Zhi-De Deng

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Education

Ph.D., **Electrical Engineering**, Columbia University 2013
Dissertation: *Electromagnetic Field Modeling of Transcranial Electric & Magnetic Stimulation: Targeting, Individualization, and Safety of Convulsive & Subconvulsive Applications*

M.Phil., **Electrical Engineering**, Columbia University 2011
Graduate concentration in Neuroscience

M.Eng., **Electrical Engineering & Computer Science**, MIT 2007
Thesis: *Stochastic Chaos and Thermodynamic Phase Transitions: Theory and Bayesian Estimation Algorithms*

S.B., **Electrical Science & Engineering**, MIT 2007

S.B., **Physics**, MIT 2006
Minor in Economics

Academic & Government Appointments

Senior Associate Scientist (Research Professor equivalent), NIMH 2025 –
Experimental Therapeutics & Pathophysiology Branch
Noninvasive Neuromodulation Unit
Director, Computational Neurostimulation Research Program

Staff Scientist, NIMH 2019 – 2025
Experimental Therapeutics & Pathophysiology Branch
Noninvasive Neuromodulation Unit
Director, Computational Neurostimulation Research Program

Adjunct Assistant Professor, Duke University School of Medicine 2016 – 2024
Department of Psychiatry & Behavioral Sciences
Division of Behavioral Medicine & Neurosciences
Network Faculty, Duke Institute for Brain Sciences

Medical Instructor, Duke University School of Medicine 2014 – 2016
Department of Psychiatry & Behavioral Sciences
Division of Brain Stimulation & Neurophysiology
KL2 Scholar, Duke Translational Medicine Institute

Postgraduate Training & Fellowship Appointments

Research Fellow, NIMH 2016 – 2019
Experimental Therapeutics & Pathophysiology Branch
Noninvasive Neuromodulation Unit
Richard J. Wyatt Memorial Fellowship for Translational Research

Postdoctoral Associate, Duke University School of Medicine 2013 – 2014
Department of Psychiatry & Behavioral Sciences
Division of Brain Stimulation & Neurophysiology

Predoctoral Research Assistantships & Internships

Visiting Graduate Research Assistant, Duke Psychiatry 2010 – 2013

Graduate Research Assistant, Columbia Psychiatry 2007 – 2010
TL1 Scholar, Irving Institute for Clinical and Translational Research

Research Assistant, Harvard–MIT Division of Health Sciences & Technology 2005 – 2007

Executive Intern, Weill Cornell Medicine Anesthesiology Summer 2004

Internship Coordinator, Children's Aid Society Summer 2003

Newsroom Technology Intern, The New York Times Company Summer 2002

Awards & Honors (selected)

Certificate for Top Cited Article 2025
Bipolar Disorders, International Society for Bipolar Disorders/Wiley

Special Act Award 2025
For outstanding scholarship advancing precision neuromodulation, NIMH

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

Elected to Full Membership 2024
Sigma Xi, The Scientific Research Honor Society

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)

Elevated to Senior Membership 2023
Institute of Electrical and Electronics Engineers (IEEE)

Elected to Associate Membership 2023
American College of Neuropsychopharmacology

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

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/University of Pittsburgh

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 Travel Fellowship Award 2015
Society of Biological Psychiatry

Innovative Research Poster Award 2014
National Network of Depression Centers

Best Abstract Award 2010
International Society for Neurostimulation

Presidential Award for Outstanding Teaching, Finalist 2010
Columbia University

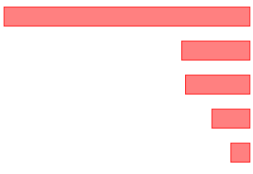
CTSA T32 Certificate Award 2009
Columbia University Irving Institute for Clinical and Translational Research

New York Times College Scholarship 2002 – 2006
The New York Times Company Foundation

Research Focus

- Neurostimulation: Technology development, computational modeling, stimulus parameter and dose optimization, translational and clinical applications
- Computational electromagnetics and bioelectricity
- Electrophysiological and neuroimaging biomarker development
- Nonlinear dynamics of physiological systems

Research Output Summary



65 Refereed journal articles
18 Refereed conference proceedings & technical letters
17 Refereed reviews, protocols, & consensus papers
10 Book chapters
5 Editorials, commentaries, & correspondences
9 IP filings (4 granted U.S. patents, 3 pending, 2 unconverted provisionals)
\+ **176** Abstracts

Refereed Journal Articles

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

A. V. Peterchev, **Z.-D. Deng**, C. Sikes-Keilp, E. C. Feuer, M. A. Rosa, and S. H. Lisanby, "Optimal frequency for seizure induction with electroconvulsive therapy and magnetic seizure therapy in nonhuman primates," *Biological Psychiatry: Global Open Science*, vol. 5, no. 3, 100471, May 2025.
DOI: 10.1016/j.bpsgos.2025.100471; PMCID: PMC11985115; Data available

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, pp. 175–185, Feb. 2025.
DOI: 10.1016/j.bpsc.2024.10.016; PMID: 39515580
Journal cover
Media coverage: *Brain & Behavior Research Foundation* | *UT Southwestern News Release*, Jan. 2025.

Z. Qi, G. M. Noetscher, A. Miles, K. Weise, T. R. Knösche, C. R. Cadman, A. R. Potashinsky, K. Liu, W. A. Wartman, G. Nunez 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*, vol. 18, no. 1, pp. 77–93, Jan./Feb. 2025.
DOI: 10.1016/j.brs.2024.12.1192; PMCID: PMC11867869; Data available

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*, vol. 3, imag_a_00412, Jan. 2025.
DOI: 10.1162/imag_a_00412; Code available
First Place in Best Student Paper (awarded to N. I. Hasan), *International Applied Computational Electromagnetics Society Symposium*, 2024.
Third Place in Best Student Paper (awarded to N. I. Hasan), *Photonics and Electromagnetics Research Symposium*, 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, Sep. 2024.
DOI: 10.1093/cercor/bhae371; PMCID: PMC11405677

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, Sep. 2024.
DOI: 10.1038/s41386-024-01871-w; PMCID: PMC11319663

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 multitargeting treatment," *The Journal of ECT*, online ahead of print, Aug. 2024.
DOI: 10.1097/YCT.0000000000001069; PMID: 39185880

* 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.
DOI: 10.3389/fpsyt.2024.1434434; PMCID: PMC11345267

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.
DOI: 10.1088/1741-2552/ad692f; PMCID: PMC11307324

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.
DOI: 10.1371/journal.pone.0302660; PMCID: PMC11073721; Code available

* 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.
DOI: 10.1017/S1092852923006387; PMCID: PMC11524532

* 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.
DOI: 10.1111/bdi.13370; PMCID: PMC10839568
Top Cited Article, awarded by Wiley, 2025.
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 rotating permanent magnet stimulation," *Bioengineering*, vol. 11, no. 3, 258, Mar. 2024.
DOI: 10.3390/bioengineering11030258; PMCID: PMC10968657
Part of Special Issue: *Electric, Magnetic, and Electromagnetic Fields in Biology and Medicine: From Mechanisms to Biomedical Applications*
Trainee Travel Award (awarded to P. L. Robins), *NIMH 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.
DOI: 10.1001/jamapsychiatry.2023.4599; PMCID: PMC10701670
Commentary: vol. 81, no. 7, pp. 736–737, Jul. 2024. Reply: pp. 737–738.

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.
DOI: 10.1038/s41386-023-01780-4; PMCID: PMC10876627
Research highlight commentary: pp. 635–636.

W. A. Wartman, K. Weise, M. Rachh, 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," *Physics in Medicine and Biology*, vol. 69, no. 5, 055030, Feb. 2024.
DOI: 10.1088/1361-6560/ad2638; PMCID: PMC10902857; Data available
Part of Special Issue: *Electromagnetic Modeling for Brain Stimulation*
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. Jorgensen, A. Jorgensen, 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.
DOI: 10.1038/s41380-023-02318-2; PMCID: PMC11116108; Code available

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. 1, 18657, Oct. 2023.
DOI: 10.1038/s41598-023-45602-5; PMCID: PMC10618282; Code available

* **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.
DOI: 10.3390/biomedicines11082320; PMCID: PMC10452519
Part of Special Issue: *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.
DOI: 10.1016/j.jad.2023.05.042; PMCID: PMC10502963

M. Teferi, W. Makhoul, **Z.-D. Deng**, D. J. Oathes, Y. 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, Jul. 2023.
DOI: 10.1016/j.bpsgos.2022.04.001; PMCID: PMC10382694

J. Miller, T. Jones, J. Upston, **Z.-D. Deng**, S. M. McClintock, E. Erhardt, D. Farrar, 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, Jul. 2023.
DOI: 10.1016/j.bpsc.2023.03.001; PMCID: PMC10329999

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.
DOI: 10.3389/fpsyt.2023.1168672; PMCID: PMC10232815
Part of Research Topic: *Translational Approaches in Neurostimulation Research: Challenges and Opportunities for Neuropsychiatry*

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.
DOI: 10.1088/1741-2552/ac9a76; PMCID: PMC10278869

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.
DOI: 10.1371/journal.pbio.3001999; PMCID: PMC9983870

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, no. 1, 43, Feb. 2023.
DOI: 10.1038/s41398-023-02312-w; PMCID: PMC9902462; Code available

* S. N. Makaroff, H. Nguyen, Q. Meng, H. Lu, A. R. Nummenmaa, and **Z.-D. Deng**, "Modeling transcranial magnetic stimulation coils with magnetic cores," *Journal of Neural Engineering*, vol. 20, no. 1, 016028, Jan. 2023.
DOI: 10.1088/1741-2552/acae0d; PMCID: PMC10481791; Code available

S. Qi, V. D. Calhoun, D. Zhang, J. Miller, **Z.-D. Deng**, K. L. Narr, Y. Sheline, S. M. McClintock, R. Jiang, X. Yang, J. Upston, T. 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. 20, no. 1, 477, Dec. 2022.
DOI: 10.1186/s12916-022-02678-6; PMCID: PMC9733153; Code available

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.
DOI: 10.1016/j.neuroimage.2022.119705; PMCID: PMC9854270

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. D. 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, no. 1, 616, Oct. 2022.
DOI: 10.1038/s41597-022-01695-7; PMCID: PMC9556519; Code available Data available

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, Jun. 2022.
DOI: 10.1097/YCT.0000000000000812; PMCID: PMC10680084

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.
DOI: 10.1088/1741-2552/ac697c; PMCID: PMC10644970

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.
DOI: 10.1016/j.neuroimage.2021.118863; PMCID: PMC8851689
Part of Special Issue: *Neuromodulation and Neuroimaging for Targeted Brain Networks Interrogation*
Media coverage: *NIMH Research Highlight*, Mar. 2022.

* **Z.-D. Deng**, M. Argyelan, J. Miller, D. K. 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.
DOI: 10.1038/s41380-021-01380-y; PMCID: PMC9095458
Commentary: vol. 27, no. 9, pp. 3571–3572, Sep. 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, 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.
DOI: 10.1038/s41386-021-01110-6; PMCID: PMC8674270

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 major depressive disorder in older adults: Phase 2 of the PRIDE study," *American Journal of Geriatric Psychiatry*, vol. 30, no. 1, pp. 15–28, Jan. 2022.
DOI: 10.1016/j.jagp.2021.04.006; PMCID: PMC8595359

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.
DOI: 10.1038/s41380-019-0589-8; PMCID: PMC7225078

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, Jul./Aug. 2021.
DOI: 10.1016/j.brs.2021.06.011; PMCID: PMC8474653

E. A. Fridgeirsson, **Z.-D. Deng**, D. Denys, J. A. van Waarde, and G. A. van Wingen, "Electric field strength induced by electroconvulsive therapy is associated with clinical outcome," *NeuroImage: Clinical*, vol. 30, 102581, Feb. 2021.
DOI: 10.1016/j.nicl.2021.102581; PMCID: PMC7895836

P. J. C. Suen, S. Doll, M. C. Batistuzzo, 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.
DOI: 10.1007/s00406-020-01127-w; PMCID: PMC8100980
Part of Collection: *Brain Stimulation in Psychiatry*

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.
DOI: 10.1016/j.jagp.2020.06.008; PMCID: PMC7744398

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E. Ekpo, H. Gura, Z. Rezaee, **Z.-D. Deng**, B. Luber, S. H. Lisanby, and L. Beynel, "Effects of practice and fMRI-Guided rTMS on a numerical Stroop task," *NIMH IRP Fellows' Scientific Training Day*, Sep. 2023.

* 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*, Sep. 2023.

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

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*, Aug. 2023.
Third Place in International Student Competition (awarded to W. A. Wartman)

* 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*, Jul. 2023.

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 Annual Symposium*, May 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*, Apr. 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*, Apr. 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," *Brain Stimulation*, vol. 16, no. 2, p. 10, Mar./Apr. 2023.

B. Luber, S. Davis, **Z.-D. Deng**, D. Murphy, A. Peterchev, and S. H. Lisanby, "Targeting deep brain structures with TMS using diffusion tensor imaging," *Brain Stimulation*, vol. 16, no. 1, p. 190, Jan./Feb. 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, Jan./Feb. 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, Jan./Feb. 2023.

J. Ferreira, L. Morales, R. Lemdiasov, H. Lu, **Z.-D. Deng**, and S. Makaroff, "TMS coil and TMS coil array designer with fast multipole method," *Brain Stimulation*, vol. 16, no. 1, p. 136, Jan./Feb. 2023.

* **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, Dec. 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*, Nov. 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*, Oct. 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*, Sep. 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," *The Journal of ECT*, vol. 38, no. 3, p. e49, Sep. 2022; also presented at *NIH Julius Axelrod Symposium*, Apr. 2022.

*🖉 P. L. Robins, M. Dannhauer, L. M. Haugen, J. D. Port, P. E. Croarkin, and **Z.-D. Deng**, "Comparison of coil localization approaches and induced electric fields in depressed adolescents receiving repetitive transcranial magnetic stimulation," *Brain & Human Body Modeling Conference*, Aug. 2022.
First Place in International Student Competition (awarded to P. L. Robins)

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, May 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, May 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, May 2022.

Intellectual Property

C. C. Abbott, **Z.-D. Deng**, J. Upston, T. Jones, and A. Datta, "Systems and methods for electroconvulsive therapy," WO 2024/148196 A1, filed Jul. 11, 2024.

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, filed Jun. 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," WO 2024/215761 A1, filed Apr. 10, 2024.

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, filed Jul. 28, 2023. Not converted to non-provisional.

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, assigned to NEVA Electromagnetics, LLC.

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 non-increasing parasympathetic modulation," U.S. Patent 9,737,258, Aug. 22, 2017, assigned to MIT.

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, filed Aug. 22, 2011. Not converted to non-provisional.

A. V. Peterchev, S. H. Lisanby, and **Z.-D. Deng**, "Methods, apparatus, and systems for magnetic stimulation," U.S. Patent 9,295,853, Mar. 29, 2016, assigned to The Trustees of Columbia University in the City of New York.

A. V. Peterchev, S. H. Lisanby, and **Z.-D. Deng**, "Methods, apparatus, and systems for magnetic stimulation," U.S. Patent 8,801,589, Aug. 12, 2014, assigned to The Trustees of Columbia University in the City of New York.

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: Sheline, Narr, Espinoza, McClintock, 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 – 2026.01
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.

Pending Research Support

Transdiagnostic trial to reduce default mode network connectivity in bipolar depression and major depressive disorder with accelerated iTBS
NIH 2025
Role: Intramural NIH collaborator; PI: Y. I. Sheline

Electromagnetic brain stimulation modeling at the synaptic level
NIH R21 2025.02
Role: Intramural NIH collaborator; PI: S. N. Makaroff

Improving ECT clinical outcomes through seizure- and model-guided stimulation parameters
NIH UG3/UH3 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 UG3/UH3 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

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.

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.

Translational research evaluating neurocognitive memory processes
NIH/NIMH K23 MH087739 2013.07 – 2014.06
Role: Postdoctoral fellow; PI: S. M. McClintock
This study informs the cognitive component processes underlying memory impairment after electroconvulsive therapy.

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.

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 2008.07 – 2009.06
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 – 2008.06
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 – 2007.05
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.

Professional Presentations Summary

29 Invited seminars & webinars
7 Grand rounds
43 Conference talks & workshops

Invited Seminars & Webinars

International Society for ECT and Neurostimulation Webinar — Upcoming 2025
Advancing ECT through computational modeling, dose optimization, and device innovation

NIMH Intramural Research Program Investigators' Seminar — 2025
Reading tells: Using facial expression analysis to track emotional states in depression

IEEE Magnetics and EMBS Chapters — 2025
Virginia Commonwealth University Mechanical & Nuclear Engineering Department Seminar
Recent advances in transcranial magnetic stimulation: Devices, modeling, and applications

University of Texas Southwestern, Department of Psychiatry — 2025
From models to medicine: Advancing precision neuromodulation through engineering

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

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

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: Treatment optimization and technology development

National Center of Neuromodulation for Rehabilitation, MUSC — 2022
Model-driven design for brain stimulation therapies

International Network of tES–fMRI Webinar — 2022
Electric field modeling and optimization approaches for individualized targeting

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

Brown University/Butler Hospital, Department of Psychiatry & Human Behavior — 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

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

Grand Rounds

Barrow Neurological Institute, Phoenix, AZ 2025
Innovating neurostimulation: From treatment optimization to next-generation technology

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

Conference Talks & Workshops

Bergen Workshop of the Global ECT–MRI Collaboration Upcoming 2025
Computational approaches to ECT: How electric field modeling guides treatment

American Neuropsychiatric Association Annual Meeting 2025
Advancing personalized seizure therapy: Magnetic seizure therapy and Multichannel Individualized Stimulation Therapy
Part of Program Committee Symposium: *Interventional neuropsychiatry: From mechanisms to clinical decision making*

International Brain Stimulation Conference 2025
Multichannel Individualized Stimulation Therapy: A targeted approach to optimize ECT

Part of symposium: *ECT reimagined: Precision, prediction, and personalized care*
Accepted for presentation, unable to attend due to government travel restrictions

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

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
TMS devices and modeling
Part of workshop: *From basics to applications: MRI of neuromodulation using TMS and FUS*

Brain and Human Body Modeling Conference 2023
Effects of low intensity magnetic stimulation

International Conference of the IEEE Engineering in Medicine and Biology Society 2023
Modeling of TMS and ECT in the treatment of depression
Part of panel: *Computational analysis of non-invasive neuromodulation constructs: Brain & spine*

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

International Society for Magnetic Resonance in Medicine 2022
Modeling of TMS
Part of workshop: *MRI of neuromodulation: Target engagement, neural mechanism, & biomarker development*

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

Brain and Human Body Modeling Conference 2022
ECT, electric field, neuroplasticity, and clinical outcomes
Part of panel: *Modeling of transcranial electrical stimulation and deep brain stimulation*

European Conference of Brain Stimulation in Psychiatry 2022
Symptom dimensions and response trajectories in ECT and MST
Part of panel: *Beyond clinical syndromes: Understanding mechanisms of neuromodulation from a dimensional perspective*

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

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
Introduction to computational psychiatry
Part of panel: *Recent work with contemporary computational methods and artificial intelligence to advance the practice of child and adolescent psychiatry*

European College of Neuropsychopharmacology Congress 2021
Precision neurostimulation: Electroconvulsive therapy
Part of panel: *Neurobiology of rapid mood changes*

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

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

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

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

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

American Society of Clinical Psychopharmacology Annual Meeting 2020
Advancing seizure therapy: Rational design for precision outcomes
Part of panel: *New developments in neurostimulation*
Accepted for presentation, conference was canceled due to COVID-19

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

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

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

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
Electric field induced by TMS: Applications in depression and anxiety
Part of panel: *Computational human models for brain stimulation*

American Psychiatric Association Annual Conference 2018
Individualized neurotargeted seizure therapy: Reinventing ECT
Part of Presidential Symposium: *ECT in the era of new brain stimulation treatments*

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

International Conference of the IEEE Engineering in Medicine and Biology Society 2010
TMS in the presence of deep brain stimulation implants: Induced electrode currents
ECT in the presence of deep brain stimulation implants: Electric field effects

Annual National Predoctoral Clinical Research Training Program Meeting 2009
Coil design for deep-brain transcranial magnetic stimulation

TRANSFORM Research Day, Irving Institute for Clinical and Translational Research 2009
Electromagnetic field shaping and coil design for transcranial brain stimulation

International Conference of the IEEE Engineering in Medicine and Biology Society 2008
Coil design considerations for deep brain transcranial magnetic stimulation

Annual Meeting of the Society for Neuroscience 2006
Heart rate variability is more chaotic in REM than NREM sleep in children

International Conference of the IEEE Engineering in Medicine and Biology Society 2006
Heart rate variability in pediatric obstructive sleep apnea

Teaching & Mentoring Appointments

Lecturer, NIH
National Institute of Mental Health
Basic Training Course on Transcranial Magnetic Stimulation 2020
fMRI Course Summer 2017
National Institute of Neurological Disorders and Stroke
Clinical Neuroscience Program Lecture Series 2017, 2019

Research Mentor, University of Maryland, College Park 2018 – 2019
Fischell Department of Bioengineering
Capstone project: *Detection of brain-to-brain synchrony for improved psychotherapy*

Faculty, Duke University
Department of Psychology & Neuroscience
Research Independent Study 2016
Matching Undergraduates to Science and Engineering Research Program 2015 – 2016
Biosciences Collaborative for Research Engagement 2015 – 2016
Department Psychiatry & Behavioral Sciences
Visiting Fellowship in Electroconvulsive Therapy (CME accredited) 2015
Visiting Fellowship in Transcranial Magnetic Stimulation (CME accredited) 2014 – 2016

Teaching Assistant, Columbia University
Department of Electrical Engineering
Analog Systems in VLSI (graudate level) Spring 2010
The Digital Information Age Fall 2009

Recitation Instructor, Columbia University Mailman School of Public Health
Department of Biostatistics
Biostatistics (graduate level) Fall 2009

Teaching Assistant, MIT
Concourse Program
Multivariable Calculus Fall 2003 – 2006
Differential Equations Spring 2004 – 2007

Mentoring Summary

5 Faculty
2 Research fellows & postdoctoral fellows
1 Sponsored thesis
4 Thesis examination committees
2 Graduate students
6 Post-baccalaureate fellows
11 Undergraduate students
6 Interns

Faculty Advisory

D. C. Farrar, M.D., Ph.D., University of New Mexico School of Medicine 2025–
Project: "CEASE-LD: Cortical Excitability, Adequacy of Seizures, and Efficacy in Late-life Depression with ECT"

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"
Klerman Prize for Exceptional Clinical Research, *Brain & Behavior Research Foundation*, 2022.

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"
Klerman Prize for Exceptional Clinical Research, *Brain & Behavior Research Foundation*, 2021.

Research Fellows & Postdocs

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

M. Dannhauer, Ph.D., NIMH Research Fellow 2022–2024
Career progression: Assistant Professor, Computer Science, East Carolina University

Sponsored Theses

G. Asturias, Psychology & Neuroscience, Duke University 2015–2017
Undergraduate honors thesis: "Effect of repetitive transcranial magnetic stimulation on the structural and functional connectome in patients with major depressive disorder." Available: *DukeSpace*, HDL: 10161/14299
Graduated with Distinction
Career progression: Medical student, Stanford University School of Medicine

Thesis Examination Committees

S. J. Bolland, Biomedical Engineering, University of Western Australia 2025
Ph.D. dissertation: "A comparative study of transcranial magnetic stimulation induced electrical field distributions in neural tissue: A translational pipeline for finite element method analysis using MRI modalities." Sponsor: J. Rodger.

D. Tang, Electrical & Computer Engineering, Worcester Polytechnic Institute 2025
M.S. thesis: "Computational and experimental approaches to brain stimulation: TMS simulation, coil measurement, and neural structure analysis." Sponsor: S. N. Makaroff.

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." Sponsor: M. Bikson. Available: *CUNY Academic Works*, URL: https://academicworks.cuny.edu/

Graduate Students

E. Bharti, Ph.D. candidate, NIH–Cambridge Scholars Program 2024 –

M. Kshirsagar, M.S., Biomedical Engineering, Duke University 2012
Career progression: Consultant, Deloitte Consulting

Postbacs

P. L. Robins, B.A., NIMH Intramural Research Training Award (IRTA) Fellow 2021 – 2024
Trainee Travel Award, NIMH Intramural Research Program, 2023.
First Place in Student Competition, *Brain & Human Body Modeling Conference*, 2022.
Career progression: TMS administrator, Columbia Associates

M. R. Hynd, B.S., NIMH IRTA Fellow 2020 – 2022
Career progression: Ph.D. student, University of North Carolina at Chapel Hill

S. Awasthi, B.S., NIMH IRTA Fellow 2018 – 2020
Career progression: Medical student, Stanford University School of Medicine

M. M. Noh, S.B., NIMH IRTA Fellow 2018 – 2019
Career progression: Medical student, University of Cincinnati College of Medicine

J. Thomas, M.S., NIMH IRTA Fellow 2017 – 2019
Career progression: Program officer, National Academies of Sciences, Engineering, & Medicine

M. Velez Afanador, B.S., NIMH IRTA Fellow 2016 – 2019
Outstanding Poster Award, *NIH Postbac Poster Day*, 2018.
Career progression: Medical student, Howard University College of Medicine

Undergrads

D. T. Weaver, Biology, Duke University 2016
Career progression: M.D./Ph.D. student, Case Western Reserve University

E. F. Salgado, Psychology & Neuroscience, Duke University 2016
Graduated with Distinction
Career progression: Ph.D. student, Indiana University–Purdue University Indianapolis

Z. Feng, Biomedical Engineering and Biology, Duke University 2015 – 2016
Career progression: Medical student, University of Colorado School of Medicine

M. L. Glidewell, Biomedical Engineering, Duke University 2015 – 2016
Career progression: Senior strategy consultant, IBM

W. Lim, Biomedical Engineering, Duke University 2015 – 2016
Career progression: Medical student, Texas A&M College of Medicine

F. M. Mercer, Gender, Sexuality and Feminist Studies, Duke University 2015 – 2016
Career progression: Analyst, Morgan Stanley

E. Shinder, Biology, Duke University 2015 – 2016
Graduated with Distinction
Career progression: Medical student, Stony Brook School of Medicine

E. P. Vienneau, Biomedical Engineering, Duke University 2015 – 2016
Howard G. Clark Award for Excellence in Research
Career progression: Ph.D. student, Vanderbilt University

S. H. Lee, Biomedical Engineering, Duke University 2015
Career progression: Manager, Strategy & Operations, Tempus Labs

R. Shah, Psychology & Neuroscience, Duke University 2015
Career progression: Medical student, Yale School of Medicine

J. R. Lilien, Electrical & Computer Engineering, Duke University 2014 – 2016
Walter J. Seeley Scholastic Award
Career progression: Machine learning engineer, Amazon

Interns

W. H. Lohr, Ph.D. cand., Biomedical Engineering, Virginia Commonwealth University 2025

M. Dib, Biomedical Engineering, University of Maryland, College Park 2018 – 2019
Supervised as a summer intern at the NIH, provided ongoing mentorship during academic terms, including advising Capstone design project
Career progression: Medical student, Weill Cornell Medicine

E. Chung, Psychology, University of Maryland, College Park 2017

A. L. Halberstadt, Biology and Psychology, Carnegie Mellon University Summer 2017
Career progression: Ph.D. student, Penn State University

C. M. Prevost, Biomedical Engineering, Clemson University Summer 2015
Career progression: Medical student, University South Carolina School of Medicine Greenville

J. V. McCall, Biomedical Engineering, North Carolina State University Summer 2013
Career progression: Ph.D. student, North Carolina State University

Professional Societies Membership

IEEE, Engineering in Medicine and Biology Society 2004 –
Senior Member (2023 –), Member (2013 – 2023), Student Member (2004 – 2013)

American College of Neuropsychopharmacology, Associate Member 2023 –

Biomedical Engineering Society, Member 2021 –

American Society of Clinical Psychopharmacology, Member 2019 –

Past memberships:

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

Professional Service & Advisory Roles

Advisory Board, Center for Multiscale Bioelectromagnetic Studies of the Brain 2025 –
Department of Electrical & Computer Engineering, Worcester Polytechnic Institute

Board Member, The Global ECT–MRI Research Collaboration (GEMRIC) 2025 –

Chapter Development Report Reviewers, Biomedical Engineering Society 2025

Contributor, Non-Invasive Brain Stimulation (NIBS)-BIDS extension proposal 2023 –
Collaborated on extending the Brain Imaging Data Structure (BIDS) specification to establish standardized data and metadata storage guidelines for the NIBS field

Early Career Committee, American Society of Clinical Psychopharmacology 2023 – 2027

Technology Committee, American Society of Clinical Psychopharmacology 2023 – 2025

Technology Task Force, American Society of Clinical Psychopharmacology 2020 – 2023

Institutional Service

Reviewer, NIH Intramural AIDS Research Fellowships 2025

Judge, NIH Fellows Award for Research Excellence Competition 2025

Educational Counselor, MIT 2022 – 2025

NIH Research Workforce Diversity and Equity Outreach Special Interest Group 2023 – 2025

Judge, NIMH Training Day Three-Minute Talks competition 2022

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

NIH Noninvasive Brain Stimulation Special Interest Group 2017 – 2025

Grant Review

Reviewer, NIH BluePrint MedTech Program 2021 –

Reviewer, NIH Center for Scientific Review
Biophysics of Neural Systems Study Section 2021.10

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

Editorial Roles

Editorial Board Member, *Brain Stimulation* 2025 –

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
BMJ Mental Health
Brain Research Bulletin
Brain Sciences
Brain Stimulation
Cerebral Cortex
Chaos, Solitons & Fractals
Clinical EEG and Neuroscience
Clinical Neurophysiology
CNS Spectrums
Computational and Mathematical Methods in Medicine
Computer Methods and Programs in Biomedicine
Computer Methods in Biomechanics and Biomedical Engineering
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 Access
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 and abstracts 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

Conference & Workshop Organization

Brain and Human Body Modeling Conference 2023
Organizing committee, and judge in student competition
Chair of panel: *New modeling methods: Spinal cord stimulation and novel stimulation*
Chair of panel: *Development and assessment of modeling methods*

American Society of Clinical Psychopharmacology Annual Meeting 2023
Program review subcommittee

International Brain Stimulation Conference 2023
Chair of symposium: *Insights and challenges in preclinical models of TMS: Multimodal investigations across animal species*
Chair of symposium: *Advanced computational modeling and optimization methods for non-invasive brain stimulation*

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

Brain and Human Body Modeling Conference 2022
Organizing committee
Chair of panel: *Modeling of transcranial electrical stimulation and deep brain stimulation*

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

International Conference of the IEEE Engineering in Medicine and Biology Society 2018
Chair of panel: *Computational human models for brain stimulation*

NYC Neuromodulation Conference 2018
Director of preconference workshop: *Computational modeling in neuromodulation: Tools for engineers, clinicians, and researchers*

Community Involvement, Outreach, & Science Advocacy

Producer, *Psychopharm Today* podcast 2024–
Hosted by the American Society of Clinical Psychopharmacology

ASCP Early Career Workshop 2021

Presentation: *Engaging presentation strategies for any audience*

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 2020
☒ Event was canceled due to COVID-19

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*

Innovation Leader, Psychiatry Innovation Lab, American Psychiatric Association 2016

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

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

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

AFNI+SUMA Training Workshop, NIH 2018

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 Recertified 2023.07

Last Updated

May 1, 2025