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LAST UPDATED December 27, 2024

RESEARCH Noninvasive brain stimulation: Device development, modeling, stimulus parameter and dose
FOCUS optimization, translational and clinical applications

Computational electromagnetics

Electrophysiological and neuroimaging biomarker development

Neural plasticity and translational neuromodeling

Nonlinear dynamics of physiological systems

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

POSTGRADUATE **Research Fellow**, National Institute of Mental Health 2016–2019

TRAINING & Noninvasive Neuromodulation Unit

FELLOWSHIP Experimental Therapeutics & Pathophysiology Branch

APPOINTMENTS  Richard J. Wyatt Memorial Fellowship for Translational Research

Postdoctoral Associate, Duke University School of Medicine 2013–2014

Division of Brain Stimulation & Neurophysiology

Department of Psychiatry & Behavioral Sciences

PROFESSIONAL **Staff Scientist**, NIMH 2019–

& ACADEMIC Noninvasive Neuromodulation Unit

APPOINTMENTS Experimental Therapeutics & Pathophysiology Branch

 *Director*, Computational Neurostimulation Research Program

Adjunct Assistant Professor, Duke University School of Medicine 2016–2024

Division of Behavioral Medicine & Neurosciences

Department of Psychiatry & Behavioral Sciences

Network Faculty, Duke Institute for Brain Sciences

Medical Instructor, Duke University School of Medicine 2014–2016

Division of Brain Stimulation & Neurophysiology

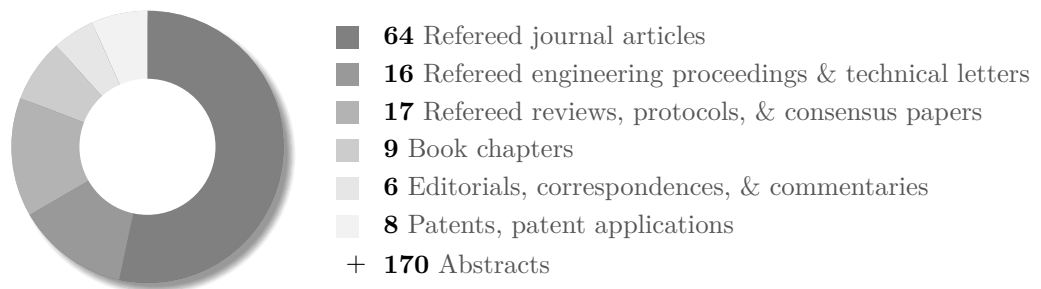
Department of Psychiatry & Behavioral Sciences

 Duke Translational Medicine Institute KL2 Fellow

NONPROFIT LEADERSHIP	Co-founder & Scientific Advisor Singula Institute	2017 –
RESEARCH ASSISTANTSHIPS & INTERNSHIPS	Visiting Graduate Research Assistant , Duke Psychiatry Division of Brain Stimulation & Neurophysiology	2010 – 2013
	Graduate Research Assistant , Columbia Psychiatry Division of Brain Stimulation & Therapeutic Modulation Irving Institute for Clinical and Translational Research T32 Fellow	2007 – 2010
	Research Assistant , MIT Harvard–MIT Division of Health Sciences & Technology	2005 – 2007
	Executive Intern , NewYork-Presbyterian/Weill Cornell Medical Center Department of Anesthesiology	2004
	Internship Coordinator , The New York Times Company Foundation	2003
	Newsroom Technology Intern , The New York Times Company	2002
AWARDS & HONORS	NIMH Director’s Award For outstanding transdisciplinary scientific contributions to advance neuromodulation technologies for the study and treatment of psychiatric disorders, NIMH	2024
	Elected Full Member Sigma Xi, The Scientific Research Honor Society	2024
	High Five Award For excellent preparation for and presentation at the Noninvasive Neuromodulation Unit’s Board of Scientific Counselors review, NIMH	2024
	Scholar, Advanced Research Institute in Geriatric Mental Health Dartmouth College, supported by grant from NIH (R25MH068502)	2023 – 2024
	NIMH Director’s Award For scientific innovation at the interface of computation and psychiatry, NIMH	2019
	Richard J. Wyatt Memorial Fellowship Award for Translational Research NIMH Intramural Research Program	2018
	New Investigator Award American Society of Clinical Psychopharmacology	2018
	Early Career Investigator Travel Fellowship Award Society of Biological Psychiatry	2018
	Research Colloquium for Junior Investigators American Psychiatric Association	2018
	Alies Muskin Career Development Leadership Program Anxiety & Depression Association of America	2018
	NARSAD Young Investigator Award Brain & Behavior Research Foundation	2017
	Career Development Institute for Psychiatry Stanford University	2017
	New Investigator Award International Society for CNS Clinical Trials and Methodology	2017
	Certificate for Highly Cited Research <i>Brain Stimulation</i> , Elsevier	2016

Young Investigator Memorial Travel Award American College of Neuropsychopharmacology	2015
Scholar, Summer Research Institute in Geriatric Mental Health Weill Cornell Medical College, supported by grant from NIH (R25MH019946)	2015
Chair's Choice Award Society of Biological Psychiatry	2014
Innovative Research Poster Award National Network of Depression Centers	2014
Best Abstract Award International Society for ECT and Neurostimulation	2010
Presidential Teaching Award Finalist Columbia University	2010
Student Paper Competition Finalist IEEE Engineering in Medicine and Biology Society	2006
New York Times College Scholarship The New York Times Company Foundation	2002

RESEARCH OUTPUT SUMMARY



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 ultra-brief 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.

PMID: 39515580; DOI: 10.1016/j.bpsc.2024.10.016

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. 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*, online ahead of print, 2024.

PMID: 39710004; DOI: 10.1016/j.brs.2024.12.1192

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.

PMCID: PMC10635016; DOI: 10.1162/imag_a_00412

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 multitargeting treat-

ment,” *The Journal of ECT*, online ahead of print, 2024.

PMID: 39185880; DOI: 10.1097/YCT.0000000000001069

- 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.

PMCID: PMC11405677; DOI: 10.1093/cercor/bhae371

- 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.


PMCID: PMC11319663; DOI: 10.1038/s41386-024-01871-w

- * 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.

PMCID: PMC11345267; DOI: 10.3389/fpsy.2024.1434434

- 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.

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

- 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. 

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

- 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.

PMCID: PMC11524532; DOI: 10.1017/S1092852923006387


- * 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.

PMCID: PMC10839568; DOI: 10.1111/bdi.13370

 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.




PMCID: PMC10968657; DOI: 10.3390/bioengineering11030258






✧ Part of the 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 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.

PMCID: PMC10701670; DOI: 10.1001/jamapsychiatry.2023.4599

⇒ Commentary: vol. 81, no. 7, pp. 736–737, July 2024.   Reply: pp. 737–738. 

 Media coverage: *Psychiatric 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.
PMCID: PMC10876627; DOI: 10.1038/s41386-023-01780-4
 Research highlight commentary: vol. 49, no. 4, 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. 
PMCID: PMC10902857; DOI: 10.1088/1361-6560/ad2638
 Part of the 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. Olstedal, 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. Yroni, P. Pérán, C. Soriano-Mas, N. Cardoner, M. Cano, L. van Diermen, D. Schrijvers, J.-B. Belge, L. Emsell, F. Bouckaert, M. Vandenbulcke, M. Kiebs, R. Hurlmann, P. C. R. Mulders, R. Redlich, U. Dannlowski, E. Kavakbasi, M. D. Kritzer, K. K. Ellard, J. A. Camprodón, 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. 
PMCID: PMC11116108; DOI: 10.1038/s41380-023-02318-2
- 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. 
PMCID: PMC10618282; DOI: 10.1038/s41598-023-45602-5
- * **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,” *Biomedicine*, vol. 11, no. 8, 2320, Aug. 2023.
PMCID: PMC10452519; DOI: 10.3390/biomedicine11082320
 Part of the 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.
PMCID: PMC10502963; DOI: 10.1016/j.jad.2023.05.042
- 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, July 2023.
PMCID: PMC10382694; DOI: 10.1016/j.bpsgos.2022.04.001
- 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, July 2023.

PMCID: PMC10329999; DOI: 10.1016/j.bpsc.2023.03.001

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.

PMCID: PMC10232815; DOI: 10.3389/fpsyt.2023.1168672

✧ Part of the 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.

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

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. McLaughlin, and X. Zhang, “Alpha oscillatory activity is causally linked to working memory retention,” *PLOS Biology*, vol. 21, no. 2, e3001999, Feb. 2023.

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

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.

PMCID: PMC9902462; DOI: 10.1038/s41398-023-02312-w

* 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. ✨

PMCID: PMC10481791; DOI: 10.1088/1741-2552/acae0d

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. 22, 477, Dec. 2022. ✨

PMCID: PMC9733153; DOI: 10.1186/s12916-022-02678-6

✧ 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.

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

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, 616, Oct. 2022. ✨

PMCID: PMC9556519; DOI: 10.1038/s41597-022-01695-7

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.

PMCID: PMC10680084; DOI: 10.1097/YCT.0000000000000812


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.

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


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.

PMCID: PMC8851689; DOI: 10.1016/j.neuroimage.2021.118863

✧ Part of the Special Issue: *Neuromodulation and Neuroimaging for Targeted Brain Networks Interrogation* 

* **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.

PMCID: PMC9095458; DOI: 10.1038/s41380-021-01380-y

✉ 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, 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.

PMCID: PMC8674270; DOI: 10.1038/s41386-021-01110-6

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. Latousakis, 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.

PMCID: PMC8595359; DOI: 10.1016/j.jagp.2021.04.006

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.

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

A. Takamiya, F. Bouckaert, M. Laroy, J. Blommaert, A. Radwan, A. Khatoun, **Z.-D. Deng**, M. McLaughlin, 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.

PMCID: PMC8474653; DOI: 10.1016/j.brs.2021.06.011


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.

PMCID: PMC7895836; DOI: 10.1016/j.nicl.2021.102581

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.

PMCID: PMC8100980; DOI: 10.1007/s00406-020-01127-w

✧ Part of the 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.

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

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.


PMCID: PMC8474665; DOI: 10.1016/j.brs.2020.03.009

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.

PMCID: PMC7150637; DOI: 10.1016/j.bpsc.2019.12.020

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, 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.

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







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-  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, 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*

ONGOING RESEARCH SUPPORT	NIMH Protocol 07-M-0021	2017–
	Role: Associate investigator; PI: A. C. Nugent	
	<i>Identifying neurobiological mechanisms that underlie acute nicotine withdrawal and drive early relapse in smokers</i>	
	NIDA Protocol 12-DA-N474	2017–
	Role: Associate investigator; PI: A. Janes	
	<i>Neuropharmacologic imaging and biomarker assessments of response to acute and repeated-dosed ketamine infusions in major depressive disorder</i>	
	NIMH Protocol 17-M-0060	2016–
	Role: Associate investigator; PI: C. A. Zarate, Jr.	
	<i>Evaluation of patients with mood and anxiety disorders and healthy volunteers</i>	
	NIMH Protocol 01-M-0254	2016–
	Role: Associate investigator; PI: C. A. Zarate, Jr.	
	<i>Modulation of the parieto-frontal communication</i>	
	NINDS Protocol 18-N-0054	2018–2019
	Role: Associate investigator; PI: M. Hallett	
	<i>Effect of TMS to frontoparietal attention network on anxiety potentiated startle</i>	
	NIMH Protocol 17-M-0042	2017–2019
	Role: Associate investigator; PI: C. Grillon	
	<i>ADEPT: Adaptive trial for the treatment of depression associated with concussion using repetitive transcranial magnetic stimulation protocols</i>	
	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.	
	<i>Charge-based brain modeling engine with boundary element fast multipole method</i>	
	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 electro-magnetic modeling.	
	<i>Novel electric-field modeling approach to quantify changes in resting state functional connectivity following theta burst stimulation</i>	
	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 neuro-modulatory TMS, and validate this model in a large cohort of healthy volunteers receiving multiple doses of either intermittent or continuous theta burst stimulation.	
	<i>Development of a novel, scalable, neurobiologically-guided transcranial magnetic stimulation protocol for the treatment of cannabis use disorder</i>	
	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.	
	<i>Deciphering mechanisms of ECT outcomes and adverse effects (DECODE)</i>	
	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
Advancing neurostimulation treatment optimization and technology innovation

2023

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 development

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 <i>Seizure therapies: The next generation</i>	2022
	Butler Hospital, Brown University <i>Computational model driven design for brain stimulation</i>	2021
	University of Pennsylvania, Center for Neuromodulation in Depression and Stress <i>Electromagnetic brain stimulation from low to high intensity</i>	2021
	VA Boston Healthcare System, Boston University School of Medicine Harvard Medical School Neuropsychiatry Translational Research Fellowship Seminar <i>Precision neurostimulation: History, physics, computational modeling, and engineering</i>	2020
	Medical University of Vienna, Neuroimaging Lab <i>Precision seizure therapy</i>	2020
	Mount Sinai Icahn School of Medicine, Depression and Anxiety Center <i>Rational design of individualized noninvasive brain stimulation</i>	2019
	NIMH Intramural Research Program Investigators' Seminar Series <i>Computational neurostimulation: Engineering better brain stimulation therapies</i>	2018
	UCLA Brain Mapping Center <i>Computational neurostimulation: Engineering better brain stimulation therapies</i>	2018
	UCLA Semel Institute for Neuroscience and Human Behavior Neuromodulation Division <i>Modeling and design for magnetic stimulation</i>	2018
	USC Mark and Mary Stevens Neuroimaging and Informatics Institute <i>Computational neurostimulation</i>	2018
	NIDA, Neuroimaging Research Branch <i>Advances in transcranial magnetic stimulation technology</i>	2016
	Mayo Clinic College of Medicine, Department of Molecular Pharmacology Neurobiology of Alcoholism and Drug Addiction Lab <i>Transcranial magnetic stimulation technology development</i>	2016
	Mayo Clinic College of Medicine, Department of Neurologic Surgery Neural Engineering Lab <i>Optimizing transcranial magnetic stimulation</i>	2016
	NIMH, Experimental Therapeutics & Pathophysiology Branch <i>Engineering better electromagnetic brain stimulation therapies</i>	2016
	Duke University School of Medicine, Department of Psychiatry & Behavioral Sciences Chair's round: <i>Fundamentals of transcranial electric and magnetic stimulation dosing</i>	2015
	Weill Cornell Medical College, Department of Biomedical Engineering <i>Transcranial magnetic stimulation: Pulse source, coil design, & concurrent neuroimaging</i>	2015
	Duke University, Department of Biomedical Engineering <i>Modeling and coil design considerations for transcranial magnetic stimulation</i>	2014
CONFERENCE TALKS, WORKSHOPS, & PANELS	International Society for ECT and Neurostimulation Annual Meeting <i>Multichannel Individualized Stimulation Therapy</i>	Upcoming 2025
	American Neuropsychiatric Association Annual Meeting Panel: <i>Interventional neuropsychiatry: From mechanisms to clinical decision-making</i> Contributed talk: <i>Advancing personalized seizure therapy: Magnetic seizure therapy and Multichannel Individualized Stimulation Therapy</i>	Upcoming 2025
	International Brain Stimulation Conference Symposium: <i>ECT reimagined: Precision, prediction, and personalized care</i>	Upcoming 2025

- Contributed talk: *Multichannel Individualized Stimulation Therapy (MIST): A targeted approach to optimize electroconvulsive therapy*
- 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*
- 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*
 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 bio-marker 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: <i>Dimensional approaches to device neuromodulation</i>	
Contributed talk: <i>Depressive symptom dimensions in seizure therapy</i>	
Global ECT–MRI Collaboration Young Researchers Collective	2022
<i>ECT, electric field, neuroplasticity, and clinical outcomes</i>	
American Academy of Child and Adolescent Psychiatry Annual Meeting	2021
Panel: <i>Recent work with contemporary computational methods and artificial intelligence to advance the practice of child and adolescent psychiatry</i>	
Contributed talk: <i>Introduction to computational psychiatry</i>	
European College of Neuropsychopharmacology Congress	2021
Panel: <i>Neurobiology of rapid mood changes</i>	
Contributed talk: <i>Precision neurostimulation: Electroconvulsive therapy</i>	
Society for Brain Mapping & Therapeutics Annual Congress	2021
<i>Advances in electroconvulsive therapy for treatment of depression</i>	
American Society of Clinical Psychopharmacology Annual Meeting	2021
Early Career Workshop: <i>How to give a virtual talk</i>	
International College of Neuropsychopharmacology Virtual World Congress	2021
<i>Next generation seizure therapy and neuromodulation</i>	
European Conference of Brain Stimulation in Psychiatry	2020
Panel: <i>What can we learn from ECT: Insights from the GEMRIC consortium</i>	
Contributed talk: <i>Electric field modeling to inform ECT dosing and device development</i>	
University of Minnesota Non-Invasive Brain Stimulation Workshop	2020
<i>Use of individual electric field models in clinical research</i> 	
American Society of Clinical Psychopharmacology Annual Meeting	2020
Panel: <i>New developments in neurostimulation</i> #coronacancelled	
NYC Neuromodulation Online	2020
Discussant: <i>Noninvasive vagus nerve stimulation applied to stress management, opioid withdrawal, and neurocognitive disorders</i>	
American College of Neuropsychopharmacology Annual Meeting	2019
Panel: <i>Precision neurostimulation for treatment of psychiatric disorders</i>	
Contributed talk: <i>Rational design of precision seizure therapy</i>	
International Symposium on Advancing Stimulation Precision Medicine of Brain Disorders, Copenhagen University Hospital Hvidovre, Danish Research Centre for Magnetic Resonance	2019
<i>Rational design of precision seizure therapy</i>	
International College of Neuropsychopharmacology Meeting	2019
Workshop: <i>Neurobiological and clinical characterization, and treatment development for treatment resistant depression</i>	
Contributed talk: <i>Individualized seizure therapy: Reinventing ECT</i>	
American Society of Clinical Psychopharmacology Annual Meeting	2019
Co-chair: <i>Treatment-resistant mood disorders across the lifespan: Novel therapeutics</i>	
International Brain Stimulation Conference	2019
Panel: <i>Individualized brain stimulation: Addressing heterogeneity across modalities</i>	
Contributed talk: <i>Individualized electroconvulsive therapy for treatment of depression</i>	
Bergen Workshop of the Global ECT–MRI Collaboration	2018
<i>Electric field modeling for electroconvulsive therapy</i>	
Joint NYC Neuromodulation Conference & NANS Summer Series	2018
<i>Optimizing high-density stimulation arrays for brain targeting</i>	

TEACHING & MENTORING APPOINTMENTS	Neuropsychiatric Drug Development Summit	2018
	<i>Targeted intermittent device delivered interventions will ultimately prove superior to maintenance treatment with drugs for brain disorders</i>	
	International Conference of the IEEE Engineering in Medicine and Biology Society	2018
	Chair: <i>Computational human models for brain stimulation</i>	
	Contributed talk: <i>Electric field induced by TMS: Applications in depression and anxiety</i>	
	American Psychiatric Association Annual Conference	2018
	Presidential symposium: <i>ECT in the era of new brain stimulation treatments</i>	
	Contributed talk: <i>Individualized neurotargeted seizure therapy: Reinventing ECT</i>	
	ADAA Anxiety and Depression Conference	2018
	Panel: <i>Personalized medicine for treatment resistant depressed patients: Novel strategies to optimize treatment with antidepressant medications, ketamine, and ECT</i>	
	Contributed talk: <i>Individualized neurotargeted seizure therapy: Reinventing ECT</i>	
	NIMH Non-Invasive Brain Stimulation Electric Field Modeling Workshop	2017
	<i>Use of individual electric field models in clinical research</i> 	
	NYC Neuromodulation Conference	2017
	<i>Low field magnetic stimulation</i>	
	NIMH Workshop on Transcranial Electrical Stimulation: Mechanisms, Technology, and Therapeutic Applications	2016
	<i>Effect of anatomical variability on electric field characteristics of tES</i>	
	International Society for ECT and Neurostimulation Annual Meeting	2015
	Workshop: <i>Spatial targeting with transcranial magnetic stimulation</i>	
	Educational Counselor , MIT	2022 –
	Research Mentor , University of Maryland, College Park	2018 – 2019
	Fischell Department of Bioengineering	
	Capstone project: <i>Detection of brain-to-brain synchrony for improved psychotherapy</i>	
	Lecturer , NIH	
	National Institute of Mental Health	
	<i>Basic Training Course on Transcranial Magnetic Stimulation</i> 	2020
	<i>fMRI Course</i>	Summer 2017
	National Institute of Neurological Disorders and Stroke	
	<i>Clinical Neuroscience Program Lecture Series</i>	2017, 2019
	Faculty , Duke University	
	Department of Psychology & Neuroscience	
	<i>Research Independent Study</i>	2016
	Matching Undergraduates to Science and Engineering Research Program	2015 – 2016
	Biosciences Collaborative for Research Engagement	2015 – 2016
	Department Psychiatry & Behavioral Sciences	
	<i>Visiting Fellowship in Electroconvulsive Therapy</i> (CME accredited)	2015
	<i>Visiting Fellowship in Transcranial Magnetic Stimulation</i> (CME accredited)	2014 – 2016
	Teaching Assistant , Columbia University	
	Department of Electrical Engineering	
	<i>Analog Systems in VLSI</i> (graduate level)	Spring 2010
	<i>The Digital Information Age</i>	Fall 2009
	Recitation Instructor , Columbia University Mailman School of Public Health	
	Department of Biostatistics	
	<i>Biostatistics</i> (graduate level)	Fall 2009

	Teaching Assistant, MIT Concourse Program <i>Multivariable Calculus</i> <i>Differential Equations</i>	Fall 2003 – 2006 Spring 2004 – 2007
SPONSORED THESES	G. Asturias, Psychology & Neuroscience, Duke University 🏅 Graduated with Distinction Undergraduate honors thesis: “Effect of repetitive transcranial magnetic stimulation on the structural and functional connectome in patients with major depressive disorder,” <i>DukeSpace</i> . HDL: 10161/14299 Post-training position: Medical student, Stanford University School of Medicine	2015 – 2017
THESIS EXAMINATION COMMITTEE MEMBERSHIP	W. A. Wartman, Electrical & Computer Engineering, Worcester Polytechnic Institute 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 Ph.D. dissertation: “Translational modeling of non-invasive electrical stimulation,” <i>CUNY Academic Works</i> . URL: academicworks.cuny.edu/cc_etds_theses/774 Sponsor: M. Bikson	2024 2019
CAREER DEVELOPMENT AWARD ADVISORY	S. K. Conroy, M.D., Ph.D., Indiana University School of Medicine 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 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 Project: “Personalized circuit-based neuromodulation targets for depression” 🏅 Klerman Prize for Exceptional Clinical Research, <i>Brain & Behavior Research Foundation</i> N. L. Balderston, Ph.D., University of Pennsylvania Perelman School of Medicine NIH/NIMH K01 MH121777 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, <i>Brain & Behavior Research Foundation</i>	2024 – 2020 – 2025 2019 – 2023
RESEARCH FELLOWS & POSTDOCS	S. Dey, Ph.D., NIMH Visiting Postdoctoral Fellow M. Dannhauer, Ph.D., NIMH Research Fellow Post-training position: Assistant Professor, Department of Computer Science, East Carolina University	2024 – 2022 – 2024
GRADUATE STUDENTS	E. Bharti, Ph.D. candidate, NIH Oxford-Cambridge Scholars Program M. Kshirsagar, M.S., Biomedical Engineering, Duke University Post-training position: Consultant, Deloitte Consulting	2024 – 2012
POSTBACS	P. L. Robins, B.A., NIMH Intramural Research Training Award (IRTA) Fellow 🏅 NIMH Intramural Research Program Trainee Travel Award 🏅 First Place in Student Competition, <i>Brain & Human Body Modeling Conference</i> Post-training position: TMS technician, Columbia Associates M. R. Hynd, B.S., NIMH IRTA Fellow Post-training position: Ph.D. student, University of North Carolina at Chapel Hill	2021 – 2024 2023 2022 2020 – 2022

	S. Awasthi, B.S., NIMH IRTA Fellow	2018 – 2020
	Post-training position: Medical student, Stanford University School of Medicine	
	M. M. Noh, S.B., NIMH IRTA Fellow	2018 – 2019
	Post-training position: Medical student, University of Cincinnati College of Medicine	
	J. Thomas, M.S., NIMH IRTA Fellow	2017 – 2019
	Post-training position: Program officer, National Academies of Sciences, Engineering, and Medicine	
	M. Velez Afanador, B.S., NIMH IRTA Fellow	2016 – 2019
	🏆 Outstanding Poster Award, <i>NIH Postbac Poster Day</i>	2018
	Post-training position: Medical student, Howard University College of Medicine	
UNDERGRADS	D. T. Weaver, Biology, Duke University	2016
	Post-training position: M.D./Ph.D. student, Case Western Reserve University	
	E. F. Salgado, Psychology & Neuroscience, Duke University	2016
	🏆 Graduated with Distinction	
	Post-training position: Ph.D. student, Indiana University–Purdue University Indianapolis	
	Z. Feng, Biomedical Engineering and Biology, Duke University	2015 – 2016
	Post-training position: Medical student, University of Colorado School of Medicine	
	M. L. Glidewell, Biomedical Engineering, Duke University	2015 – 2016
	Post-training position: Senior strategy consultant, IBM	
	W. Lim, Biomedical Engineering, Duke University	2015 – 2016
	Post-training position: Medical student, Texas A&M College of Medicine	
	F. M. Mercer, Gender, Sexuality and Feminist Studies, Duke University	2015 – 2016
	Post-training position: Analyst, Morgan Stanley	
	E. Shinder, Biology, Duke University	2015 – 2016
	🏆 Graduated with Distinction	
	Post-training position: Medical student, Stony Brook School of Medicine	
	E. P. Vienneau, Biomedical Engineering, Duke University	2015 – 2016
	🏆 Howard G. Clark Award for Excellence in Research	
	Post-training position: Ph.D. student, Vanderbilt University	
	S. H. Lee, Biomedical Engineering, Duke University	2015
	Post-training position: Manager, Strategy & Operations, Tempus Labs	
	R. Shah, Psychology & Neuroscience, Duke University	2015
	Post-training position: Medical student, Yale School of Medicine	
	J. R. Lilien, Electrical & Computer Engineering, Duke University	2014 – 2016
	🏆 Walter J. Seeley Scholastic Award	
	Post-training position: Machine learning engineer, Amazon	
INTERNS	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	
	Post-training position: Medical student, Weill Cornell Medicine	
	A. L. Halberstadt, Biology and Psychology, Carnegie Mellon University	Summer 2017
	Post-training position: Ph.D. student, Penn State University	
	C. M. Prevost, Biomedical Engineering, Clemson University	Summer 2015
	Post-training position: Medical student, University of South Carolina School of Medicine	
	J. V. McCall, Biomedical Engineering, North Carolina State University	Summer 2013
	Post-training position: Ph.D. student, North Carolina State University	

PROFESSIONAL SOCIETIES MEMBERSHIP & SERVICE	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, <i>Psychopharm Today</i> podcast 🎙️	2024 –
	Technology Task Force	2020 – 2023
	Biomedical Engineering Society	
	Member	2021 –
	American College of Neuropsychopharmacology	
	Associate Member	2023 –
	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
EDITORIAL ROLES	Society for Industrial and Applied Mathematics	
	Student Member	2008 – 2012
	Society for Neuroscience	
	Student Member	2005 – 2012
	American Physical Society	
	Student Member	2004 – 2009
	Deputy Editor, <i>Transcranial Magnetic Stimulation</i>	2024 –
	Associate Editor, <i>Frontiers in Psychiatry</i>	2022 –
	Sections: Neurostimulation, Neuroimaging	
	Co-Editor on Research Topic: How Does Brain Stimulation Work? Neuroversion and Other Putative Mechanisms of Action 📖	2024
	Review Editor, <i>Frontiers in Psychology</i>	2022 –
	Sections: Addictive Behaviors, Consciousness Research	
	Review Editor, <i>Frontiers in Psychiatry</i>	2016 – 2022
	Sections: Neurostimulation, Neuroimaging	
	Guest Associate Editor, <i>Frontiers in Pharmacology: Neuropharmacology</i>	2020
	Co-Editor on Research Topic: Neurobiology of Rapid Mood Changes 📖	
	Guest Editor, <i>Physics in Medicine and Biology</i>	2024
	Special Issue: Electromagnetic Modeling for Brain Stimulation 📖	
	<i>Ad hoc</i> journal reviewer	2010 –
	<i>AIP Advances</i>	
	<i>American Journal of Psychiatry</i>	
	<i>Asian Journal of Psychiatry</i>	
	<i>Australasian Physical and Engineering Sciences in Medicine</i>	
	<i>Biological Psychiatry</i>	
	<i>BioMedical Engineering OnLine</i>	

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
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 and 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	Reviewer, NIH BluePrint MedTech Program	2022 –
REVIEW	<i>Ad hoc</i> reviewer, NIH Early Career Reviewer Program	2021
PANELS	Biophysics of Neural Systems Study Section	
	Reviewer, Duke Institute for Brain Sciences, Research Incubator Awards	2018, 2021
CONFERENCE	Organizing committee, and judge in student competition	2022 – 2023
ORGANIZING	Brain and Human Body Modeling Conference	
COMMITTEE	Program review subcommittee	2023
	American Society of Clinical Psychopharmacology Annual Meeting	
	Preconference workshop director, NYC Neuromodulation Conference	2018
	Workshop: <i>Computational modeling in neuromodulation: Tools for engineers, clinicians, and researchers</i>	

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: <i>Fundamentals of transcranial brain stimulation</i>	
	Jewish Social Service Agency	2020
	Presentation: <i>Basics of brain stimulation devices: What are they and how do they work</i>	
	Exhibitor, USA Science & Engineering Festival #coronacancelled	2020
	University of Pennsylvania, Wharton Undergraduate Health Care Club	2019
	Presentation: <i>Research in mental health treatment</i>	
	Judge, MIT Hacking Medicine: DC Grand Hack	2019
	NIH High School Scientific Training and Enrichment Program	2019
	Presentation: <i>Bioelectricity and brain stimulation</i>	
	NIH Take Your Child to Work Day	2019
	Presentation: <i>How to fool your brain</i>	
	UCLA, CruX Neurotech Organization	2019
	Presentation: <i>Neuromodulation in psychiatry</i>	
	University of Pennsylvania, Wharton Undergraduate Health Care Club	2018
	Presentation: <i>Technology and the future of mental health treatment</i>	
	NIH Noninvasive Brain Stimulation Special Interest Group	2017 –
	Judge/Lead Judge, NIH Postbac Poster Day	2017 – 2019
PROFESSIONAL DEVELOPMENT & CONTINUING EDUCATION	Innovation Leader, Psychiatry Innovation Lab, American Psychiatric Association	2016
	Duke Psychiatry, Mood Disorders Support and Education Group	
	Presentation: <i>Brain stimulation treatments for severe mood disorders</i>	2016
	Presentation: <i>New frontiers in treatments for mood disorders</i>	2015
	Duke Translational Medicine Institute, Undergraduate Research Society	2016
	Presentation: <i>Engineering meets psychiatry</i>	
	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 2023.07