekpo, **Z.-D. Deng**, O. Joseph, P. Taylor, and S. H. Lisanby, "When the target is a moving target: Practical issues in using task fMRI for rTMS targeting," *Aperture Neuro*, vol. 4, no. Suppl 1, pp. 1457–1458, 2024

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* P. L. Robins, J. R. Gilbert, and **Z.-D. Deng**, "Characterizing hippocampal activation with magnetoencephalography using the mnemonic similarity task in healthy participants," *Biological Psychiatry*, vol. 95, no. 10, p. S205, 2024; also in *Aperture Neuro*, vol. 4, no. Suppl 1, p. 1713, 2024; and *NIH Postbac Poster Day*, 2024.

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P. L. Robins, S. H. Lisanby, and **Z.-D. Deng**, "Quantifying aliasing in paper electroencephalography (EEG) during electroconvulsive therapy (ECT)," *International Society for ECT and Neurostimulation Annual Meeting*, 2024.

M. Teferi, M. Patel, A. Casalvera, **Z.-D. Deng**, K. Lynch, D. Oathes, Y. Sheline, and N. Balderston, "Both cTBS and iTBS increase anxiety when delivered to the right dlPFC in healthy volunteers," *Neuropsychopharmacology*, vol. 46, supplement, p. 83, 2023.

M. Jaime, L. M. Oberman, S. M. Francis, J. Stout, **Z.-D. Deng**, P. L. Robins, J. W. van der Veen, and S. H. Lisanby, "An experimental methods based approach to understanding the mechanisms underlying MEG indices of auditory/language processing," *MEG North America Workshop*, 2023.

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* M. Dannhauer, S. H. Lisanby, and **Z.-D. Deng**, "The next generation of Dosing Optimization for Transcranial Magnetic Stimulation (DO-TMS)," *NIMH IRP Fellows' Scientific Training Day*, 2023.

* P. L. Robins, S. N. Makaroff, and **Z.-D. Deng**, "Electric field characteristics of rotating permanent magnet stimulation," *Biomedical Engineering Society Annual Meeting*, 2023; also presented at *NIMH IRP Fellows' Scientific Training Day*, 2023.
NIMH IRP Trainee Travel Award

E. Jones, **Z.-D. Deng**, Z. Rezaee, P. Rohde, P. L. Robins, W. T. Regenold, and S. H. Lisanby, "Transcranial electric stimulation therapy for treatment resistant depression," *American Psychiatric Nurses Association Annual Conference*, 2023.

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† W. A. Wartman, K. Weise, M. Rach, L. Morales, **Z.-D. Deng**, A. Nummenmaa, and S. N. Makaroff, "An adaptive h-refinement method for the boundary element fast multipole method for quasi-static electromagnetic modeling," *Brain & Human Body Modeling Conference*, 2023.
Third Place in International Student Competition (awarded to W. A. Wartman)

† S. N. Makaroff, W. A. Wartman, **Z.-D. Deng**, and A. Nummenmaa, "Charge-based brain modeling engine at mesoscale and multiscale," *WPI Research, Discovery, and Innovation (ReDI) Annual Symposium*, 2023.

* J. Kim, B. A. Pritchard, R. H. Schor, G. R. Dold, S. H. Lisanby, and **Z.-D. Deng**, "Multichannel Individualized Stimulation Therapy (MIST) system for treatment of depression," *Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, 2023.

P. L. Robins, P. Rohde, **Z.-D. Deng**, W. T. Regenold, and S. H. Lisanby, "Feasibility method for magnetoencephalography data collection and analysis for patients receiving electroconvulsive therapy," *NIH Postbac Poster Day*, 2023.

P. Rohde, P. L. Robins, Z. Rezaee, **Z.-D. Deng**, E. Jones, W. T. Regenold, and S. H. Lisanby, "A feasibility study of transcranial electric stimulation (TEST) for treatment resistant depression investigating the necessity of seizure in electroconvulsive therapy," *NIH Postbac Poster Day*, 2023.

A. Guillen, C. C. Abbott, **Z.-D. Deng**, D. Truong, and A. Datta, "Impact of modeled field of volume in ECT current flow simulations," *International Brain Stimulation Conference*, 2023.

B. Luber, S. Davis, **Z.-D. Deng**, D. Murphy, A. V. Peterchev, and S. H. Lisanby, "Targeting deep brain structures with TMS using diffusion tensor imaging," *Brain Stimulation*, vol. 16, no. 1, p. 180, 2023.

W. Wartman, A. Miles, G. Hartwigsen, T. Knösche, **Z.-D. Deng**, and K. Weise, "How important are extracerebral brain compartments for TES, TMS, and ECT modeling predictions?" *Brain Stimulation*, vol. 16, no. 1, p. 138, 2023.

*† M. Dannhauer and **Z.-D. Deng**, "Optimizing the placements of multielectrode tES montages from EEG dipole modeling," *Brain Stimulation*, vol. 16, no. 1, pp. 136–137, 2023.

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* **Z.-D. Deng**, M. Hynd, Z. Rezaee, A. R. Brunoni, and S. H. Lisanby, "Sham response in transcranial magnetic stimulation depression trials is increasing over time," *Neuropsychopharmacology*, vol. 47, supplement, p. 199, 2022.

* H. Gura, E. Feuer, C. Abboud Chalhoub, S. Awasthi, M. Noh, B. Luber, and S. H. Lisanby, and **Z.-D. Deng**, "Effect of intertrain interval on theta burst induced changes in motor cortical excitability," Program No. 752.18. *Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience*, 2022.

E. Jones, **Z.-D. Deng**, Z. Rezaee, F. Mukhtar, E. Feuer, P. Rohde, P. L. Robins, W. T. Regenold, and S. H. Lisanby, "Innovative electroconvulsive therapy: Individualized Low Amplitude Seizure Therapy," *American Psychiatric Nurses Association Annual Conference*, 2022.
Poster Award (awarded to the Noninvasive Neuromodulation Unit), *NIMH 75th Anniversary Event*, 2023.

*† P. L. Robins and **Z.-D. Deng**, "Comparison of coil localization approaches and induced electric fields in depressed adolescents receiving repetitive transcranial magnetic stimulation," *NIMH IRP Fellows' Scientific Training Day*, 2022.

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M. Argyelan, C. C. Abbott, **Z.-D. Deng**, B. Wade, GEMRIC Consortium, G. Petrides, and A. Malhotra, "Personalizing electroconvulsive therapy with electrical field modeling," *Biological Psychiatry*, vol. 91, no. 9, p. S210, 2022.

*† C. C. Abbott, S. M. McClintock, M. Argyelan, and **Z.-D. Deng**, "Individualizing electroconvulsive therapy (ECT) amplitude to improve clinical outcomes," *Biological Psychiatry*, vol. 91, no. 9, pp. S54–S55, 2022.

*† **Z.-D. Deng**, S. M. McClintock, M. Husain, and S. H. Lisanby, "Depressive symptom dimensions and response trajectories in electroconvulsive therapy and magnetic seizure therapy," *Biological Psychiatry*, vol. 91, no. 9, p. S21, 2022.

E. C. Feuer, **Z.-D. Deng**, A. V. Peterchev, C. Sikes-Keilp, M. A. Rosa, and S. H. Lisanby, "Effects of stimulus frequency and individualized current amplitude on EEG and EMG characteristics in electroconvulsive therapy and magnetic seizure therapy," *International Society for ECT and Neurostimulation Annual Meeting*; also presented at *NIH Julius Axelrod Symposium*, 2022.

Intellectual Property

Z.-D. Deng, J. Kim, G. R. Dold, B. A. Pritchard, R. H. Schor, and S. H. Lisanby, "Systems and methods for adjustable current individualized stimulation therapy," U.S. Provisional Patent application 63/656,515, June 5, 2024.

Z.-D. Deng, B. A. Pritchard, J. Kim, G. R. Dold, R. H. Schor, and S. H. Lisanby, "Systems and methods for multichannel individualized stimulation therapy," PCT/US24/23876, Apr. 10, 2024; U.S. Provisional Patent application 63/495,244, Apr. 10, 2023.

C. C. Abbott, **Z.-D. Deng**, J. Upston, T. Jones, and A. Datta, "Systems and methods for E-field informed electroconvulsive therapy," PCT WO/2024/148196, July 11, 2024; U.S. Provisional Patent application 63/437,017, Jan. 4, 2023.

C. C. Abbott, A. Datta, J. Upston, T. Jones, and **Z.-D. Deng**, "Systems and methods for amplitude-determined seizure titrations and electric field modeling in electroconvulsive therapy," U.S. Provisional Patent application 63/516,371, July 28, 2023.

S. N. Makarov, G. M. Noetscher, V. S. Makarov, and **Z.-D. Deng**, "Whole body non-contact electrical stimulation device with variable parameters," U.S. Patent 10,551,449, Feb. 4, 2020.

C.-S. Poon and **Z.-D. Deng**, "Systems and methods for detecting a physiological abnormality in a patient by using cardiac or other chaos in combination with a non-increasing parasympathetic modulation," U.S. Patent 9,737,258, Aug. 22, 2017; PCT WO/2014/120353, July 8, 2014.

A. V. Peterchev and **Z.-D. Deng**, "Transcranial magnetic stimulation coil with electronically switchable active and sham modes," U.S. Provisional Patent application 61/525,922, Aug. 22, 2011.

A. V. Peterchev, S. H. Lisanby, and **Z.-D. Deng**, "Methods, apparatus, and systems for magnetic stimulation," U.S. Patent 9,295,853 B2, Mar. 29, 2016; U.S. Patent 8,801,589, Aug. 12, 2014; PCT WO/2010/017249; U.S. Patent 2011/0184223 A1; U.S. Patent 2009/052768, Aug. 4, 2009.

NIH Protocols

A feasibility study of Transcranial Electric Stimulation Therapy (TEST) for treatment resistant depression
NIMH Protocol 21-M-0031 2021–
Role: Associate investigator; PI: S. H. Lisanby

Role of GABAergic transmission in auditory processing in Autism Spectrum Disorder
NIMH Protocol 20-M-0159 2020–
Role: Associate investigator; PI: S. H. Lisanby

Safety and feasibility of individualized low amplitude seizure therapy
NIMH Protocol 19-M-0073 2019–
Role: Associate investigator; PI: S. H. Lisanby

Mechanism of action underlying ketamine's antidepressant effects: An investigation of the AMPA throughput theory in patients with treatment-resistant major depression
NIMH Protocol 19-M-0107 2019–
Role: Associate investigator; PI: C. A. Zarate, Jr.

Concurrent fMRI-guided rTMS and cognitive therapy for the treatment of major depressive episodes
NIMH Protocol 17-M-0147 2017–

Role: Associate investigator; PI: S. H. Lisanby

Development of non-invasive brain stimulation techniques
NIMH Protocol 18-M-0015 2017–
Role: Associate investigator; PI: S. H. Lisanby

Development of functional and structural magnetic resonance imaging techniques for the study of mood and anxiety disorders
NIMH Protocol 07-M-0021 2017–
Role: Associate investigator; PI: A. C. Nugent

Identifying neurobiological mechanisms that underlie acute nicotine withdrawal and drive early relapse in smokers
NIDA Protocol 12-DA-N474 2017–
Role: Associate investigator; PI: A. Janes

Neuropharmacologic imaging and biomarker assessments of response to acute and repeated-dosed ketamine infusions in major depressive disorder
NIMH Protocol 17-M-0060 2016–
Role: Associate investigator; PI: C. A. Zarate, Jr.

Evaluation of patients with mood and anxiety disorders and healthy volunteers
NIMH Protocol 01-M-0254 2016–
Role: Associate investigator; PI: C. A. Zarate, Jr.

Modulation of the parieto–frontal communication
NINDS Protocol 18-N-0054 2018–2019
Role: Associate investigator; PI: M. Hallett

Effect of TMS to frontoparietal attention network on anxiety potentiated startle
NIMH Protocol 17-M-0042 2017–2019
Role: Associate investigator; PI: C. Grillon

Ongoing Research Support

ADEPT: Adaptive trial for the treatment of depression associated with concussion using repetitive transcranial magnetic stimulation protocols
Congressionally Directed Medical Research Programs Award TP220072 2024–
Role: Intramural NIH collaborator; PI: D. L. Brody
This study aims to compare different types of TMS that may alleviate depressive symptoms in US military service members with a history of concussion.

Charge-based brain modeling engine with boundary element fast multipole method
NIH/NIMH R01 MH130490 2023.07–2028.05
Role: Intramural NIH collaborator; PI: S. N. Makaroff
This project seeks to create a new brain modeling engine that employs boundary element and fast multipole methods to achieve superior spatial resolution and accuracy in electromagnetic modeling.

Novel electric-field modeling approach to quantify changes in resting state functional connectivity following theta burst stimulation
NIH/NIMH U01 MH130447 2022.09–2027.06
Role: Intramural NIH collaborator; PI: N. L. Balderston
This study aims to develop a model using whole-brain estimates of the TMS-induced electric field to predict changes in resting state functional connectivity following neuromodulatory TMS, and validate this model in a large cohort of healthy volunteers receiving multiple doses of either intermittent or continuous theta burst stimulation.

Development of a novel, scalable, neurobiologically-guided transcranial magnetic stimulation protocol for the treatment of cannabis use disorder
Centre for Addiction and Mental Health, Toronto, ON, Canada 2023.02–
Role: Consultant; PI: V. M. Tang

This proof-of-concept clinical trial will evaluate the feasibility and tolerability of a 4-week course of rTMS to the prefrontal cortex and insula as a treatment for cannabis use disorder.

Deciphering mechanisms of ECT outcomes and adverse effects (DECODE)
NIH/NIMH R01 MH128686/MH128690/MH128691/MH128692 2022.08–2027.05
Role: Intramural NIH collaborator; mPIs: Y. I. Sheline, K. L. Narr, R. Espinoza, S. M. McClintock, C. C. Abbott
This multi-site prospective study aims to study the mechanism of ECT-induced antidepressant benefits and cognitive adverse effects to determine optimal ECT dose.

ECT amplitude titration for improved clinical outcomes in late-life depression
NIH/NIMH R61/R33 MH125126 2021.02–2023.01
Role: Intramural NIH collaborator; PI: C. C. Abbott
This study uses titrated amplitude ECT, individualized based on seizure threshold, to improve clinical response while minimizing cognitive impairment in geriatric depression.

Neuromodulation of social cognitive circuitry in people with schizophrenia spectrum disorders
NIH/NIMH R61/R33 MH120188 2020.05–2023.04
Role: Intramural NIH collaborator; mPIs: A. N. Voineskos, D. M. Blumberger
This study uses advanced brain imaging, and compare different brain stimulation techniques, to determine whether targeting the dorsomedial prefrontal cortex can engage social cognitive brain circuitry in people with schizophrenia spectrum disorders.

Pending Research Support

Improving ECT clinical outcomes through seizure- and model-guided stimulation parameters
NIH UH3/UG3 2024.10
Role: mPI; collaborating PIs: C. C. Abbott, A. Datta

Development of high-density theta burst TMS technology and initial testing in humans
NIH UH3/UG3 2024.09
Role: Intramural NIH collaborator; PI: H. Lu

Improving the optimization of TMS coil placement with precise calculation of electric fields and robust computation of personalized functional networks
NIH/NIMH R01 2024.10
Role: Intramural NIH collaborator; PI: Y. Fan

Targeting the causal depression network with electroconvulsive therapy
NIH/NIMH R33/R61 2024.02
Role: Intramural NIH collaborator; PI: M. Argyelan

Development of a next generation ECT system: PRecision Optimally Targeted ECT
NIH/NIMH UG3/UH3 2024.06
Role: Intramural NIH collaborator; PI: C. C. Abbott

Completed Research Support

ECT pulse amplitude and medial temporal lobe engagement
NIH/NINDS U01 MH111826 2016.09–2020.07
Role: Co-I; PI: C. C. Abbott
This study explores the impact of targeted hippocampal engagement with varying levels of electroconvulsive therapy current amplitude in elderly patients with clinical, neuropsychological and neuroimaging assessments.

Individualized low amplitude seizure therapy (iLAST)
Brain & Behavior Research Foundation Young Investigator Award 26161 2018.06–2020.06
Role: PI
This study aims to develop a novel form of seizure therapy for depression that avoids the neurocognitive side effects of electroconvulsive therapy by using computational modeling to direct multi-electrode configurations that provide targeted and individualized dosing.

Fast-Fail Trials: Mood and Anxiety Spectrum Disorders (FAST-MAS)
NIMH 271201200006I-3-27100003-1 2016.06–2017.12
Role: Data analyst; PI: A. D. Krystal

The goal of this project is to establish the kappa opiate receptor occupancy and mu opiate receptor effects after two weeks of daily dosing with the investigational agent LY2456302, which has been demonstrated to be a selective kappa opiate receptor antagonist.

Transcranial direct current stimulation as a treatment for acute fear
NIH/NIMH R21 MH106772 2015.04–2017.01
Role: Co-I; PI: A. D. Krystal
This study investigates the utility of transcranial direct current stimulation to engage a target neural circuit, which could serve as the basis for developing better therapies for those suffering from acute fear related difficulties.

Individualized optimally-targeted seizure therapy
NIH/NCATS KL2 TR001115 2014.07–2016.06
Role: PI; Training Grant PI: R. M. Califf
This award from the Duke Translational Medicine Institute prepares the fellow for a successful career as a multidisciplinary independent researcher. The goal of the project is to develop a novel individualized neurotargeted seizure therapy.

Safety and feasibility of low amplitude electroconvulsive therapy
Duke University School of Medicine, Pilot fund 2015.03–2016.06
Role: PI
This study evaluates whether neurocognitive side effects of electroconvulsive therapy can be improved by reducing the current pulse amplitude.

Prolonging Remission In Depressed Elderly (PRIDE)
NIH/NIMH U01 MH084241 2009.04–2016.03
Role: Data analyst; PI: S. H. Lisanby
This study evaluates the efficacy and neurocognitive effects of combined electroconvulsive and pharmacotherapy in prolonging remission in elderly patients with major depression.

Low field magnetic stimulation coil design
Tal Medical 2015.04–2016.06
Role: Co-I; PI: A. V. Peterchev
This project develops a novel coil system for low field magnetic stimulation.

Concurrent cognitive behavioral therapy and transcranial magnetic stimulation in obsessive-compulsive disorder
American Psychiatric Association Research Scholarship 2015.11–2016.06
Role: Acting PI; Grantee: Y. Hu
The purpose of this pilot study is to evaluate the feasibility of repetitive transcranial magnetic stimulation of the supplementary motor area concurrently with elements of exposure and response prevention in patients with obsessive-compulsive disorder.

Evoked potentials as markers of ketamine-induced cortical plasticity in patients with major depressive disorder
Janssen Research & Development, LLC 2014.01–2015.12
Role: Co-I; PI: A. D. Krystal
This open-label trial evaluates the utility of somatosensory, motor, and transcranial magnetic stimulation-based evoked potentials as markers of cortical plasticity in response to a single intravenous infusion of ketamine in patients with depression.

Magnetic seizure therapy for the treatment of depression
Stanley Medical Research Institute 2005.07–2011.07
Role: Postdoctoral fellow; PI: S. H. Lisanby
This two-center, randomized, double-blind controlled trial compares the antidepressant efficacy and side effects of magnetic seizure therapy and electroconvulsive therapy.

Translational research evaluating neurocognitive memory processes
NIH/NIMH K23 MH087739 2010.07–2015.01
Role: Postdoctoral fellow; PI: S. M. McClintock

This study informs the cognitive component processes underlying memory impairment after electroconvulsive therapy.

Rational dosing for electric and magnetic seizure therapy
NIH/NIMH R01 MH091083 2010.07–2015.12
Role: Graduate research assistant, contributed to grant writing; PI: S. H. Lisanby
This study aims to optimize stimulus parameters of electric and magnetic seizure therapy through computational modeling and preclinical studies of seizure induction.

Field shaping and coil design for transcranial magnetic stimulation
NIH/NCRR TL1 RR024158 2010.09–2011.06
Role: PI; Training Grant PI: H. N. Ginsberg
This award from the Columbia University Irving Institute for Clinical and Translational Research supports clinical research training for predoctoral students in the basic sciences. The goal of the project is to develop novel coil design for transcranial magnetic stimulation.

Development of a novel TMS device with controllable pulse shape
NIH/NIBIB R21 EB006855 2007.08–2009.07
Role: Graduate research assistant; PI: A. V. Peterchev
This project develops an efficient transcranial magnetic stimulation device that produces nearly rectangular pulses with adjustable amplitude, width, and directionality.

Nonlinear analysis of heart rate variability
NIH/NHLBI R01 HL079503 2005.11–2009.06
Role: Graduate research assistant; PI: C.-S. Poon
This project develops advanced nonlinear estimation and adaptive control algorithms for the modeling and analysis of the cardiovascular system.

Grand Rounds

Advanced Research Institute Grand Rounds in Mental Health and Aging Research 2023
Advancing neurostimulation treatment optimization and technology innovation

Westmead Hospital, Sydney, Australia 2020
Advances in neuromodulation: Electroconvulsive therapy

Clinical TMS Society 2018
Transcranial magnetic stimulation: Physics, devices, and modeling

University of New Mexico, Department of Psychiatry & Behavioral Sciences 2017
Toward individualized electroconvulsive therapy for treatment of depression

Central Regional Hospital, Butner, NC 2015
Individualized seizure therapy

Duke University School of Medicine, Department of Psychiatry & Behavioral Sciences 2015
Toward next generation seizure therapy

Invited Seminars

NIMH Intramural Research Program Investigators' Seminar Series Upcoming 2025
Reading faces: Application of facial expression analysis for tracking emotional states in depression

UCSF Department of Psychiatry & Behavioral Sciences Upcoming 2025
Engineering precision in neuromodulation: Computational models and clinical applications

University of Pittsburgh, Geriatric Psychiatry Neuroimaging Laboratory 2024
The full spectrum: Electromagnetic brain stimulation from minimal to maximal intensity

University of Texas Southwestern, Center for Depression Research and Clinical Care 2023
Advancements in computational neurostimulation for depression treatment optimization and technology development

University of Pittsburgh, Department of Psychiatry 2023
Computational neurostimulation: Approach to treatment optimization and technology de-

velopment

Medical University of South Carolina 2022
National Center of Neuromodulation for Rehabilitation
Model-driven design for brain stimulation therapies

NIMH Intramural Research Program Investigators' Seminar Series 2022
Seizure therapies: The next generation

Butler Hospital, Brown University 2021
Computational model driven design for brain stimulation

University of Pennsylvania, Center for Neuromodulation in Depression and Stress 2021
Electromagnetic brain stimulation from low to high intensity

VA Boston Healthcare System, Boston University School of Medicine 2020
Harvard Medical School Neuropsychiatry Translational Research Fellowship Seminar
Precision neurostimulation: History, physics, computational modeling, and engineering

Medical University of Vienna, Neuroimaging Lab 2020
Precision seizure therapy

Mount Sinai Icahn School of Medicine, Depression and Anxiety Center 2019
Rational design of individualized noninvasive brain stimulation

NIMH Intramural Research Program Investigators' Seminar Series 2018
Computational neurostimulation: Engineering better brain stimulation therapies

UCLA Brain Mapping Center 2018
Computational neurostimulation: Engineering better brain stimulation therapies

UCLA Semel Institute for Neuroscience and Human Behavior 2018
Neuromodulation Division
Modeling and design for magnetic stimulation

USC Mark and Mary Stevens Neuroimaging and Informatics Institute 2018
Computational neurostimulation

NIDA, Neuroimaging Research Branch 2016
Advances in transcranial magnetic stimulation technology

Mayo Clinic College of Medicine, Department of Molecular Pharmacology 2016
Neurobiology of Alcoholism and Drug Addiction Lab
Transcranial magnetic stimulation technology development

Mayo Clinic College of Medicine, Department of Neurologic Surgery 2016
Neural Engineering Lab
Optimizing transcranial magnetic stimulation

NIMH, Experimental Therapeutics & Pathophysiology Branch 2016
Engineering better electromagnetic brain stimulation therapies

Duke University School of Medicine, Department of Psychiatry & Behavioral Sciences 2015
Chair's round: *Fundamentals of transcranial electric and magnetic stimulation dosing*

Weill Cornell Medical College, Department of Biomedical Engineering 2015
Transcranial magnetic stimulation: Pulse source, coil design, & concurrent neuroimaging

Duke University, Department of Biomedical Engineering 2014
Modeling and coil design considerations for transcranial magnetic stimulation

Conference Talks, Workshops, & Panels

International Society for ECT and Neurostimulation Annual Meeting Upcoming 2025
Multichannel Individualized Stimulation Therapy

American Neuropsychiatric Association Annual Meeting Upcoming 2025

Panel: *Interventional neuropsychiatry: From mechanisms to clinical decision-making*

International Brain Stimulation Conference Upcoming 2025
On-demand symposium: *ECT reimagined: Precision, prediction, and personalized care*

IEEE Brain Discovery & Neurotechnology Workshop, University of Illinois Chicago 2024
A model-driven approach to personalized neuromodulation treatment

International Symposium on Novel Neuromodulation Techniques 2024
Model-driven brain stimulation treatments

NIMH Workshop on The Placebo Effect: Key Questions for Translational Research 2024
Challenges and strategies in implementing effective sham stimulation for noninvasive brain stimulation trials

International Society for Magnetic Resonance in Medicine Annual Meeting 2024
Workshop: *From basics to applications: MRI of neuromodulation using TMS and FUS*
Contributed talk: *TMS devices and modeling*

Brain and Human Body Modeling Conference 2023
The Martinos Center for Biomedical Imaging, Massachusetts General Hospital
Chair: *New modeling methods and targets: Spinal cord stimulation and novel stimulation*
Chair: *Development and assessment of modeling methods*
Contributed talk: *Effects of low intensity magnetic stimulation*
Judge: Student competition

International Conference of the IEEE Engineering in Medicine and Biology Society 2023
Panel: *Computational analysis of non-invasive neuromodulation: Brain and spine*
Contributed talk: *Modeling of TMS and ECT in the treatment of depression*

ADAA Anxiety and Depression Conference 2023
Panel: *Parsing through syndromic heterogeneity in youths with mental illness to identify neurocircuit mechanisms and develop novel treatments*
Contributed talk: *Modeling and dose optimization for TMS and ECT*

International Brain Stimulation Conference 2023
Symposium chair: *Insights and challenges in preclinical models of TMS: Multimodal investigations across animal species*
Fast-track oral symposium chair: *Advanced computational modeling and optimization methods for noninvasive brain stimulation*

International Network of tES–fMRI (INTF) Webinar Series 2022
Electric field modeling and optimization approaches for individualized targeting

International Society for Magnetic Resonance in Medicine 2022
Workshop: *MRI of neuromodulation: Target engagement, neural mechanism, and biomarker development*
Contributed talk: *Modeling of TMS*

Bergen Workshop of the Global ECT–MRI Collaboration 2022
ECT device development

International Congress of Clinical Neurophysiology 2022
Chair: *Towards optimized TMS targeting approaches*

Brain and Human Body Modeling Conference 2022
The Martinos Center for Biomedical Imaging, Massachusetts General Hospital
Chair: *Modeling of transcranial electrical stimulation and deep brain stimulation*
Contributed talk: *ECT, electric field, neuroplasticity, and clinical outcomes*

European Conference of Brain Stimulation in Psychiatry 2022
Panel: *Beyond clinical syndromes: Understanding mechanisms of neuromodulation from a dimensional perspective*

Contributed talk: *Symptom dimensions and response trajectories in ECT and MST*

Society of Biological Psychiatry Annual Meeting 2022
Panel: *Dimensional approaches to device neuromodulation*
Contributed talk: *Depressive symptom dimensions in seizure therapy*

Global ECT–MRI Collaboration Young Researchers Collective 2022
ECT, electric field, neuroplasticity, and clinical outcomes

American Academy of Child and Adolescent Psychiatry Annual Meeting 2021
Panel: *Recent work with contemporary computational methods and artificial intelligence to advance the practice of child and adolescent psychiatry*
Contributed talk: *Introduction to computational psychiatry*

European College of Neuropsychopharmacology Congress 2021
Panel: *Neurobiology of rapid mood changes*
Contributed talk: *Precision neurostimulation: Electroconvulsive therapy*

Society for Brain Mapping & Therapeutics Annual Congress 2021
Advances in electroconvulsive therapy for treatment of depression

American Society of Clinical Psychopharmacology Annual Meeting 2021
Early Career Workshop: *How to give a virtual talk*

International College of Neuropsychopharmacology Virtual World Congress 2021
Next generation seizure therapy and neuromodulation

European Conference of Brain Stimulation in Psychiatry 2020
Panel: *What can we learn from ECT: Insights from the GEMRIC consortium*
Contributed talk: *Electric field modeling to inform ECT dosing and device development*

University of Minnesota Non-Invasive Brain Stimulation Workshop 2020
Use of individual electric field models in clinical research

American Society of Clinical Psychopharmacology Annual Meeting 2020
Panel: *New developments in neurostimulation* #coronacancelled

NYC Neuromodulation Online 2020
Discussant: *Noninvasive vagus nerve stimulation applied to stress management, opioid withdrawal, and neurocognitive disorders*

American College of Neuropsychopharmacology Annual Meeting 2019
Panel: *Precision neurostimulation for treatment of psychiatric disorders*
Contributed talk: *Rational design of precision seizure therapy*

International Symposium on Advancing Stimulation Precision Medicine of Brain Disorders, Copenhagen University Hospital Hvidovre, Danish Research Centre for Magnetic Resonance
Rational design of precision seizure therapy 2019

International College of Neuropsychopharmacology Meeting 2019
Workshop: *Neurobiological and clinical characterization, and treatment development for treatment resistant depression*
Contributed talk: *Individualized seizure therapy: Reinventing ECT*

American Society of Clinical Psychopharmacology Annual Meeting 2019
Co-chair: *Treatment-resistant mood disorders across the lifespan: Novel therapeutics*

International Brain Stimulation Conference 2019
Panel: *Individualized brain stimulation: Addressing heterogeneity across modalities*
Contributed talk: *Individualized electroconvulsive therapy for treatment of depression*

2nd Bergen Workshop of the Global ECT–MRI Collaboration 2018
Electric field modeling for electroconvulsive therapy

Joint NYC Neuromodulation Conference & NANS Summer Series 2018

Optimizing high-density stimulation arrays for brain targeting

Neuropsychiatric Drug Development Summit 2018
Targeted intermittent device delivered interventions will ultimately prove superior to maintenance treatment with drugs for brain disorders

International Conference of the IEEE Engineering in Medicine and Biology Society 2018
Chair: *Computational human models for brain stimulation*
Contributed talk: *Electric field induced by TMS: Applications in depression and anxiety*

APA Annual Conference Presidential Symposium 2018
Presidential symposium: *ECT in the era of new brain stimulation treatments*
Contributed talk: *Individualized neurotargeted seizure therapy: Reinventing ECT*

ADAA Anxiety and Depression Conference 2018
Panel: *Personalized medicine for treatment resistant depressed patients: Novel strategies to optimize treatment with antidepressant medications, ketamine, and ECT*
Contributed talk: *Individualized neurotargeted seizure therapy: Reinventing ECT*

NIMH Non-Invasive Brain Stimulation Electric Field Modeling Workshop 2017
Use of individual electric field models in clinical research

NYC Neuromodulation Conference 2017
Low field magnetic stimulation

NIMH Workshop on Transcranial Electrical Stimulation: Mechanisms, Technology, and Therapeutic Applications 2016
Effect of anatomical variability on electric field characteristics of tES

International Society for ECT and Neurostimulation Annual Meeting 2015
Workshop: *Spatial targeting with transcranial magnetic stimulation*

Teaching & Mentoring Appointments

National Institutes of Health Bethesda, MD

Lecturer, NINDS

Clinical Neuroscience Program Lecture Series 2017, 2019

Lecturer, NIMH

NIH Basic Training Course on Transcranial Magnetic Stimulation 2020
fMRI Course 2017

University of Maryland, College Park College Park, MD

Research Mentor, Fischell Department of Bioengineering 2018–2019

Duke University Durham, NC

Instructor, Department of Psychology & Neuroscience

Research Independent Study 2016

Faculty, Department of Psychiatry & Behavioral Sciences

Visiting Fellowship in Transcranial Magnetic Stimulation & Electroconvulsive Therapy Fellowship (Continuing Medical Education accredited) 2014–2016

Research Mentor

Matching Undergraduates to Science and Engineering Research Program 2015–2016

Faculty, Biosciences Collaborative for Research Engagement 2015–2016

Columbia University New York, NY

Teaching Assistant, Department of Electrical Engineering

Analog Systems in VLSI (graudate level) Spring 2010
The Digital Information Age Fall 2009

Recitation Instructor, Department of Biostatistics, Mailman School of Public Health

Biostatistics (graduate level) Fall 2009

Massachusetts Institute of Technology Cambridge, MA

Educational Counselor 2022–

Teaching Assistant, Concourse Program

Multivariable Calculus Fall 2003–2006
Differential Equations Spring 2004–2007

Grader, Department of Electrical Engineering & Computer Science

Signals and Systems Fall 2004

Sponsored Theses

G. Asturias, Psychology & Neuroscience, Duke University 2015–2017
Graduated with Distinction
Undergraduate honors thesis: "Effect of repetitive transcranial magnetic stimulation on the structural and functional connectome in patients with major depressive disorder," *DukeSpace*
Post-training position: Medical student, Stanford University School of Medicine

Thesis Examination Committee Membership

W. A. Wartman, Electrical & Computer Engineering, Worcester Polytechnic Institute 2024
Ph.D. dissertation: "Adaptive mesh refinement for quasistatic electromagnetic modeling of brain stimulation and recording methods"
Sponsor: S. N. Makaroff

D. Q. Troung, Biomedical Engineering, CUNY City College 2019
Ph.D. dissertation: "Translational modeling of non-invasive electrical stimulation," *CUNY Academic Works*
Sponsor: M. Bikson

Career Development Award Advisory

S. K. Conroy, M.D., Ph.D., Indiana University School of Medicine 2024–
Project: "Targeting the medial prefrontal cortex with theta burst stimulation to reduce negative self-referential processing in major depression"

S. M. Hare, Ph.D., University of Maryland School of Medicine
NIH/NIMH K01 MH133116 2024–2029
Project: "Cognitive and neural correlates of TMS motor intracortical inhibition in schizophrenia"

S. H. Siddiqi, M.D., Brigham & Women's Hospital
NIH/NIMH K23 MH121657 2020–2025
Project: "Personalized circuit-based neuromdulation targets for depression"

N. L. Balderston, Ph.D., University of Pennsylvania Perelman School of Medicine
NIH/NIMH K01 MH121777 2019–2023
Project: "Examining the mechanisms of anxiety regulation using a novel, sham-controlled, fMRI-guided rTMS protocol and a translational laboratory model of anxiety"

Research Fellows & Postdocs

S. Dey, Ph.D., NIMH Visiting Postdoctoral Fellow 2024–

M. Dannhauer, Ph.D., NIMH Research Fellow 2022–2024
Post-training position: Assistant Professor, Department of Computer Science, East Carolina University

Graduate Students	E. Bharti, Ph.D. candidate, NIH Oxford-Cambridge Scholars Program	2024–
	M. Kshirsagar, M.S., Biomedical Engineering, Duke University Post-training position: Consultant, Deloitte Consulting	2012
Postbacs	P. L. Robins, B.A., NIMH Intramural Research Training Award (IRTA) Fellow	2021–2024
	NIMH Intramural Research Program Trainee Travel Award	2023
	First Place in Student Competition, *Brain & Human Body Modeling Conference*	2022
	Post-training position: TMS technician, Columbia Associates	
	M. R. Hynd, B.S., NIMH IRTA Fellow Post-training position: Doctoral student, University of North Carolina at Chapel Hill	2020–2022
	S. M. Awasthi, B.S., NIMH IRTA Fellow Post-training position: Medical student, Stanford University School of Medicine	2018–2020
	M. Noh, S.B., NIMH IRTA Fellow Post-training position: Medical student, University of Cincinnati College of Medicine	2018–2019
	J. Thomas, M.S., NIMH IRTA Fellow Post-training position: Program officer, National Academies of Sciences, Engineering, and Medicine	2017–2019
	M. Velez Afanador, B.S., NIMH IRTA Fellow	2016–2019
	Outstanding Poster Award, *NIH Postbac Poster Day*	2018
	Post-training position: Medical student, Howard University College of Medicine	
Undergrads	M. Dib, Biomedical Engineering, University of Maryland, College Park Supervised as a summer intern at the NIH, provided ongoing mentorship during academic terms, including advising Capstone design project: "Detection of brain-to-brain synchrony for improved psychotherapy" Post-training position: Medical student, Weill Cornell Medicine	2018–2019
	E. Salgado, Psychology & Neuroscience, Duke University Graduated with Distinction	2016
	D. T. Weaver, Biology, Duke University	2016
	Z. Feng, Biomedical Engineering and Biology, Duke University	2015–2016
	M. Glidewell, Biomedical Engineering, Duke University	2015–2016
	S. Lee, Biomedical Engineering, Duke University	2015–2016
	W. Lim, Biomedical Engineering, Duke University	2015–2016
	F. M. Mercer, Women's Studies, Duke University	2015–2016
	R. Shah, Psychology & Neuroscience, Duke University	2015–2016
	E. Shinder, Biology, Duke University Graduated with Distinction	2015–2016
	E. P. Vienneau, Biomedical Engineering, Duke University Howard G. Clark Award for Excellence in Research	2015–2016
	J. R. Lilien, Electrical & Computer Engineering, Duke University Walter J. Seeley Scholastic Award	2014–2016
Interns	E. Chung, Psychology, University of Maryland, College Park	2017
	A. L. Halberstadt, Biology and Psychology, Carnegie Mellon University	2017
	C. M. Prevost, Biomedical Engineering, Clemson University	2015
	J. V. McCall, Biomedical Engineering, North Carolina State University	2013

Professional & Scholastic Societies Membership

IEEE, Engineering in Medicine and Biology Society
- Senior Member — 2023–
- Member — 2013–2023
- Student Member — 2004–2013

American Society of Clinical Psychopharmacology
- Member — 2019–
- Early Career Committee — 2023–2027
- Technology Committee — 2023–2025
- Producer, *Psychopharm Today* podcast — 2024–
- Technology Task Force — 2020–2023

Biomedical Engineering Society
- Member — 2021–

American College of Neuropsychopharmacology
- Associate Member — 2023–

Sigma Xi, The Scientific Research Honor Society
- Full Member — 2024–

Anxiety and Depression Association of America
- Member — 2017–2018

International Society for CNS Clinical Trials and Methodology
- Member — 2017–2019

Organization for Human Brain Mapping
- Member — 2014–2019

Society for Industrial and Applied Mathematics
- Student Member — 2008–2012

Society for Neuroscience
- Student Member — 2005–2012

American Physical Society
- Student Member — 2004–2009

Editorial Roles

Deputy Editor, *Transcranial Magnetic Stimulation* — 2024–

Associate Editor, *Frontiers in Psychiatry* — 2022–
- Sections: Neurostimulation, Neuroimaging
- Co-Editor on Research Topic: How does brain stimulation work? Neuroversion and other putative mechanisms of action — 2024

Review Editor, *Frontiers in Psychology* — 2022–
- Sections: Addictive Behaviors, Consciousness Research

Review Editor, *Frontiers in Psychiatry* — 2016–2022
- Sections: Neurostimulation, Neuroimaging

Guest Associate Editor, *Frontiers in Pharmacology: Neuropharmacology* — 2020
- Co-Editor on Research Topic: Neurobiology of rapid mood changes

Guest Editor, *Physics in Medicine and Biology* — 2024
- Special Issue: Electromagnetic modeling for brain stimulation

Ad hoc journal reviewer — 2010–
- *AIP Advances*
- *American Journal of Psychiatry*
- *Asian Journal of Psychiatry*
- *Australasian Physical and Engineering Sciences in Medicine*

Biological Psychiatry
BioMedical Engineering OnLine
Brain Sciences
Brain Stimulation
Cerebral Cortex
Clinical EEG and Neuroscience
Clinical Neurophysiology
CNS Spectrums
Computational and Mathematical Methods in Medicine
Computer Methods and Programs in Biomedicine
Cortex
European Psychiatry
Frontiers in Cell and Developmental Biology
Frontiers in Medicine: Intensive Care Medicine and Anesthesiology
Frontiers in Neurology: Applied Neuroimaging
Frontiers in Neuroscience: Brain Imaging Methods
IEEE Antennas and Propagation Magazine
IEEE Journal of Electromagnetics, RF, and Microwaves in Medicine and Biology
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Neural Systems & Rehabilitation Engineering
IEEE Transactions on Magnetics
Imaging Neuroscience
Journal of ECT
Journal of Neural Engineering
Journal of Neuroscience Methods
Journal of Psychiatric Research
JoVE
Medical & Biological Engineering & Computing
Medical Hypotheses
Nature Mental Health
NeuroImage; *NeuroImage Clinical*
Neuromodulation: Technology at the Neural Interface
Neuroscience Letters
PLOS ONE
Scientific Reports
Translational Psychiatry

Reviewer, Conference Proceedings & Abstract 2008–
International Conference of the IEEE Engineering in Medicine and Biology Society
IEEE/EMBS International Conference on Neural Engineering
IEEE/EMBS International Conference on Biomedical and Health Informatics
Biomedical Engineering Society Annual Meeting

Grant Review Panels

Reviewer, NIH BluePrint MedTech Program 2022–2024

Ad hoc reviewer, NIH Early Career Reviewer Program 2021
Biophysics of Neural Systems Study Section

Reviewer, Duke Institute for Brain Sciences, Research Incubator Awards 2018, 2021

Conference Organizing Committee

Organizing committee, Brain and Human Body Modeling Conference 2022–2023

Program review subcommittee 2023
American Society of Clinical Psychopharmacology Annual Meeting

Preconference workshop director, NYC Neuromodulation Conference 2018
Workshop: *Computational modeling in neuromodulation: Tools for engineers, clinicians, and researchers*

Community Involvement, Outreach, & Science Advocacy

NIH Research Workforce Diversity and Equity Outreach Special Interest Group 2023–

Judge, NIMH Training Day Three-Minute Talks competition 2022

Mental Health Association of Maryland 2020
Presentation: *Fundamentals of transcranial brain stimulation*

Jewish Social Service Agency 2020
Presentation: *Basics of brain stimulation devices: What are they and how do they work*

Exhibitor, USA Science & Engineering Festival #coronacancelled 2020

University of Pennsylvania, Wharton Undergraduate Health Care Club 2019
Presentation: *Research in mental health treatment*

Judge, MIT Hacking Medicine: DC Grand Hack 2019

NIH High School Scientific Training and Enrichment Program 2019
Presentation: *Bioelectricity and brain stimulation*

NIH Take Your Child to Work Day 2019
Presentation: *How to fool your brain*

UCLA, CruX Neurotech Organization 2019
Presentation: *Neuromodulation in psychiatry*

University of Pennsylvania, Wharton Undergraduate Health Care Club 2018
Presentation: *Technology and the future of mental health treatment*

NIH Noninvasive Brain Stimulation Special Interest Group 2017–

Judge/Lead Judge, NIH Postbac Poster Day 2017–2019

Innovation Leader, Psychiatry Innovation Lab, American Psychiatric Association 2016

Duke Psychiatry, Mood Disorders Support and Education Group
Presentation: *Brain stimulation treatments for severe mood disorders* 2016
Presentation: *New frontiers in treatments for mood disorders* 2015

Duke Translational Medicine Institute, Undergraduate Research Society 2016
Presentation: *Engineering meets psychiatry*

Professional Development & Continuing Education

Mid-Level Leadership Program, NIH 2023

Diversity and Inclusion Certificate Program, NIH 2021–2022

Non-invasive Transcranial Brain Stimulation Course, Danish Research Centre for Magnetic Resonance, Copenhagen University Hospital Hvidovre 2019

Health Disparities Research Curriculum, Duke Translational Medicine Institute 2015–2016

Tackling the Challenges of Big Data, MIT Professional Education Program 2015

Clinical Research Training Program, Duke University 2014–2015

Transcranial magnetic stimulation administration certified, Columbia University Irving Medical Center/New York State Psychiatric Institute 2009

Basic Life Support, American Heart Association renewed 2023