# Zhi-De Deng

zzzdeng@alum.mit.edu
+1 919 564 5282
www.zzzdeng.net

## Research Specialties

- Noninvasive brain stimulation: technology development, modeling, device safety, translational and clinical applications
- Computational electromagnetics
- Electrophysiological and neuroimaging biomarker development
- Neural plasticity
- Nonlinear dynamics of physiological systems
- Translational neuromodeling

## Education

expected 2021 **M.H.Sc., Clinical Research**, Duke University

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

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

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

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

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

# Professional Appointments & Employment

## Academic

2019–present **Staff Scientist**, **Director of Computational Neurostimulation Research Program**, Noninvasive Neuromodulation Unit, Experimental Therapeutics & Pathophysiology Branch, Intramural Research Program, NIMH

2016–present **Adjunct Assistant Professor**, Department of Psychiatry & Behavioral Sciences, Duke University School of Medicine

2016–2019 **Research Fellow**, Noninvasive Neuromodulation Unit, Experimental Therapeutics & Pathophysiology Branch, Intramural Research Program, NIMH

- Richard J. Wyatt Memorial Fellowship for Translational Research

2015–present **Faculty**, Duke Institute for Brain Sciences, Duke University

2014–2016 **Medical Instructor**, Department of Psychiatry & Behavioral Sciences, Duke University School of Medicine

- Duke Translational Medicine Institute KL2 Fellow

2013–2014 **Postdoctoral Associate**, Department of Psychiatry & Behavioral Sciences, Duke University School of Medicine

2010–2013 **Visiting Graduate Research Assistant**, Department of Psychiatry & Behavioral Sciences, Duke University School of Medicine

2007–2010 **Graduate Research Assistant**, Department of Psychiatry, Columbia University College of Physicians and Surgeons/New York State Psychiatric Institute

- Columbia Irving Institute for Clinical and Translational Research T32 Fellow

2006–2007 **Graduate Research Assistant**, Harvard–MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology

2005–2006 **Undergraduate Research Assistant**, Harvard–MIT Division of Health Sciences and Technology, Massachusetts Institute of Technology

## Nonprofit Organization

2017–present **Co-founder**, **Scientific Advisor**, Singula Institute

## Internships

2004 **Executive Intern**, Department of Anesthesiology, New York–Presbyterian Hospital/Weill Cornell Medical College

2003 **Internship Coordinator**, The New York Times Company Foundation

2002 **News Technology Intern**, The New York Times Company

# Publications (* denotes first, joint first, or senior author)

## Refereed Journal Articles

51 S. H. Lisanby, S. M. McClintock, G. Alexopoulos, S. H. Bailine, E. Bernhardt, M. C. Briggs, C. M. Cullum, **Z.-D. Deng**, M. Dooley, E. T. Geduldig, R. M. Greenberg, M. M. Husain, S. Kaliora, R. G. Knapp, V. Latoussakis, L. S. Liebman, W. V. McCall, M. Mueller, G. Petrides, J. Prudic, P. B. Rosenquist, M. V. Rudorfer, S. Sampson, A. A. Teklehaimanot, K. G. Tobias, R. D. Weiner, R. C. Young, C. H. Kellner, on behalf of the CORE/PRIDE Work Group, "Longitudinal neurocognitive effects of combined electroconvulsive therapy (ECT) and pharmacotherapy in geriatric major depressive disorder: Phase 2 of the PRIDE study," *American Journal of Geriatric Psychiatry*, in press. DOI: 10.1016/j.jagp.2021.04.006

50 E. A. Friðgeirsson, **Z.-D. Deng**, D. Denys, J. A. van Waarde, and G. A. van Wingen, "Electric field strength induced by electroconvulsive therapy may be associated with clinical outcome: a pilot study," *NeuroImage: Clinical*, vol. 30, 102581, 2021. PMCID: PMC7895836. DOI: 10.1016/j.nicl.2021.102581

49 P. J. C. Suen, S. Doll, M. C. Battistuzzo, G. Busatto, L. B. Razza, F. Padberg, E. Mezger, L. Bulubas, D. Keeser, **Z.-D. Deng**, and A. R. Brunoni, "Association between tDCS computational modeling and clinical outcomes in depression: data from the ELECT-TDCS trial," *European Archives of Psychiatry and Clinical Neuroscience*, vol. 271, no. 1, pp. 101–110, 2021. PMCID: PMC8100980. DOI: 10.1007/s00406-020-01127-w

48 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, 2021. PMCID: PMC7744398. DOI: 10.1016/j.jagp.2020.06.008

47 N. L. Balderston, C. Roberts, E. M. Beydler, **Z.-D. Deng**, T. Radman, B. Luber, S. H. Lisanby, M. Ernst, and C. Grillon, "A generalized method for conducting electric-field optimized, fMRI-guided, transcranial magnetic stimulation," *Nature Protocols*, vol. 15, no. 11, pp. 3595–3614, 2020. PMCID: PMC8123368. DOI: 10.1038/s41596-020-0387-4

46 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, 2020. PMID: 32289719. DOI: 10.1016/j.brs.2020.03.009

45 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, 2020. PMCID: PMC7150637. DOI: 10.1016/j.bpsc.2019.12.020

44 S. H. Lisanby, S. M. McClintock, G. Alexopoulos, S. H. Bailine, E. Bernhardt, M. C. Briggs, C. M. Cullum, **Z.-D. Deng**, M. Dooley, E. T. Geduldig, R. M. Greenberg, M. M. Husain, S. Kaliora, R. G. Knapp, V. Latoussakis, L. S. Liebman, W. V. McCall, M. Mueller, G. Petrides, J. Prudic, P. B. Rosenquist, M. V. Rudorfer, S. Sampson, A. A. Teklehaimanot, K. G. Tobias, R. D. Weiner, R. C. Young, C. H. Kellner, on behalf of the CORE/PRIDE Work Group, "Neurocognitive effects of combined electroconvulsive therapy (ECT) and venlafaxine in geriatric depression: Phase 1 of the PRIDE study," *American Journal of Geriatric Psychiatry*, vol. 28, no. 3, pp. 304–316, 2020. PMCID: PMC7050408. DOI: 10.1016/j.jagp.2019.10.003. Commentary in pp. 317–319

## Refereed Journal Articles (continue)

43 L.-Z. Yang, W. Zhang, W. Wang, Z. Yang, H. Wang, **Z.-D. Deng**, C. Li, B. Qiu, D.-R. Zhang, R. Cohen Kadosh, H. Li, and X. Zhang, "Neural and psychological predictors of cognitive enhancement and impairment due to neurostimulation," *Advanced Science*, vol. 7, no. 4, 1902863, 2020. PMCID: PMC7029648. DOI: 10.1002/advs.201902863.

42 N. L. Balderston, E. M. Beydler, M. Goodwin, **Z.-D. Deng**, T. Radman, B. Luber, S. H. Lisanby, M. Ernst, and C. Grillon, "Low-frequency parietal repetitive transcranial magnetic stimulation reduces fear and anxiety," *Translational Psychiatry*, vol. 10, no. 1, 68, 2020. PMCID: PMC7026136. DOI: 10.1038/s41398-020-0751-8

41 N. L. Balderston, E. M. Beydler, C. Roberts, **Z.-D. Deng**, T. Radman, T. Lago, B. Luber, S. H. Lisanby, M. Ernst, and C. Grillon, "Mechanistic link between right prefrontal cortical activity and anxious arousal revealed using transcranial magnetic stimulation in healthy subjects," *Neuropsychopharmacology*, vol. 45, no. 4, pp. 694–702, 2020. PMCID: PMC7021903. DOI: 10.1038/s41386-019-0583-5

40 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*, 2019, online ahead of print. PMCID: PMC7225078. DOI: 10.1038/s41380-019-0589-8

39 T. Dufor, S. Grehl, A. D. Tang, M. Doulazmi, M. Traoré, N. Debray, C. Dubacq, **Z.-D. Deng**, J. Mariani, A. M. Lohof, and R. M. Sherrard, "Neural circuit repair by low-intensity magnetic stimulation requires cellular magnetoreceptors and specific stimulation patterns," *Science Advances*, vol. 5, no. 10, eaav9847, 2019. PMCID: PMC6821463. DOI: 10.1126/sciadv.aav9847

38 M. Argyelan, L. Oltedal, **Z.-D. Deng**, B. Wade, M. Bikson, A. Joanlanne, S. Sanghani, H. Bartsch, M. Cano, A. M. Dale, U. Dannlowski, A. Dols, V. Enneking, R. Espinoza, U. Kessler, K. L. Narr, K. J. Oedagaard, M. L. Oudega, R. Redlich, M. L. Stek, A. Takamiya, L. Emsell, F. Bouckaert, P. Sienaert, J. Pugol, I. Tendolkar, P. van Eijndhoven, G. Petrides, A. K. Malhotra, and C. Abbott, "Electric field causes volumetric changes in the human brain," *eLife*, vol. 8, e49115, 2019. PMCID: PMC6874416. DOI: 10.7554/eLife.49115

*37 L. Beynel, L. G. Appelbaum, B. Luber, C. A. Crowell, S. A. Hilbig, W. Lim, D. Nguyen, N. A. Chrapliwy, S. W. Davis, R. Cabeza, S. H. Lisanby, and **Z.-D. Deng**, "Effects of online repetitive transcranial magnetic stimulation (rTMS) on cognitive processing: a meta-analysis and recommendations for future studies," *Neuroscience & Biobehavioral Reviews*, vol. 107, pp. 47–58, 2019. PMCID: PMC7654714. DOI: 10.1016/j.neubiorev.2019.08.018

36 S. M. Goetz, S. M. Madhi Alavi, **Z.-D. Deng**, and A. V. Peterchev, "Statistical model of motor evoked potentials," *IEEE Transactions on Neural Systems & Rehabilitation Engineering*, vol. 27, no. 8, pp. 1539–1545, 2019. PMCID: PMC6719775. DOI: 10.1109/TNSRE.2019.2926543

35 T. Popa, L. S. Morris, R. Hunt, **Z.-D. Deng**, S. Horovitz, K. Mente, H. Shitara, K. Baek, M. Hallett, and V. Voon, "Modulation of resting connectivity between the mesial frontal cortex and basal ganglia," *Frontiers in Neurology*, vol. 10, 587, 2019. PMCID: PMC6593304. DOI: 10.3389/fneur.2019.00587

## Refereed Journal Articles (continue)

34 M. J. Dubin, I. P. Ilieva, **Z.-D. Deng**, J. Thomas, A. Albright, K. Kravets, B. D. Brody, P. J. Christos, J. H. Kocsis, C. Liston, and F. M. Gunning, "A double-blind pilot dosing study of low field magnetic stimulation (LFMS) for treatment-resistant depression (TRD)," *Journal of Affective Disorders*, vol. 249, pp. 286–293, 2019. PMCID: PMC6486658. DOI: 10.1016/j.jad.2019.02.039

33 P. E. Croarkin, P. A. Nakonezny, **Z.-D. Deng**, M. Romanowicz, J. L. Vande Voort, D. Doruk Camsari, K. M. Schak, J. D. Port, and C. P. Lewis, "High frequency repetitive TMS for suicidal ideation in adolescents with depression," *Journal of Affective Disorders*, vol. 239, pp. 282–290, 2018. PMCID: PMC6431788. DOI: 10.1016/j.jad.2018.06.048

32 B. Wang, M. R. Shen, **Z.-D. Deng**, J. E. Smith, J. J. Tharayil, C. J. Gurrey, L. J. Gomez, and A. V. Peterchev, "Redesigning existing transcranial magnetic stimulation coils to reduce energy: application to low field magnetic stimulation," *Journal of Neural Engineering*, vol. 15, no. 3, 036022, 2018. PMCID: PMC5929994. DOI: 10.1088/1741-2552/aaa505

31 S. Grehl, D. Martina, C. Goyenvalle, **Z.-D. Deng**, J. Rodger, and R. M. Sherrard, "*In vitro* magnetic stimulation: a simple stimulation device to deliver defined low intensity electromagnetic fields," *Frontiers in Neural Circuits*, vol. 10, 85, 2016. PMCID: PMC5093126. DOI: 10.3389/fncir.2016.00085

*30 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Effects of anatomical variability on electric field characteristics of electroconvulsive therapy and magnetic seizure therapy: a parametric modeling study," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 23, no. 1, pp. 22–31, 2015. PMCID: PMC4289667. DOI: 10.1109/TNSRE.2014.2339014

29 J. K. Mueller, E. M. Grigsby, V. Prevosto, F. W. Petraglia, III, H. Rao, **Z.-D. Deng**, A. V. Peterchev, M. A. Sommer, T. Egner, M. L. Platt, and W. M. Grill, "Simultaneous transcranial magnetic stimulation and single-neuron recording in alert non-human primates," *Nature Neuroscience*, vol. 17, no. 8, pp. 1130–1136, 2014. PMCID: PMC4115015. DOI: 10.1038/nn.375.

*28 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Coil design considerations for deep transcranial magnetic stimulation," *Clinical Neurophysiology*, vol. 125, no. 6, pp. 1202–1212, 2014. PMCID: PMC4020988. DOI: 10.1016/j.clinph.2013.11.038. Commentary in pp. 1077–1078.

*27 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Controlling stimulation strength and focality in electroconvulsive therapy via electrode size, spacing, and current amplitude," *The Journal of ECT*, vol. 29, no. 4, pp. 325–335, 2013. PMCID: PMC3905244. DOI: 10.1097/YCT.0b013e3182a4b4a7.

26 B. Luber, J. Stener, A. Tucker, C. Habeck, A. V. Peterchev, **Z.-D. Deng**, R. Basner, Y. Stern, and S. H. Lisanby, "Extended remediation of sleep deprived-induced working memory deficits using fMRI-guided transcranial magnetic stimulation," *Sleep*, vol. 36, no. 6, pp. 857–871, 2013. PMCID: PMC3649828. DOI: 10.5665/sleep.2712

*25 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Electric field depth–focality tradeoff in transcranial magnetic stimulation: simulation comparison of 50 coil designs," *Brain Stimulation*, vol. 6, no. 1, pp. 1–13, 2013. PMCID: PMC3568257. DOI: 10.1016/j.brs.2012. 02.005. Commentary in pp. 14–15

## Refereed Journal Articles (continue)

24 W. H. Lee, **Z.-D. Deng**, T. S. Kim, A. F. Laine, S. H. Lisanby, and A. V. Peterchev, "Regional electric field induced by electroconvulsive therapy in a realistic head model: influence of white matter anisotropic conductivity," *NeuroImage*, vol. 59, no. 3, pp. 2110–2123, 2012. PMCID: PMC3495594. DOI: 10.1016/j.neuroimage.2011.10.029

*23 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Electric field strength and focality of electroconvulsive therapy and magnetic seizure therapy: a finite element simulation study," *Journal of Neural Engineering*, vol. 8, no. 1, 016007, 2011. PMCID: PMC3903509. DOI: 10.1088/1741-2560/8/1/016007

22 N. M. Arzeno, **Z.-D. Deng**, and C.-S. Poon, "Analysis of first-derivative based QRS detection algorithms," *IEEE Transactions on Biomedical Engineering*, vol. 55, no. 2, pp. 478–484, 2008. PMCID: PMC2532677. DOI: 10.1109/TBME.2007.912658

## Refereed IEEE Proceedings

*21 **Z.-D. Deng** and S. H. Lisanby, "Electric field characteristics of low-field synchronized transcranial magnetic stimulation (sTMS)," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2017, pp. 1445–1448. PMID: 29060150. DOI: 10.1109/EMBC.2017.8037106

*20 **Z.-D. Deng**, S. M. McClintock, and S. H. Lisanby, "Brain network properties in depressed patients receiving seizure therapy: a graph theoretical analysis of peri-treatment resting EEG," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2015, pp. 2203–2206. PMID: 26736728. DOI: 10.1109/EMBC.2015.7318828

*19 **Z.-D. Deng**, A. V. Peterchev, A. D. Krystal, B. Luber, S. M. McClintock, M. M. Husain, and S. H. Lisanby, "Topography of seizures induced by electroconvulsive therapy and magnetic seizure therapy," *Proceedings of the IEEE Engineering in Medicine and Biology Society Conference on Neural Engineering*, 2013, pp. 577–580. DOI: 10.1109/NER.2013.6696000

18 W. H. Lee, **Z.-D. Deng**, A. F. Laine, S. H. Lisanby, and A. V. Peterchev, "Influence of white matter conductivity anisotropy on electric field strength induced by electroconvulsive therapy," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2011, pp. 5473–5476. PMID: 22255576. DOI: 10.1109/IEMBS.2011.6091396

*17 **Z.-D. Deng** and A. V. Peterchev, "Transcranial magnetic stimulation coil with electronically switchable active and sham modes," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2011, pp. 1993–1996. PMID: 22254725. DOI: 10.1109/IEMBS.2011.6090561

*16 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Transcranial magnetic stimulation in the presence of deep brain stimulation implants: induced electrode currents," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2010, pp. 6812–6824. PMID: 21095849. DOI: 10.1109/IEMBS.2010.5625958

*15 **Z.-D. Deng**, D. E. Hardesty, S. H. Lisanby, and A. V. Peterchev, "Electroconvulsive therapy in the presence of deep brain stimulation implants: electric field effects," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2010, pp. 2049–2062. PMID: 21096149. DOI: 10.1109/IEMBS.2010.5626517

## Refereed IEEE Proceedings (continue)

*14 W. H. Lee, **Z.-D. Deng**, T. S. Kim, A. F. Laine, S. H. Lisanby, and A. V. Peterchev, "Regional electric field induced by electroconvulsive therapy: a finite element simulation study," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2010, pp. 2045–2048. PMID: 21096148. DOI: 10.1109/IEMBS.2010.5626553

*13 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Effect of head anatomical variability on neural polarization strength and focality in electroconvulsive therapy and magnetic seizure therapy," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2009, pp. 682–688. PMID: 19964484. DOI: 10.1109/IEMBS.2009.5334091

*12 **Z.-D. Deng**, A. V. Peterchev, and S. H. Lisanby, "Coil design considerations for deep brain transcranial magnetic stimulation," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2008, pp. 5675–5679. PMID: 19164005. DOI: 10.1109/IEMBS.2008.4650502

*11 **Z.-D. Deng**, C.-S. Poon, N. M. Arzeno, and E. S. Katz, "Heart rate variability in pediatric obstructive sleep apnea," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2006, pp. 3565–3568. PMID: 17946187. DOI: 10.1109/IEMBS.2006.260139

*10 N. M. Arzeno, C.-S. Poon, and **Z.-D. Deng**, "Quantitative analysis of QRS detection algorithms based on the first derivative of the ECG," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2006, pp. 1788–1791. PMID: 17946480. DOI: 10.1109/IEMBS.2006.260051

## Reviews & Consensus Papers

9 L. Borrione, H. Bellini, L. B. Razza, A. G. Avila, C. Baeken, A.-K. Brem, G. Busatto, A. F. Carvalho, A. Chekroud, Z. J. Daskalakis, **Z.-D. Deng**, J. Downar, W. Gattaz, C. Loo, P. A. Lotufo, M. D. G. M. Martin, S. M. McClintock, J. O'Shea, F. Padberg, I. C. Passos, G. A. Salum, M.-A. Vanderhasselt, R. Fraguas, I. Benseñor, L. Valiengo, and A. R. Brunoni, "Precision non-implantable neuromodulation therapies: a perspective for the depressed brain," *Brazilian Journal of Psychiatry*, vol. 42, no. 4, pp. 403–419, 2020. PMCID: PMC7430385. DOI: 10.1590/1516-4446-2019-0741

8 B. Kadriu, **Z.-D. Deng**, C. Kraus, I. D. Henter, S. H. Lisanby, and C. A. Zarate, Jr., "Not so fast: recent successes and failures in treating depression," *Journal of Clinical Psychiatry*, vol. 81, no. 4, 19ac13138, 2020. PMCID: PMC7681914. DOI: 10.4088/JCP.19ac13138

*7 **Z.-D. Deng**, B. Luber, N. L. Balderston, M. Velez Afanador, M. M. Noh, J. Thomas, W. C. Altekruse, S. L. Exley, S. Awasthi, and S. H. Lisanby, "Device-based modulation of neurocircuits as a therapeutic for psychiatric disorders," *Annual Review of Pharmacology and Toxicology*, vol. 60, pp. 591–614, 2020. PMCID: PMC8100981. DOI: 10.1146/annurev-pharmtox-010919-023253

6 E. Kallioniemi, S. M. McClintock, **Z.-D. Deng**, M. M. Husain, and S. H. Lisanby, "Magnetic seizure therapy: towards personalized seizure therapy for major depression," *Personalized Medicine in Psychiatry*, vol. 17–18, pp. 37–42, 2019. PMCID: PMC7442165. DOI: 10.1016/j.pmip.2019.04.003

## Reviews & Consensus Papers (continue)

*5 M. Bikson, A. R. Brunoni, L. E. Charvet, V. P. Clark, L. G. Cohen, **Z.-D. Deng**, J. P. Dmochowski, D. J. Edwards, F. Fröhlich, E. S. Kappenman, K. O. Lim, C. Loo, A. Mantovani, D. P. McMullen, L. C. Parra, M. Pearson, J. D. Richardson, J. M. Rumsey, P. Sehatpour, D. I. Sommers, G. Unal, E. M. Wassermann, A. J. Woods, and S. H. Lisanby, "Rigor and reproducibility in research with transcranial electrical stimulation: an NIMH-sponsored workshop," *Brain Stimulation*, vol. 11, no. 3, pp. 465–480, 2018. PMCID: PMC5997279. DOI: 10.1016/j.brs.2017.12.008

4 S. M. Goetz and **Z.-D. Deng**, "The development and modeling of devices and paradigms for transcranial magnetic stimulation," *International Review of Psychiatry*, vol. 29, no. 2, pp. 115–145, 2017. PMCID: PMC5484089. DOI: 10.1080/09540261.2017.1305949

*3 **Z.-D. Deng**, S. M. McClintock, N. E. Oey, B. Luber, and S. H. Lisanby, "Neuromodulation for mood and memory: from the engineering bench to the patient bedside," *Current Opinion in Neurobiology*, vol. 30, pp. 38–43, 2015. PMCID: PMC4342851. DOI: 10.1016/jconb.2014.08.015

2 S. M. McClintock, J. Choi, **Z.-D. Deng**, L. G. Appelbaum, A. D. Krystal, and S. H. Lisanby, "Multifactorial determinants of the neurocognitive effects of electroconvulsive therapy," *The Journal of ECT*, vol. 30, no. 2, pp. 165–176, 2014. PMCID: PMC4143898. DOI: 10.1097/YCT.0000000000000137.

1 A. V. Peterchev, M. A. Rosa, **Z.-D. Deng**, J. Prudic, and S. H. Lisanby, "Electroconvulsive therapy stimulus parameters: rethinking dosage," *The Journal of ECT*, vol. 26, no. 3, pp. 159–174, 2010. PMCID: PMC2933093. DOI: 10.1097/YCT.0b013e3181e48165.

## Book Chapters

7 J. Thomas, **Z.-D. Deng**, S. Awasthi, and S. H. Lisanby, "Magnetic seizure therapy," to appear in *Handbook of Neurocognitive Function in Depression: Scientific Foundations and Clinical Practice*, S. M. McClintock and J. Choi, Eds. New York: Guilford Press.

6 B. Kadriu, S. Subramanian, **Z.-D. Deng**, I. D. Henter, L. T. Park, and C. A. Zarate, Jr., "Rapid-acting antidepressants," in *Primer on Depression*, M. H. Trivedi, Ed. Oxford, UK: Oxford University Press, 2019, ch. 13, pp. 218–240. *PsyArXiv* DOI: 10.31234/osf.io/xwk57

*5 **Z.-D. Deng**, C. Liston, F. M. Gunning, M. J. Dubin, E. A. Friðgeirsson, J. Lilien, G. A. van Wingen, and J. A. van Waarde, "Electric field modeling for transcranial magnetic stimulation and electroconvulsive therapy," in *Brain and Human Body Modeling: Computational Human Modeling at EMBC 2018*, S. N. Makarov, M. Horner, and G. M. Noetscher, Eds. Switzerland: Springer Nature, 2019, ch. 4, pp. 75–84. PMID: 31725245. DOI: 10.1007/978-3-030-21293-3_4

*4 S. N. Makarov, G. Bogdanov, G. M. Noetscher, W. Appleyard, R. Ludwig, J. T. Joutsa, and **Z.-D. Deng**, "Design and analysis of a whole body non-contact electromagnetic subthreshold stimulation device with field modulation targeting nonspecific neuropathic pain," in *Brain and Human Body Modeling: Computational Human Modeling at EMBC 2018*, S. N. Makarov, M. Horner, and G. M. Noetscher, Eds. Switzerland: Springer Nature, 2019, ch. 5, pp. 85–123. PMID: 31725237. DOI: 10.1007/978-3-030-21293-3_5

3 B. Luber and **Z.-D. Deng**, "Application of non-invasive brain stimulation in psychophysiology," in *Handbook of Psychophysiology*, J. T. Cacioppo, L. G. Tassinary, G. Berntson, Eds., 4th ed. Cambridge, UK: Cambridge University Press, 2016, ch. 7, pp. 116–150. DOI: 10.1017/9781107415782.007

## Book Chapter (continue)

2 S. H. Lisanby and **Z.-D. Deng**, "Magnetic seizure therapy for the treatment of depression," in *Brain Stimulation: Methodologies and Interventions*, I. Reti, Ed. Hoboken, NJ: Wiley-Blackwell, 2015, ch. 8, pp. 123–148. DOI: 10.1002/9781118568323.ch8

1 A. V. Peterchev, **Z.-D. Deng**, and S. M. Goetz, "Advances in transcranial magnetic stimulation technology," in *Brain Stimulation: Methodologies and Interventions*, I. Reti, Ed. Hoboken, NJ: Wiley-Blackwell, 2015, ch. 10, pp. 165–190. DOI: 10.1002/9781118568323.ch10

## Letters to the Editor, Commentaries, & Technical Reports

*3 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "On deep transcranial magnetic stimulation coil characterization," *Clinical Neurophysiology*, vol. 126, no. 7, pp. 1456–1457, 2015. PMID: 25468237. DOI: 10.1016/j.clinph.2014.10.144

*2 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "On the stimulation depth of transcranial magnetic stimulation coils," *Clinical Neurophysiology*, vol. 126, no. 4, pp. 843–844, 2015. PMID: 25088734. DOI: 10.1016/j.clinph.2014.06.048

*1 **Z.-D. Deng** and A. V. Peterchev, "Safety of transcranial magnetic stimulation and electroconvulsive therapy in patients with a deep brain stimulation implant," Technical report for St. Jude Medical/Advanced Neuromodulation System, Plano, TX, 2010.

## Other Publications

*1 **Z.-D. Deng**, "Blind researchers and the pathologic brain," *National Academy of Neuropsychology Bulletin*, vol. 33, no. 1, cover artwork, 2020. e-digitaleditions.com/i/1241418-spring-issue

## Articles in Review, Preprints, & Contracted Chapters

*0 **Z.-D. Deng**, N. M. Arzeno, E. S. Katz. H. Chang, C. L. Marcus, and C.-S. Poon, "Non-high frequency heart rate chaos: a noninvasive marker of REM sleep and obstructive sleep apnea syndrome in children," *bioRxiv* DOI: 10.1101/457630

0 M. Alawi, P. F. Lee, Y. K. Goh, **Z.-D. Deng**, and P. E. Croarkin, "The differential effect of age on transcranial magnetic stimulation induced fields."

0 H. Bagherzadeh, Q. Meng, **Z.-D. Deng**, H. Lu, E. Hong, Y. Yang, and F.-S. Choa, "Angle-tuned TMS coils: ideal building blocks for brain stimulation with better depth–spread performance."

0 N. L. Balderston, J. C. Beer, D. Seok, W. Makhoul, **Z.-D. Deng**, T. Girelli, M. Teferi, N. Smyk, M. Jaskir, D. J. Oathes, R. T. Shinohara, and Y. I. Sheline, "Development of a novel connectivity-based electric-field modelling approach for individualized targeting of transcranial magnetic stimulation treatment," *bioRxiv* DOI: 10.1101/2020.12.06.408856

0 X. Chen, R. Ma, W. Zhang, Q. Wu, A. Yimiti, X. Xia, J. Cui, Q. Zeng, J. Bu, Q. Chen, X. Yu, S. Wang, **Z.-D. Deng**, A. T. Sack, M. Mc Laughlin, and X. Zhang, "Alpha oscillatory causally linked to working memory retention: insights from online phase-locking closed-loop transcranial alternating current stimulation (tACS)," *bioRxiv* DOI: 10.1101/2021.05.23.445322

0 R. J. Ilmoniemi, **Z.-D. Deng**, L. J. Gomez, L. M. Koponen, J. O. Nieminen, and C. M. Epstein, "Transcranial magnetic stimulation coils," to appear in *The Oxford Handbook of Transcranial Stimulation*, E. M. Wassermann, V. Walsh, A. V. Peterchev, U. Ziemann, S. H. Lisanby, and H. R. Siebner, Eds., 2nd ed. Oxford, UK: Oxford University Press.

0 M. S. Lener, **Z.-D. Deng**, M. A. Chary, J. C. Rubin, J. E. Leikauf, T. Verghese, and O. Frieder, "Towards a learning mental health system to facilitate precision treatment for major depressive disorder."

0 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."

*0 S. N. Makarov, G. Bogdanov, G. M. Noetscher, W. Appleyard, R. Ludwig, J. T. Joutsa, and **Z.-D. Deng**, "Design and analysis of a whole body non-contact electromagnetic stimulation device with field modulation," *bioRxiv* DOI: 10.1101/416065

0 J. Miller, T. Jones, J. Upston, **Z.-D. Deng**, S. M. McClintock, S. Ryman, D. Quinn, and C. C. Abbott, "Ictal theta power: an electroconvulsive safety biomarker a pilot study."

0 W. T. Regenold, **Z.-D. Deng**, and S. H. Lisanby, "Noninvasive neuromodulation of the prefrontal cortex in mental health disorders."

0 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, 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," *medRxiv* DOI: 10.1101/2021.04.19.21255633

## Dissertation & Thesis

*2 **Z.-D. Deng**, "Electromagnetic Field Modeling of Transcranial Electric and Magnetic Stimulation: Targeting, Individualization, and Safety of Convulsive and Subconvulsive Applications," Ph.D. dissertation, Columbia University, Department of Electrical Engineering, New York, NY, 2013. Sponsor: K. L. Shepard. Available: Columbia University Academic Commons, http://doi.org/10.7916/D8F47WCS

*1 **Z.-D. Deng**, "Stochastic Chaos and Thermodynamic Phase Transitions: Theory and Bayesian Estimation Algorithms," M.Eng. thesis, Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science, Cambridge, MA, 2007. Sponsor: C.-S. Poon. Available: DSpace@MIT, http://hdl.handle.net/1721.1/41649

## Selected Abstracts (10/113)

*10 **Z.-D. Deng**, "Toward individualized seizure therapy," *Neuropsychopharmacology*, vol. 44, p. S75, 2019.

9 S. N. Makarov, D. N. Pham, G. M. Noetscher, A. Nummenmaa, and **Z.-D. Deng**, "Boundary element fast multipole method for TES modeling," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2019.

*8 **Z.-D. Deng**, C. Liston, F. M. Gunning-Dixon, and M. J. Dubin, "Electric field induced by repetitive transcranial magnetic stimulation in patients depression," *Proceedings of the IEEE Engineering in Medicine and Biology Society*, 2018.

*7 **Z.-D. Deng**, E. M. Lo, L. Beynel, E. Fang, B. Luber, and A. D. Krystal, "Cortical excitability in patients with treatment resistant depression," *Biological Psychiatry*, vol. 81, no. 10, p. S242, 2017.

*6 **Z.-D. Deng**, S. W. Davis, G. Asturias, M. Glidewell, C. Liston, and M. J. Dubin, "Effect of repetitive transcranial magnetic stimulation on the structural connectome in patients with major depression," *Clinical Neurophysiology*, vol. 128, no. 3, p. e144–e145, 2017.

*5 **Z.-D. Deng**, W. Lim, L. M. Haugen, J. D. Port, and P. E. Croarkin, "Electric field induced by repetitive transcranial magnetic stimulation in adolescents with major depressive disorder: comparison of coil localization approaches," *Neuropsychopharmacology*, vol. 41, no. S1, p. S478, 2016.

*4 **Z.-D. Deng**, S. M. McClintock, T. Jones, and C. C. Abbott, "Engaging medial temporal lobes with ECT pulse amplitude to improve clinical outcomes," *Neuropsychopharmacology*, vol. 41, no. S1, p. S173–S174, 2016.

*3 **Z.-D. Deng**, S. M. McClintock, and S. H. Lisanby, "Connectivity analysis of resting EEG in depressed patients receiving electroconvulsive therapy and magnetic seizure therapy," *Neuropsychopharmacology*, vol. 40, no. S1, p. S486, 2015.

*2 **Z.-D. Deng**, S. M. McClintock, and S. H. Lisanby, "EEG-based graph theoretical measures as biomarkers of clinical outcome in electroconvulsive and magnetic seizure therapy," *The National Network of Depression Centers Annual Conference*, 2014. Innovative Poster Award

*1 **Z.-D. Deng**, S. H. Lisanby, and A. V. Peterchev, "Improving the focality of electroconvulsive therapy: the roles of current amplitude, and electrode size and spacing," *The Journal of ECT*, vol. 26, no. 2, p. 151, 2010. Best Abstract Award

# Intellectual Property

4 Whole body non-contact electrical stimulation device with variable parameters. Co-inventors: S. N. Makarov, G. M. Noetscher, V. S. Makarov; Assignee: NEVA Electromagnetics, LLC
- § US No. 10,551,449; Feb. 4, 2020

3 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. Co-inventor: C.-S. Poon; Assignee: MIT
- § US No. 9,737,258; Aug. 22, 2017
- § PCT WO/2014/120353; July 8, 2014

2 Transcranial magnetic stimulation coil with electronically switchable active and sham modes. Co-inventor: A. V. Peterchev; Assignee: Columbia University
- § U.S. Provisional Patent application No. 61/525,922; Aug. 22, 2011

1 Methods, apparatus, and systems for magnetic stimulation. Co-inventors: A. V. Peterchev, S. H. Lisanby; Assignee: Columbia University
- § US No. 9,295,853; Mar. 29, 2016
- § US No. 8,801,589; Aug. 12, 2014
- § PCT WO/2010/017249, US 2011/0184223 A1, US 2009/052768; Aug. 4, 2009

# Research Support

## Ongoing Research Support

Dec. 2020–Nov. 2021 **Electroconvulsive therapy amplitude titration for improved clinical outcomes in late-life depression**
NIH/NIMH R61 MH125126 (PI: C. C. Abbott)
Role: Intramural NIH collaborator
This study proposes to use titrated amplitude electroconvulsive therapy, individualized based on seizure threshold, to improve clinical response while minimizing cognitive impairment in geriatric depression.

Apr. 2019–Feb. 2024 **Efficacy of biomarker-guided rTMS for treatment resistant depression**
NIH/NIMH R01 MH118388 (PIs: J. Downar, F. M. Gunning, C. M. Liston)
Role: Intramural NIH collaborator
This confirmatory efficacy trial will test a novel, biotype-guided treatment selection strategy for rTMS in treatment-resistant depression.

May 2020–Apr. 2021 **Neuromodulation of social cognitive circuitry in people with schizophrenia spectrum disorders**
NIH/NIMH R61 MH120188 (PIs: A. N. Voineskos, Z. J. Daskalakis)
Role: Intramural NIH collaborator
This study will use 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.

2020–2024 **Personalized circuit-based neuromodulation targets for depression**
NIH/NIMH K23 MH121657 (PI: S. H. Siddiqi)
Role: Intramural NIH collaborator/advisor

## NIH Protocols

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

2019– **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 (PI: C. A. Zarate, Jr.)
Role: Associate investigator

2017– **Concurrent fMRI-guided rTMS and cognitive therapy for the treatment of major depressive episodes**
NIMH Protocol 17-M-0147 (PI: S. H. Lisanby)
Role: Associate investigator

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

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

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

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

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

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

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

## Uniform Services University–NIH Protocol

2019– **ADEPT: Adaptive trial for the treatment of depression associated with concussion using repetitive transcranial magnetic stimulation protocols**
Center for Neuroscience and Regenerative Medicine protocol (PI: L. M. Oberman)
Role: Associate investigator

## Completed Research Support

Sept. 2016–
July 2020

**ECT pulse amplitude and medial temporal lobe engagement**
NIH/NINDS U01 MH111826 (PI: C. C. Abbott)
Role: Co-I
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.

June 2018–
June 2020

**Individualized low amplitude seizure therapy (iLAST)**
NARSAD/Brain & Behavior Research Foundation 26161
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.

June 2016–
Dec. 2017

**Fast-Fail Trials: Mood and Anxiety Spectrum Disorders (FAST-MAS)**
NIMH 271201200006I-3-27100003-1 (PI: A. D. Krystal)
Role: Data analyst
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 JNJ-67953964, which has been demonstrated to be a selective kappa opiate receptor antagonist.

Apr. 2015–
Jan. 2017

**Transcranial direct current stimulation as a treatment for acute fear**
NIH/NIMH R21 MH106772 (PI: A. D. Krystal)
Role: Co-I
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.

July 2014–
June 2016

**Individualized optimally-targeted seizure therapy**
NIH/NCATS KL2 TR001115 (Training Grant PI: R. M. Califf)
Role: PI
This award from the Duke Translational Medicine Institute prepares the fellow for a successful career as a multidisciplinary independent investigator in the field of brain stimulation. The goal of the project is to develop a novel individualized neurotargeted seizure therapy.

Mar. 2015–
June 2016

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

Apr. 2009–
Mar. 2016

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

Apr. 2015–
June 2016

**Low field magnetic stimulation coil design**
Tal Medical (PI: A. V. Peterchev)
Role: Co-I
This project develops a novel coil system for low field magnetic stimulation.

## Completed Research Support (continue)

Nov. 2015–
June 2016

**Concurrent cognitive behavioral therapy and transcranial magnetic stimulation in obsessive-compulsive disorder**
American Psychiatric Association Research Scholarship (Grantee: Y. Hu)
Role: Acting PI
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.

Jan. 2014–
Dec. 2015

**Evoked potentials as markers of ketamine-induced cortical plasticity in patients with major depressive disorder**
Janssen Research & Development, LLC (PI: A. D. Krystal)
Role: Co-I
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.

July 2005–
July 2011

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

July 2010–
Jan. 2015

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

July 2010–
Dec. 2015

**Rational dosing for electric and magnetic seizure therapy**
NIH/NIMH R01 MH091083 (PI: S. H. Lisanby)
Role: Graduate research assistant, contributed to grant writing
This study lays a foundation for optimizing stimulus parameters of electric and magnetic seizure therapy through computational modeling and preclinical studies of seizure induction.

Sept. 2010–
June 2011

**Field shaping and coil design for transcranial magnetic stimulation**
NIH/NCRR TL1 RR024158 (Training Grant PI: H. N. Ginsberg)
Role: Predoctoral fellow
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 deep transcranial magnetic stimulation.

Aug. 2007–
July 2009

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

Sept. 2005–
June 2009

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

## Scholarships, Fellowships, & Honors

2019 **NIMH Director's Award**, for scientific innovation at the interface of computation and psychiatry, NIMH Intramural Research Program

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

2018 **New Investigator Award**, American Society of Clinical Psychopharmacology

2018 **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

2017 **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

2016 **Certificate for Highly Cited Research**, Brain Stimulation, Elsevier

2015 **Young Investigator Memorial Travel Award**, American College of Neuropsychopharmacology

2015 **Summer Research Institute in Geriatric Mental Health**, Weill Cornell Medical College

2015 **Chair's Choice Award**, Society of Biological Psychiatry

2014 **Innovative Poster Award, Young Investigator Award Finalist**, National Network of Depression Centers

2010 **Best Abstract Award**, International Society for Neurostimulation

2010 **Presidential Teaching Award Finalist**, Columbia University

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

2002 **New York Times College Scholarship**, New York Times Company Foundation

## Talks & Colloquia

### Grand Rounds

2020 Westmead Hospital, Sydney, Australia
*Advances in neuromodulation: electroconvulsive therapy*

2018 Clinical TMS Society Grand Rounds Webinar
*Transcranial magnetic stimulation: physics, devices, and modeling*

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

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

2015 Central Regional Hospital, Butner, NC
*Individualized seizure therapy*

## Invited Talks, Seminars, Worskops, & Panels

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

2021 European College of Neuropsychopharmacology Congress
Panel: *Neurobiology of rapid mood changes*

2021 University of Pennsylvania, Center for Neuromodulation in Depression and Stress
Topic TBD

2021 Society for Brain Mapping & Therapeutics Annual Congress
*Advances in transcranial magnetic stimulation and electroconvulsive therapy for treatment of depression*

2021 American Society of Clinical Psychopharmacology Annual Meeting
Early Career Workshop: *7 tips for effective presentation*

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

2020 European Conference of Brain Stimulation in Psychiatry
Panel: *What can we learn from ECT: Insights from the GEMRIC consortium*

2020 University of Minnesota
Workshop: *Computational modeling in noninvasive brain stimulation*

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

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

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

2020 Medical University of Vienna, Neuroimaging Lab
*Precision seizure therapy*

2019 American College of Neuropsychopharmacology
Panel: *Precision neurostimulation for treatment of psychiatric disorders*

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

2019 International College of Neuropsychopharmacology Meeting
Workshop: *Neurobiological and clinical characterization, and treatment development for treatment resistant depression*

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

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

## Invited Talks, Seminars, Worskops, & Panels (continue)

2019 International Brain Stimulation Conference
Panel: *Individualized brain stimulation: addressing heterogeneity across modalities*

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

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

Semel Institute for Neuroscience and Human Behavior, Neuromodulation Division
*Modeling and design for magnetic stimulation*

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

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

2018 Joint NYC Neuromodulation Conference & NANS Summer Series
Preconference workshop director: *Computational modeling in neuromodulation: tools for engineers, clinicians, and researchers*
Contributed talk: *Optimizing stimulation arrays and high-density EEG for brain targeting*

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

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

2018 APA Annual Conference Presidential Symposium
Panel: *ECT in the era of new brain stimulation treatments: road map of future enhancements*

2018 ADAA Anxiety and Depression Conference
Panel: *Personalized medicine for treatment resistant depressed patients: novel strategies to optimize treatment with antidepressant medications, ketamine, and ECT*

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

2017 NYC Neuromodulation Conference
*Low field magnetic stimulation*

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

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

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

Department of Neurosurgery Research, Neural Engineering Lab
*Optimizing transcranial magnetic stimulation*

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

## Invited Talks, Seminars, Worskops, & Panels (continue)

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

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

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

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

# Teaching & Mentoring

## Appointments

2018–2019 **Research Mentor**, Fischell Department of Bioengineering, University of Maryland, College Park, A. James Clark School of Engineering
*Capstone Design Project: Detection of brain-to-brain synchrony for improved psychotherapy*

2017, 2019 **Lecturer**, NINDS
*Clinical Neuroscience Program Lecture Series*

2017 **Lecturer**, NIMH
*fMRI Course*

2016 **Instructor**, Department of Neuroscience, Duke University
*Research Independent Study*

2014–2016 **Faculty**, Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine
*Visiting Fellowship in Transcranial Magnetic Stimulation & Electroconvulsive Therapy Fellowship* (Continuing Medical Education)

2015–2016 **Research Mentor**, Matching Undergraduates to Science and Engineering Research Program, Duke University

2015–2016 **Faculty**, Biosciences Collaborative for Research Engagement, Duke University

Spring 2010 **Teaching Assistant, Columbia Video Network Course Assistant**, Department of Electrical Engineering, Columbia University Fu Foundation School of Engineering and Applied Science
*Analog Systems in VLSI* (graduate level)

Fall 2009 **Teaching Assistant**, Department of Electrical Engineering, Columbia University Fu Foundation School of Engineering and Applied Science
*The Digital Information Age*

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

2003–2007 **Teaching Assistant**, Department of Mathematics, MIT
*Multivariable Calculus* (Fall '03–'06), *Differential Equations* (Spring '04–'07)

Fall 2004 **Grader**, Department of Electrical Engineering and Computer Science, MIT
*Signals and Systems*

## Thesis Committee

2019 D. Q. Troung, "Translational Modeling of Non-Invasive Electrical Stimulation," Ph.D. dissertation, City College of the City University of New York, Department of Biomedical Engineering, New York, NY, 2019. Sponsor: M. Bikson. Available: CUNY Academic Works, https://academicworks.cuny.edu/cc_etds_theses/774

2017 G. Asturias, "Effect of Repetitive Transcranial Magnetic Stimulation on the Structural and Functional Connectome in Patients with Major Depressive Disorder," Undergraduate Honors Thesis, Duke University, Department of Psychology and Neuroscience, Durham, NC, 2017. Sponsor: Z.-D. Deng. Available: DukeSpace, https://hdl.handle.net/10161/14299

## Mentees

### Graduate Student

2012 M. Kshirsagar, Biomedical Engineering, Duke University

### NIH Postbaccalaureate IRTAs

2018–2020 S. M. Awasthi, Biomedical Engineering, Johns Hopkins University
2018–2019 M. M. Noh, Bioengineering, MIT
2017–2019 J. Thomas, Physiology and Biophysics, University of Virginia
2016–2019 M. Velez Afanador, Microbiology, University of Puerto Rico

### Undergraduate Students

2014–2017 G. Asturias, Neuroscience & Psychology, Duke University (Distinction)
Z. Feng, Biomedical Engineering and Biology, Duke University
M. Glidewell, Biomedical Engineering, Duke University
S. Lee, Biomedical Engineering, Duke University
J. R. Lilien, Electrical & Computer Engineering, Duke University (Walter J. Seeley Award)
W. Lim, Biomedical Engineering, Duke University
F. M. Mercer, Women's Studies, Duke University
E. Salgado, Neuroscience & Psychology, Duke University (Distinction)
R. Shah, Neuroscience & Psychology, Duke University
E. Shinder, Biology, Duke University (Distinction)
E. P. Vienneau, Biomedical Engineering, Duke University (Howard G. Clark Award)
D. T. Weaver, Biology, Duke University

### Summer Interns

2018 M. Dib, Biomedical Engineering, University of Maryland, College Park
2017 E. Chung, Psychology, University of Maryland, College Park
2017 A. L. Halberstadt, Biology and Psychology, Carnegie Mellon University
2015 C. M. Prevost, Biomedical Engineering, Clemson University
2013 J. V. McCall, Biomedical Engineering, North Carolina State University

# Professional Affiliations & Services

## Professional Society Membership

2004–present **Institute of Electrical and Electronics Engineers**, Engineering in Medicine and Biology Society, member

2019–present **American Society of Clinical Psychopharmacology**, member, Technology Task Force

2014–2019 **Organization for Human Brain Mapping**, member

2017–2018 **Anxiety and Depression Association of America**, member

2017–2019 **International Society for CNS Clinical Trials and Methodology**, member

2008–2012 **Society for Industrial and Applied Mathematics**, student member

2005–2012 **Society for Neuroscience**, student member

2004–2009 **American Physical Society**, student member

## Editorial & Grant Review Services

### Peer Review Journals

review editor Frontiers in Psychiatry: Neuroimaging and Stimulation

guest associate editor Frontiers in Psychiatry: Neuropharmacology

### Conference Proceedings Review

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

### Grant Review Panels

Duke Institute for Brain Sciences, Research Incubator Awards

*ad hoc* reviewer
AIP Advances
American Journal of Psychiatry
Australasian Physical and Engineering Sciences in Medicine
BioMedical Engineering OnLine
Brain Sciences
Brain Stimulation
Cerebral Cortex
Clinical EEG and Neuroscience
Clinical Neurophysiology
CNS Spectrums
Computational and Mathematical Methods in Medicine
Computer Methods and Programs in Biomedicine
Cortex
Frontiers in Neurology: Applied Neuroimaging
Frontiers in Neuroscience: Brain Imaging Methods
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Neural Systems & Rehabilitation Engineering
IEEE Transactions on Magnetics
Journal of ECT
Journal of Neural Engineering
Journal of Neuroscience Methods
JoVE
Medical & Biological Engineering & Computing
Medical Hypotheses
NeuroImage; NeuroImage Clinical
Neuromodulation: Technology at the Neural Interface
Neuroscience Letters
PLoS One
Scientific Reports
Translational Psychiatry

## Community Involvement & Outreach

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

2020 Jewish Social Service Agency
*Basics of brain stimulation devices – what are they and how do they work*

2020 Exhibitor, USA Science & Engineering Festival #coronacancelled

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

2019 Judge, MIT Hacking Medicine: DC Grand Hack

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

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

2019 UCLA, CruX Neurotech Organization
*Neuromodulation in psychiatry*

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

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

2016 Innovation Leader, Psychiatry Innovation Lab, American Psychiatric Association

2016 Duke Psychiatry, Mood Disorders Support and Education Group
*Brain stimulation treatments for severe mood disorders*

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

2015 Duke Psychiatry, Mood Disorders Support and Education Group
*New frontiers in treatments for mood disorders*

## Certifications & Continuing Education

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

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

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

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

renewed 2019 Basic Life Support, American Heart Association