

Corey J. Keller, MD PhD
Assistant Professor
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A. ACADEMIC HISTORY

Colleges and Universities Attended

2007	BS, Biomedical and Electrical Engineering, Tufts University
2009	M. Phil, Biomedical Engineering, Harvard (research), Tufts (coursework)
2015	Ph.D., Neuroscience, Albert Einstein College of Medicine
2015	M. D., Albert Einstein College of Medicine

Residency and Fellowship Training

2015 – 2019	Residency, Department of Psychiatry and Behavioral Sciences, Stanford University
2019	Postdoctoral Fellowship, Department of Psychiatry and Behavioral Sciences, Stanford University

Board Certification

2020	Diplomate, American Board of Psychiatry and Neurology
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Study and Research Resources

Present:

2021-2025	R01MH126639-02 Funder: NIMH (R01/DP5) \$250,000 direct / year <i>Closing the loop: Development of real-time, personalized brain stimulation</i> The major goal of this grant is to develop a non-invasive personalized brain stimulation platform for neuropsychiatric disorders Role: PI
2021-2026	R01 MH129018-01 Funder: NIMH \$200,000 direct / year <i>CRCNS US-France Research Proposal: Probing the Dorsolateral Prefrontal Cortex and Central Executive</i> The major goal of this grant is to optimize TMS procedures for depression by analyzing brain responses from TMS/EEG experiments and direct cortical stimulations in SEEG. Role: MPI

- 2021-2026 **Career Award for Medical Scientists**
 Funder: Burroughs Wellcome Foundation \$140,000 direct / year
Closing the loop: Development of real-time, personalized brain stimulation
 Role: PI
- 2021-2026 **5R01-MH122754-02**
 Funder: NIH (NIMH) Williams (PI)
Utilizing changes in human brain connectivity to establish a dose-response relationship involved in the therapeutic actions of prefrontal brain stimulation on depression symptoms
 The major goal of this grant is to elucidate the nature of the connectivity changes produced by applying accelerated theta burst stimulation.
 Role: Co-I
- 2021-2025 **1R01-MH125160**
 Funder: NIH (NIMH) Williams (PI)
Effects of Stanford Accelerated Intelligent Neuromodulation Therapy on Explicit and Implicit Suicidal Cognition
 The major goal of this grant is to elucidate the nature of the suicidal cognition changes produced by applying accelerated theta burst stimulation in acutely suicidal inpatients.
 Role: Co-I
- Under Review:**
- 2022-2027 **1R01 MH129347-01**
Investigating the neural mechanisms of repetitive brain stimulation with invasive and noninvasive electrophysiology in humans
 Funder: NIMH \$500,000 direct / year
 Role: MPI
 The goal of this project is to characterize the key signatures of the brain's response to theta burst stimulation (TBS) with an unparalleled combination of spatial and temporal resolution using intracranial recordings (Aim 1), link intracranial and non-invasive EEG measures (Aim 2), and investigate how EEG measures derived from intracranial recordings relate to clinical outcome in TBS treatment for depression.
- 2022-2023 *Development of dynamic brain biomarkers for personalized treatment of depression.*
 Funder: Stanford Wu Tsai Seed Grant \$100,000 direct / year
 Role: Co-PI
- 2022-2027 *Establishing Multimodal Brain Biomarkers Using Data-driven Analytics for Treatment Selection in Depression (PI Zhang)*
 Funder: NIMH
 Role: Co-I
- Past:**
- 2020 Funder: NIMH (R44 SBIR)

Validation of Machine Learning-Based Treatment Biomarkers in Depression
Role: Co-I

2018-2019 **K23MH118466**
Electrophysiological basis of cortical plasticity in repetitive transcranial magnetic stimulation
Funder: NIMH (K23)
Role: PI

2019 Funder: NIMH (T32)
Role: Postdoctoral Fellow (PI: Alan Schatzberg)

2011-2015 **F31 NS080357**
Funder: NINDS (F31)
Localizing functional and pathological networks in epilepsy
Role: PI

2010-2011 Funder: Epilepsy Foundation
Localizing networks with evoked potentials and resting state fMRI
Role: PI

2011-2013 Funder: NINDS (T32)
Medical Scientist Training Program Pre-Doctoral Fellowship
Role: Graduate Student

2018-2019 Funder: Stanford
Modeling of human neuroplasticity following repetitive stimulation
Role: PI

2016-2018 Funder: AOA
AOA Postgraduate Award

2016-2017 Funder: Stanford
Induction and quantification of long-term plasticity in the human brain
Role: PI

B. EMPLOYMENT

02/2021– present Investigator
Sierra-Pacific Mental Illness Research Education and Clinical Center (MIRECC)
VA Palo Alto Health Care System

12/2019-Present Assistant Professor
Psychiatry and Behavioral Sciences
Stanford University School of Medicine

12/2019-11/2020 Chief Medical Officer, Alto Neuroscience, Inc

07/2019-12/2019 Instructor, Clinical & Translational Neuroscience, Stanford University

C. PUBLIC AND PROFESSIONAL SERVICE

Stanford Teaching

04/09/2021 Neuroimaging
 Guest lecture in Stanford Neuroscience Resident Course

Mentored research courses registered by students:

Naryeong Kim PSY 199 (2021)
Saachi Munot PSY 199 (2021)
Gayathri Ganesan PSY 199 (2021)

Current Postdoctoral Fellows and Residents

Name	Position @ Keller Lab	Primary Affiliation	Project topics
Christopher Cline, PhD	Staff Scientist	Stanford University	Closed-loop TMS-EEG
Austin Talbot, PhD	Post-doc	Stanford University	depression, biomarkers, EEG
Jessica Ross, PhD	Post-doc	Stanford University	TMS, EEG, sensory effects
Francesco Donati	Collaborating Post-doc	University of Milan	TMS, EEG, brain networks

Current Graduate Students

Name	Position @ Keller Lab	Primary Affiliation	Project topics
Jeffrey Wang	Collaborating Neuroscience Graduate Student	MD/PhD Candidate, Bioengineering, Stanford	TMS, iEEG
Christopher Minasi	Neuroscience Graduate Student	PhD Candidate, Neuroscience	Electrical stimulation, iEEG
Ossama Abu-Halawa	Collaborating Neuroscience Graduate Student	MD/PhD Candidate, Bioengineering, U of Iowa	Electrical stimulation, iEEG

Current Research Assistants

Name	Position @ Keller Lab	Primary Affiliation	Project topics
Manjima Sarkar	Clinical Research Coordinator	Stanford University	TMS, EEG

Current Undergraduate Students

Name	Position @ Keller Lab	Primary Affiliation	Project topics
Jessica Yang	Undergraduate	Stanford University	depression, TMS

Naryeong Kim	Undergraduate	Stanford University	CCEPs, plasticity
Gayathri Ganesan	Undergraduate	Stanford University	CCEPs, plasticity
Saachi Munot	Undergraduate	Stanford University	CCEPs, plasticity
Ciara Gibbs	Undergraduate	Imperial College London	TMS, plasticity

Former Trainees

Former Undergraduate, Post-Baccalaureate and Graduate Students

Name	Position @ Keller Lab	Years @ Keller Lab	Current Location	Project topics
Christopher Minasi	Rotating Graduate Student	Winter 2021	PhD Student, Stanford	TMS, EEG, epilepsy
Claudia Tischler	Collaborating Research Assistant	2020	MD/PhD Student, Baylor	TMS, EEG, depression

Former Postdoctoral Fellows and Residents

Name	Position @ Keller Lab	Years @ Keller Lab	Current Location	Project topics
Danny Huang	Medical Student	1	Neurosurgery Resident, Stanford	Electrical stimulation, epilepsy, iEEG brain networks
Lewis Kerwin	Medical Student	1	Psychiatry Resident, U of Washington	TMS, EEG, reliability, plasticity

POST-DEGREE HONORS AND AWARDS, INCLUDING MEMBERSHIPS IN PROFESSIONAL SOCIETIES

Honors

- 2019 NIH DP5 Early Independence Award
- 2019 NIH K23 Mentored Patient-Oriented Research Career Development Award
- 2019 BWF Career Award for Medical Scientists (CAMS)
- 2018 Alpha Omega Alpha Medical Honor Society
- 2018 Stanford Society of Physician Scholars Collaborative Research Fellowship
- 2018 NIMH T32 Postdoctoral Fellowship
- 2018 Career Development Institute for Psychiatry
- 2017 NIMH Outstanding Resident Award
- 2017 ASCP New Investigator Award
- 2017 Winter Conference on Brain Research Travel Fellowship
- 2017 Society of Biological Psychiatry Early Career Investigator Travel Award
- 2016 BrainBox Neuroscience Initiative Young Investigator Award
- 2016 Alpha Omega Alpha Postgraduate Research Award
- 2015 American Society of Clinical Psychopharmacology Fellowship for Clinical Trials
- 2015 Stanford Society of Physician Scholars Collaborative Research Fellowship
- 2014 Society of Biological Psychiatry Medical School Scholar
- 2014 NINDS Combining Clinical and Research Careers in Neuroscience Travel Award

2013	Albert Einstein College of Medicine Senior Research Fellowship	
2011-2015	Neural Systems and Behavior Course Endowed Scholarship Fund	Ruth L.
	Kirschstein National Research Service Award Medical Scientist Training Program Pre-Doctoral Fellowship	
2010-2011	Fellowship	
2009	Epilepsy Foundation Pre-Doctoral Research Training Fellowship	
2009	Albert Einstein College of Medicine Grant for Summer Research	
2007	Master's Thesis Highest Honors	
2007	Magna Cum Laude and Senior Thesis Highest Honors	
2004-2007	Eta Kappa Nu – Electrical Engineering Honors Society	
	Dean's List Honors, Tufts University	

Current and Past Memberships in Professional Organizations

2019-	Member, ISCTM AI/Machine Learning Working Group
2019-	Member, StartX Entrepreneurial Incubator
2018-	Member, Alpha Omega Alpha Medical Honors Society
2016-	Member, Clinical TMS Society
2016-	Member, Society of Physician Entrepreneurs
2015-	Member, Human Brain Mapping
2015-	Member, International Neuromodulation Society
2015-	Member, Society of Biological Psychiatry
2013-	Alumnus, Woods Hole MBL Neural Systems and Behavior Course
2009-	Member, Society for Neuroscience
2009-	Member, American Epilepsy Society
2009-	Member, American Medical Association

National Teaching

N/A

Department Committees

2021-present Member, research track psychiatry residency selection committee
 2021-present Member, PAVIR, VA, and Stanford Integrated Committee (PVSIC)

National Scientific Committees and Grant Review

NIH: NINDS Translational Neural Devices (ZN21 SRB-S-03): Neural, Brain, and Pain Relief Devices, November, 2019, Bethesda, MD.

NIH: ZRG1 ETTN-D (91): Special Topics: Noninvasive Neuromodulation and EEG/MEG Neuroimaging, March 2021

Journal Review Service

Ad-hoc reviewer: Nature Communications, PNAS, Journal of Neuroscience, Neuropsychopharmacology, Human Brain Mapping, Neuroreport, IEEE Transactions on Biomedical Engineering, Neuroscientist, Journal of Psychiatric Research, Brain Topography

Editorial Positions

Frontiers Neuroscience (Guest Editor) 2020, 2021

Patents

Keller CJ, Etkin A, Wu W. Use of a brain-based signal for predicting and guiding brain stimulation treatment in depression. U.S. Patent Application 41243-520P01US, filed April 2016. Patent Pending.

Etkin A, Keller CJ, Wu W. Artifact Rejection for Transcranial Magnetic Stimulation Electroencephalogram Data. U.S. Patent Application 41243-520P02US, filed December 2016. Patent Pending.

Professional Training

- 2018 NIH Brain Camp, Cold Spring Harbor Laboratory, NY
- 2018 Career Development Institute, Pittsburgh, PA
- 2017 TMS-EEG Workshop, Helsinki, Finland
- 2016 Combining Brain Stimulation and Neuroimaging Short Course, Geneva, Switzerland
- 2014 NINDS Combining Clinical and Research Careers in Neuroscience, Washington, DC
- 2014 Human Brain Mapping Short Course, Brain Stimulation, Hamburg, Germany
- 2013 Society for Neuroscience Short Course, Advances in ECoG, New Orleans, LA
- 2013 Neural Systems and Behavior, Marine Biology Laboratory, Woods Hole, MA

SCHOLARLY WORK

Peer-reviewed Articles (27 published, 4 under review)

1. Huang Y, Kakusa B, Feng A, Shivacharan R, Lee EB, Kuijper FM, Barbosa DA, Parker JJ, Bohon C, **Keller CJ**, Halpern CH. *The insulo-opercular cortex encodes food-specific content under controlled and naturalistic conditions. Nature Communications 12 (2021):3609.*
2. Huang Y, Feng A, Barbosa AN, Gattas S, Shivacharan R, Lee EB, Kuijper FM, Saluja S, Parker JJ, Miller KJ, **Keller CJ**, Bohon C, Halpern CH. *Anticipatory Human Subthalamic Area Beta-band Power Responses to Dissociable Tastes Predict Weight Gain. Neurobiology of Disease 7 (2021): 105348.*
3. Hanjal B, Entz L, Toth E, **Keller CJ**, Wittner L, Mehta A, Ulbert I, Eross L, Fabo D. *Electrically evoked cortical potentials during wakefulness mirror slow oscillations during sleep.* Under review: **eNeuro.**
4. Xiao X, Bentzley BS, Cole EJ, Tischler C, Stimpson KH, Duvio D, Bishop JH, DeSouza DD, Schatzberg A, **Keller CJ**, Sudheimer KD, Williams NR. *Functional connectivity changes with rapid remission from severe major depressive disorder. Under Review: PNAS.*
5. Meshulam M, Golan T, Harel M, Groppe D, **Keller CJ**, Megevand P, Mehta A, Malach R. *Repeated performance in problem-solving tasks attenuates human cortical responses. Under review: Journal of Cognitive Neuroscience.*
6. Isserles M, Tendler A, Roth Y, Bystrisky A, Blumberger DM, Ward H, Feifel D, Viner L, Duffy W, Levkovitz Y, Zohar Y, **Keller CJ**, Bhati MT, Etkin A, George MS, Filipcic I, Lapidus K, Casuto L, Vaishnavi S, Stein A, Deutsch L, Deutsch F, Morales O, Daskalakis ZJ, Zangen A, Ressler KJ. *Deep Transcranial Magnetic Stimulation Combined with Brief Exposure Procedure for Post-Traumatic Stress Disorder – A Prospective Multicenter Randomized Controlled Study. In press: Biological Psychiatry.*
7. Huang D, Herrero J, Entz L, Fabo D, Hajnal B, Mehta A, **Keller CJ**. *Intracortical dynamics underlying repetitive stimulation predicts changes in network connectivity. Journal of*

Neuroscience. 31 (2019): 6122-6135. **Impact: 7.2.**

8. Eshel N*, **Keller CJ***, Wu W, Jang J, Huemer J, Mills-Finnerty C, Wright R, Ichikawa N, Fonzo G, Sphigel S, Wong M, Yee A, McTeague L, Etkin A. *Global connectivity and local excitability changes underlie antidepressant effects of repetitive transcranial magnetic stimulation.* 2019. **Neuropsychopharmacology.** 2020; 45(6):1018-1025.
9. Belardinelli P, ... **Keller CJ**, ..., Ilmoniemi R. Reproducibility in TMS-EEG studies: a call for data sharing, standard procedures and effective experimental control. **Brain Stimulation.** 19 (2019): 30041-5. **Impact: 6.0.**
10. Etkin A, Fonzo G, Huemer J, Patenaude B, Vertes P, Richiardi J, Goodkind M, **Keller CJ**, et al. *Using fMRI connectivity to define a treatment-resistant form of post-traumatic stress disorder.* **Science Translational Medicine.** 2019 Apr 3;11(486). **Impact: 16.7.**
11. **Keller CJ**, Huang D, Honey CJ, Du V, Fini M, Lado FA, Mehta AD. *Induction and quantification of excitability changes in human cortical networks.* **Journal of Neuroscience:** 23 (2018): 5384-98. **Impact: 7.2**
12. **Keller CJ***, Wu W*, Rogasch NC, Longwell P, Spigel E, Rolle CE, Etkin A. *ARTIST: A Fully Automated Artifact Rejection Algorithm for Single-Pulse TMS-EEG Data.* **Human Brain Mapping.** 00 (2018): 1-19. **Impact: 5.9.** *These authors contributed equally.
13. **Keller CJ***, **Kerwin L***, Wu W, Etkin A. *Test-Retest Reliability of Transcranial Magnetic Stimulation EEG Evoked Potentials.* **Brain Stimulation:** 3 (2018): 536-44. *These authors contributed equally. **Impact: 6.0.**
14. Megevand P, Groppe DM, Bickel S, Mercier M, Goldfinger MS, **Keller CJ**, Entz L, Mehta AD. *The hippocampus and amygdala are integrators of distributed neocortical influence: a cortico-cortical evoked potential study.* **Brain Connectivity.** 10 (2017): 648-660. **Impact: 4.0.**
15. **Keller CJ**, Davidesco I, Megevand P, Groppe DM, Lado FA, Mehta AD. *Tuning face perception with electrical stimulation of the fusiform gyrus.* **Human Brain Mapping.** 6 (2017): 2830-2842. **Impact: 5.9.**
16. Bott N, **Keller CJ**, Kuppuswamy M, Spelber D, Zeier J. *Cotard Delusion in the Context of Schizophrenia: A Case Report and Review of the Literature.* **Frontiers of psychology.** 2016 Sep 7;7:1351.
17. **Keller CJ***, Fischer AS*, Etkin A. *The clinical applicability of functional connectivity in depression: Pathways toward more targeted intervention.* **Journal of Biological Psychiatry: Cognitive Neuroscience and Neuroimaging.** 3 (2016): 262-270. *These authors contributed equally.
18. **Keller CJ**, Chen EC, Brodsky K, Yoon J. *A case of butane hash oil (marijuana wax)-induced psychosis.* **Substance Abuse.** 33 (2016): 384-386. **Impact: 2.0**
19. **Keller CJ**, Chen C, Lado FA, Khodokakhah K. *The limited utility of high frequency activity in differentiating neuronal population dynamics in the mouse striatum.* **PLoS One.** 11 (2016): 1-20. **Impact: 3.2**

20. Entz L, Toth E, **Keller CJ**, Groppe DM, Megevand P, Fabo D, Ulbert I, Eross LG, Mehta AD. *The human neocortex demonstrates projectors and integrators of influence: a consideration in neuromodulation therapy*. **Neurosurgery**. 61 (2014): 1:224.
21. **Keller CJ**, Honey CJ, Megevand P, Entz L, Ulbert I, Mehta AD. *Mapping complex brain networks with cortico-cortical evoked potentials*. **Phil Trans Royal Soc B**. 369 (2014): 1-14. **Impact: 6.2**
22. **Keller CJ**, Honey CJ, Entz L, Bickel S, Groppe DM, Toth E, Lado FA, Ulbert I, Mehta AD. *Probing the human connectome: cortico-cortical evoked potentials reveal projectors and integrators within human brain networks*. **Journal of Neuroscience**. 34 (2014): 9152-63. **Impact: 7.2**
23. Entz L, Toth E, **Keller CJ**, Bickel S, Groppe D, Fabo D, Kozak LR, Eross L, Ulbert I, Mehta AD. *Effective connectivity of the human neocortex derived from direct electrocortical stimulation*. **Human Brain Mapping**. 12 (2014): 5736-53. **Impact: 5.9**.
24. Groppe DM, Bickel S, **Keller CJ**, Jain SK, Hwang ST, Harden C, Mehta AD. *Dominant frequencies of resting human brain activity as measured by the electrocorticogram*. **NeuroImage**. 79 (2013): 223-33. **Impact: 5.9**
25. Davidesco I, Zion-Golumbic E, **Keller CJ**, Bickel S, Harel M, Groppe DM, Schroeder C, Mehta AD, Malach R. *Exemplar selectivity reflects perceptual similarities in the human fusiform cortex*. **Cerebral Cortex**: 24 (2014): 1879-93. **Impact: 6.8**
26. **Keller CJ**, Bickel S, Honey CJ, Groppe DM, Craddock CR, Kelley C, Lado FA, Milham M, Mehta AD. *Neurophysiological investigation of spontaneous correlated and anticorrelated fluctuations of the BOLD signal*. **Journal of Neuroscience**. 33 (2013): 6333-42. **Impact: 7.2**
27. Dykstra A, Chan AM, Quinn BT, Zepeda R, **Keller CJ**, Cormier JE, Madsen JR, Eskandar EN, Cash SS. *Individualized localization and cortical surface-based registration of intracranial electrodes*. **NeuroImage** 59 (2012): 3563-70. **Impact: 5.9**
28. **Keller CJ**, Bickel S, Entz L, Ulbert I, Kelly C, Milham M, Mehta AD. *Intrinsic functional architecture predicts electrically-evoked responses in the human brain*. **Proceedings of the National Academy of Sciences** 108 (2011): 10308-13. **Impact: 10.2**
29. **Keller CJ**, Truccolo W, Gale JT, Eskandar E, Thesen T, Carlson C, Devinsky O, Kuzniecky R, Doyle WK, Madsen JR, Schomer DL, Mehta AD, Brown EN, Hochbert LR, Ulbert I, Halgren E, Cash SS. *Distinct Neuronal Firing Types During Interictal Epileptiform Discharges in the Human Cortex*. **Brain** 133: (2010) 1668-81. **Impact: 9.2**
30. **Keller CJ**, Cash SS, Narayanan S, Wang C, Kuzniecky R, Carlson C, Devinsky O, Thesen T, Doyle W, Sassaroli A, Boas AD, Ulbert I, Halgren E. *Intracranial microprobe for evaluating neuro-hemodynamic coupling in unanesthetized human neocortex*. **Journal of Neuroscience Methods** 179 (2009) 208–218. **Impact Factor: 2.1**
31. Gow DW, Jr, **Keller CJ**, Eskandar E, Meng N, Cash SS. *Superior temporal coordination of the perisylvian speech network: A Granger analysis of intracranial EEG data*. **Brain and Language**, 110 (2009) 43-8. **Impact: 2.8**

Non-Peer-reviewed Articles - Book Chapters

1. **Keller CJ, Bhati M, Downar J, Etkin A.** *Brain Stimulation Therapies*. In: **The American Psychiatric Publishing Textbook of Psychiatry. 6th Edition**, 2018.
2. **Wu, W, Keller, CJ, Etkin, A.** *Artifact Rejection for Concurrent TMS-EEG Data*. In **Dynamic Neuroscience: Statistics, Modeling, and Control**. (eds. Chen, Z. & Sarma, S.V.) 141-173, Springer International Publishing, Cham, 2018.

Invited Presentations

1. **Keller, CJ (2020).** *Transforming the Practice of Mental Health Care: The Desired Future State. NIMH Virtual Symposia.*
2. **Keller, CJ (2020).** *Towards Personalized Brain Stimulation for Neuropsychiatric Disorders. UCSD, Markou Seminar, San Diego, CA.*
3. **Keller, CJ (2020).** *Towards Personalized Brain Stimulation for Neuropsychiatric Disorders. Shenzhen University, Shenzhen, China.*
4. **Keller, CJ (2019).** *Towards Personalized Brain Stimulation for Neuropsychiatric Disorders. Conte Center Series Symposium, Columbia University, New York, NY.*
5. **Keller, CJ (2019).** *Towards Personalized Brain Stimulation for Neuropsychiatric Disorders. Innovations in Psychiatry Symposium, Mt. Sinai School of Medicine, New York, NY.*
6. **Keller, CJ (2019).** *Towards Personalized Brain Stimulation for Neuropsychiatric Disorders. Society for Biological Psychiatry, Chicago, IL.*
7. **Keller, CJ (2018).** *Large-scale, naturalistic rTMS plasticity monitoring. University of Texas Southwestern, Dallas, TX.*
8. **Keller, CJ (2018).** *Towards Personalized Neuromodulation. McLean Hospital, Harvard Medical School, Boston, MA.*
9. **Keller, CJ (2018).** *Personalized Medicine for Subjects with Treatment-Resistant Major Depressive Disorder: Novel Strategies to Optimize Treatment with Antidepressant Medications, rTMS, Ketamine, and ECT. Anxiety and Depression Association of America, Washington, DC.*
10. **Keller, CJ (2017).** *Naturalistic clinical monitoring of rTMS-induced plasticity with TMS-EEG. TMS-EEG Workshop, Helsinki, Finland.*
11. **Keller, CJ (2017).** *Naturalistic clinical monitoring of rTMS-induced plasticity with TMS-EEG. Winter Brain Conference, Vancouver, BC.*
12. **Keller, CJ (2017).** *Towards personalized rTMS treatment for MDD. Human Brain Mapping, Vancouver, BC.*

13. **Keller, CJ (2017).** *Induction and quantification of brain plasticity across populations and scales.* Society for Biological Psychiatry, San Diego, CA.
14. **Keller, CJ (2016).** *Simultaneous TMS-EEG as a causal tool to probe functional brain networks.* Winter Brain Conference, Big Sky, Montana.
15. **Keller, CJ (2016).** *Long-term plasticity underlies antidepressant effect of repetitive transcranial magnetic stimulation.* Shenzhen University, Shenzhen, China.
16. **Keller, CJ (2016).** *Modifying neural circuits with brain stimulation.* University of Milan, Milan, Italy.
17. **Keller, CJ (2016).** *Repetitive brain stimulation induces long-term plasticity across patient populations and spatial scales.* Brain Stimulation Conference, Human Brain Mapping, Geneva, Switzerland.
18. **Keller, CJ (2015).** *Investigating the neuronal mechanisms underlying repetitive brain stimulation with implantable microelectrode arrays.* Stanford University, Palo Alto.
19. **Keller, CJ (2015).** *Investigating the neuronal mechanisms underlying repetitive brain stimulation with implantable microelectrode arrays.* Massachusetts General Hospital, Harvard Medical School, Boston, MA.
20. **Keller, CJ (2015).** *The neural origins of the default mode network and resting fMRI.* New York Psychiatric Institute, Columbia University Medical Center, New York.
21. **Keller, CJ (2014).** *Investigating the neuronal mechanisms underlying repetitive brain stimulation with implantable microelectrode arrays.* The Feinstein Institute for Medical Research, Manhasset, New York.
22. **Keller, CJ (2014).** *Testing propagation of brain stimulation with implanted electrode arrays.* Berenson-Allen Center for Brain Stimulation, Harvard Medical School, Boston.
23. **Keller, CJ (2014).** *The neural origins of resting functional brain networks.* Human Brain Mapping, Hamburg, Germany.
24. **Keller, CJ (2013).** *The electrophysiological signature of the DMN.* Weizmann Institute, Rehovot, Israel.

Selected Abstracts (50 of 72)

1. **Keller CJ, Wu W, Wright R, Rolle C, Sarhadi K, Ichikawa N, Huemer J, Wong M, Yee A, McTeague L, Fini M, Du V, Honey CJ, Lado F, Mehta AD, Etkin A.** Repetitive brain stimulation induces long-term plasticity across patient populations and spatial scales. Human Brain Mapping, Geneva, Switzerland, June 2016.
2. Mehta AD, Megevand P, Du V, Yeagle E, Herrero J, Mercier M, Bickel S, **Keller CJ**, Groppe DM, Entz L, Davis B, Argyelan M. Correspondence of BOLD- and Electrophysiology-Based Connectivity Dynamics Before and After Corpus Callosotomy. Human Brain Mapping, Geneva, Switzerland, June 2016.

3. **Keller CJ**, Wu W, Wright R, Rolle C, Sarhadi K, Ichikawa N, Huemer J, Wong M, Yee A, McTeague L, Fini M, Du V, Honey CJ, Lado F, Mehta AD, Etkin A. Repetitive brain stimulation induces long-term plasticity across patient populations and spatial scales. Brain Stimulation and Imaging, Geneva, Switzerland, June 2016.
4. Du V, **Keller CJ**, Herrero J, Yeagle E, Khuvis S, Mehta AD. Modifying neural circuits with dual-site stimulation. Feinstein Institute for Biomedical Research Conference, Cold Spring Harbor Laboratory, New York, June 2016.
5. **Keller CJ**, Wu W, Wright R, Rolle C, Sarhadi K, Ichikawa N, Huemer J, Wong M, Yee A, McTeague L, Fini M, Du V, Honey CJ, Lado F, Mehta AD, Etkin A. Repetitive brain stimulation induces long-term plasticity across patient populations and spatial scales. Society of Biological Psychiatry, Atlanta, May, 2015
6. **Keller CJ**, Fini M, Honey CJ, Lado FA, Mehta AD. Optimizing repetitive brain stimulation using direct electrical recordings from human brain networks. Society for Neuroscience, Chicago, IL, October, 2015.
7. **Keller CJ**, Fini M, Honey CJ, Lado FA, Mehta AD. Induction and quantification of plasticity in human cortical networks using repetitive brain stimulation. Human Brain Mapping, Honolulu, HI, June, 2015.
8. **Keller CJ**, Fini M, Honey CJ, Lado FA, Mehta AD. Induction and quantification of plasticity in human cortical networks using repetitive brain stimulation. Society of Biological Psychiatry, Toronto, CA, May, 2015.
9. Entz L, Megevand P, Groppe DM, Toth E, Fabo D, Fallil Z, Hwang ST, Harden CL, Bickel S, **Keller CJ**, Mehta AD. Exploring seizure networks using cortico-cortical evoked potentials: internally hyperconnected, externally hypoconnected? American Epilepsy Society, Seattle, WA, December 2014.
10. **Keller CJ**, Davidesco I, Megevand P, Groppe DM, Lado FA, Mehta AD. A causal role of the fusiform face area in face perception. Society for Neuroscience, Washington DC, November, 2014.
11. Groppe D, Megevand P, Bickel S, Mercier M, **Keller CJ**, Goldfinger MS, Mehta AD. Electrographic oscillatory activity predicts resting state functional magnetic resonance imaging connectivity. Society for Neuroscience, Washington DC, November, 2014.
12. Entz L, Toth E, Fabo D, **Keller CJ**, Bickel S, Eross L, Ulbert I, Mehta AD. Cortico-cortical evoked potentials may reveal pathological and function networks in the brain. Human Brain Mapping, Hamburg, Germany, June, 2014.
13. Groppe DM, Megevand P, Bickel S, **Keller CJ**, Goldfinger M, Mehta AD. Coherence vs fluctuations in high gamma band activity for defining resting state functional connectivity in the electrocorticogram. Human Brain Mapping, Hamburg, Germany, June, 2014.
14. **Keller CJ**, Davidesco I, Megevand P, Groppe DM, Lado FA, Mehta AD. A causal role of the fusiform face area in face perception. Human Brain Mapping, Hamburg, Germany, June, 2014.
15. Entz L, Toth E, **Keller CJ**, Groppe D, Megevand P, Fabo D, Ulbert I, Eross LG, Mehta AD. Evoked effective connectivity of the human neocortex and identification of seizure network

properties. Cognitive Neuroscience, Boston, MA, April, 2014.

16. Megevand P, Goldfinger MS, Groppe DM, **Keller CJ**, Bickel S, Hwang ST, Fallil Z, Harden CL, Mehta AD. Safety of cortico-cortical evoked potentials by low-frequency stimulation of intracranial electrodes. American Epilepsy Society, Washington DC, December, 2013.
17. Groppe, D.M., Bickel, S., **Keller, CJ**, Kingsley, P.B., Mehta, A.D. (2013) Identification of eloquent cortical areas using resting state fMRI: A validation with in vivo direct cortical electrical stimulation in humans. Curing the Epilepsies 2013: Pathways Forward.
18. Groppe D, Entz L, Bickel S, **Keller CJ**, Megevand P, Mehta AD. Analysis of functional and effective brain networks using electrocorticography and corticocortical evoked potentials: correspondence with fMRI and beyond. Society for Neuroscience, San Diego, November, 2013.
19. **Keller CJ**, Groppe DM, Megevand P, Bickel S, Mehta AD. Electrophysiological Analysis of Default Mode Network Demonstrates Functional and Effective Connectivity. Society for Neuroscience, San Diego, November, 2013.
20. Groppe DM, Megevand P, Bickel S, **Keller CJ**, Mehta AD. Delineation of eloquent cortical areas via resting state functional connectivity as measured by functional magnetic resonance imaging and the electrocorticogram. American Epilepsy Society, Washington DC, 2013.
21. Megevand P, Goldfinger M, Groppe DM, **Keller CJ**, Bickel S, Entz L, Mehta AD. Safety of cortico-cortical evoked potentials by low frequency stimulation of intracranial electrodes. American Epilepsy Society, Washington DC, 2013.
22. Toth E, Entz L, **Keller CJ**, Fabo D, Bickel S, Kozak LR, Eross L, Ulbert I, Mehta AD. Cortical electrical stimulation may reveal pathological and functional networks in the human brain. Hungarian Neuroscience Meeting, Budapest, Hungary, January 17-19, 2013.
23. Entz L, Toth E, **Keller CJ**, Bickel S, Fabo D, Kozak LR, Eross L, Ulbert I, Mehta AD. Anatomico-functional parcellation of the brain based on human electrical stimulation data. Hungarian Neuroscience Meeting, Budapest, Hungary, January 17-19, 2013.
24. **Keller CJ**, Entz L, Ahn S, Davidesco I, Groppe D, Bickel S, Toth E, Kingsley PB, Hwang S, Jain S, Ulbert I, Malach R, Lado F, Mehta AD. The electrophysiological signature of the default mode network. Human Brain Mapping, Seattle, Washington, June 13-17, 2013.
25. Golan T, Davidesco I, Groppe DM, Melloni L, Zion-Golumbic E, **Keller CJ**, Schroeder CE, Mehta A, Malach R. An ECoG exploration of the neural correlates of perceptual continuity during eye blinks. Human Brain Mapping, Seattle, Washington, June 13-17, 2013.
26. Entz L, **Keller CJ**, Toth E, Ulbert I, Eross L, Mehta AD. Electrical stimulation and functional MRI based multimodal approach to map functional and pathological brain areas. Society for British Neurological Surgeons, May 22-24, 2013.
27. Groppe D, Bickel S, **Keller CJ**, Jain S, Hwang S, Harden C, Mehta AD. Oscillations characteristic of non-epileptogenic neocortex in a resting state. American Epilepsy Society, San Diego, CA, November 29-December 4, 2012.
28. **Keller CJ**, Entz L, Bickel S, Groppe DM, Toth E, Kingsley P, Harden C, Hwang S, Jain S, Lado

- FA, Ulbert I, Mehta AD. Multimodal investigation of the segregation of functional and pathological networks. American Epilepsy Society, San Diego, CA, November 29-December 4, 2012.
29. Entz E, Toth E, **Keller CJ**, Bickel S, Groppe D, Ulbert I, Eross L, Mehta AD. Single Pulse Electrical Stimulation is a Promising Tool for Delineating the Seizure Focus Using Network Analysis. European Association of Neurological Societies, Bratislava, Slovakia, October 24-27, 2012.
30. Toth E, Entz L, Fabo D, **Keller CJ**, Bickel S, Kozak LR, Eross L, Ulbert I, Mehta AD. Pathological and functional network connectivity analysis in the human brain using single pulse electrical stimulation. *International Brain Research Organization*, Szeged, Hungary, Jan 19 - 21, 2012
31. Entz L, Bickel S, **Keller CJ**, Toth E, Eross L, Ulbert I, Mehta AD. Single Pulse Electrical Stimulation (SPES) is a Promising Tool for Localizing Functional and Pathological Networks. *American Association of Neurological Surgeons*, Miami, FL, April 14-18, 2012.
32. Jain S, Bickel S, Entz L, **Keller CJ**, Groppe D, Hwang S, Lado F, Mehta AD. Electrode localization in epilepsy surgery – developing a more accurate methodology. *American Epilepsy Society*, Baltimore, MD, December 4-8, 2011.
33. **Keller CJ**, Bickel S, Jain S, Groppe D, Entz L, Kelley C, Hwang S, Lado F, Mehta AD. Using correlated resting BOLD signal fluctuations to delineate seizure networks *American Epilepsy Society*, Baltimore, MD, December 4-8, 2011.
34. Groppe D, Bickel L, **Keller CJ**, Entz L, Mehta A. Dominant frequencies of human cortical areas as measured by electrocorticogram and direct stimulation of the cortical surface. *Society for Neuroscience*, Washington, DC, November 9-14, 2011.
35. Entz L, Bickel L, **Keller CJ**, Toth E, Ulbert I, Eross L, Mehta A. Resting state functional MRI and single pulse electrical stimulation (SPES) are possible new methods to map functional brain networks. *14th European Congress of Neurosurgery*, Rome, Italy, October 9-14, 2011. **Won best poster in stereotactic / functional section.**
36. Entz L, Bickel L, Toth E, **Keller CJ**, Vakili S, Corines J, Stream S, Sanjay J, Ulbert I, Mehta A. Identifying brain networks using single pulse electrical stimulation and resting state functional MRI connectivity analysis. *Congress of Neurological Surgeons*, Washington DC, October 1-6, 2011.
37. **Keller CJ**, Entz L, Bickel S, Honey CJ, Jain S, Groppe D, Hwang S, Lado F, Mehta AD. Probing the human connectome: Cortico-cortical evoked potentials reveal projectors and integrators within human brain networks. *Neuroinformatics*, Boston, MA, September 4-6, 2011.
38. Dykstra AD, Chan AM, Zepeda R, **Keller CJ**, Quinn BT, Cash SS. Individualized localization and cortical surface-based registration of semi-chronic intracranial electrodes. *Human Brain Mapping*, Quebec, CA, June 26-30, 2011.
39. Entz L, Bickel L, **Keller CJ**, Tóth E, Eröss L, Ulbert I, Mehta AD. Noninvasive Connectivity Analysis: A Novel Methodology for Functional Cortical Mapping. *The American Association of Neurological Surgeons Meeting*, Denver, CO, April 9-13, 2011.
40. Entz L, Bickel L, **Keller CJ**, Tóth E, Eröss L, Ulbert I, Mehta AD. Noninvasive Connectivity Analysis: A Novel Methodology for Functional Cortical Mapping. *The 13th Conference of the Hungarian Neuroscience Society*, Budapest, Hungary, January 20-22, 2011.

41. **Keller CJ**, Entz L, Bickel S, Hwang W, Jain S, Mehta AD. Identifying pathological and functional networks with single pulse electrical stimulation in patients with intractable epilepsy. *American Epilepsy Society*, San Antonio, TX, December 4-8, 2010.
42. Bickel S, Entz L, **Keller CJ**, Kelley C, Jain S, Hwang S, Mehta AD. Localization of epileptic and functional networks at rest using independent component and functional connectivity analysis of the BOLD signal. *American Epilepsy Society*, San Antonio, TX, December 4-8, 2010.
43. Bickel S, **Keller CJ**, Entz L, Kelley C, P. Kingsley, Jain S, Hwang S, Mehta AD. Probing language networks with electrical intracranial fMRI and resting state functional connectivity analysis. *Society for Neuroscience*, San Diego, CA, November 15-20, 2010.
44. **Keller CJ**, Bickel S, Entz L, Hwang S, Jain S, Mehta AD. Identifying pathological and functional networks with single pulse electrical stimulation and resting state functional MRI in patients with intractable epilepsy. *American Medical Association Research Symposium*, San Diego, CA, November 5-6, 2010.
45. Bickel S, Entz L, **Keller CJ**, Kelley C, P. Kingsley, Jain S, Hwang S, Mehta AD. Probing language networks with electrical intracranial fMRI and resting state functional connectivity analysis. *Cleveland Clinic Epilepsy Symposium*, Cleveland, OH, October 1-3, 2010.
46. Cash SS, **Keller CJ**, Ulbert I, Truccolo W, Cole AJ, Gale JT, Eskandar E, Thesen T, Carlson C, Devinsky O, Kuzniecky R, Doyle W, Madsen JR, Schomer D, Mehta AD, Brown EN, Hochberg L and Halgren E. Successive Engagement of Different Cortical Circuits During Seizure Onset and Propagation. *American Clinical Neurophysiology Society*, San Diego, CA, February 2-7, 2010.
47. **Keller CJ**, Cash SS, Narayanan S, Wang C, Kuzniecky R, Carlson C, Devinsky O, Thesen T, Doyle W, Sassaroli A, Boas DA, Ulbert I, Halgren E. Intracranial microprobe for evaluating neuro-hemodynamic coupling in unanesthetized human neocortex. *Society for Neuroscience*, Washington D.C., November 15-19, 2008.
48. Gow DW, Segawa J, and **Keller CJ**. Interactive processing in the identification of prosodic and segmental units in speech: Evidence from multimodal imaging and Granger analysis. *International Conference on Cognitive and Neural Systems*, Boston, MA, May 14-17, 2008.
49. Weiner V, Cash SS, Eskandar E, **Keller CJ**, Peterfreund RA, Pierce ET, Salazar AF, Szabo MD, Brown EN, Purdon PL. Intracranial neural recordings in deep structures of the human brain during general anesthesia; implications for improved anesthetic monitoring. *MGH Clinical Research Symposium*, May 28, 2009.

Personal Statement

My work maps the interaction between brain networks, stimulation-induced brain changes, and neuropsychiatric symptoms. I combine my backgrounds in electrophysiology, bioengineering, and neuroscience to perform translational research while practicing as an interventional psychiatrist, with a focus on mood disorders and treatment-resistant depression. During my PhD, I developed novel intracranial brain mapping tools and applied these to demonstrate the neural basis of resting functional MRI in humans. During residency and my postdoctoral fellowship, I co-developed fully automated non-invasive brain mapping techniques, now used across industry and academia. My laboratory combines techniques from computer science, neuroscience, and engineering coupled with a clinical understanding

of psychiatry to focus on three central aims: 1) to better understand the mechanisms underlying human brain plasticity; 2) to develop novel methods to probe the human brain; and 3) to personalize brain stimulation by developing trans-diagnostic platforms for rapid biomarker development, evaluation, and integration into brain stimulation treatments. This approach has the expected outcome of producing novel stimulation treatments with enhanced specificity, plasticity, and efficacy. By increasing our mechanistic understanding and ability to monitor brain changes during stimulation, we will markedly increase the utility of these powerful techniques. Together, this work will help transform interventional psychiatry from a one-size-fits-all treatment approach to one that focuses on targeting objective biomarkers for the individual, pushing the field towards personalized neurotherapeutics.

Contribution to Science

1. My early work in the laboratory of Sydney Cash focused on the mechanisms underlying inter-ictal spikes, which define epileptic cortex. We recorded simultaneous local field potentials and single neuron action potentials during inter-ictal discharges (IID) using high density microelectrode arrays implanted in patients with medically-resistant epilepsy to characterize the firing pattern that underlies IIDs. We determined that only $\frac{1}{2}$ of neurons in epileptic areas modulate their firing rate during IIDs. Furthermore, as expected $\frac{1}{4}$ of neurons increased their firing rate during the IID. In direct contrast to predictive models of the IID, however, we identified a subset of population of neurons that modulate their firing rate *prior* to the IID. These subset of neurons were only observed in epileptic regions, suggesting they may play a role in the generation of the IID. During this time, we also developed a microelectrode that records simultaneous electrophysiology and hemodynamics and an algorithm for accurately localizing intracranial electrodes implanted in patients during epilepsy surgery.
 - a. **Keller CJ**, Cash SS, Narayanan S, Wang C, Kuzniecky R, Carlson C, Devinsky O, Thesen T, Doyle W, Sassaroli A, Boas AD, Ulbert I, Halgren E. *Intracranial microprobe for evaluating neuro-hemodynamic coupling in unanesthetized human neocortex*. Journal of Neuroscience Methods 179 (2009) 208–218.
 - b. Dykstra A, Chan AM, Quinn BT, Zepeda R, **Keller CJ**, Cormier JE, Madsen JR, Eskandar EN, Cash SS. *Individualized localization and cortical surface-based registration of intracranial electrodes*. NeuroImage 59 (2012): 3563-70.
 - c. **Keller CJ**, Truccolo W, Gale JT, Eskandar E, Thesen T, Carlson C, Devinsky O, Kuzniecky R, Doyle WK, Madsen JR, Schomer DL, Mehta AD, Brown EN, Hochbert LR, Ulbert I, Halgren E, Cash SS. *Distinct Neuronal Firing Types During Interictal Epileptiform Discharges in the Human Cortex*. Brain 133 (2010) 1668-81.
2. During my PhD with Ashesh Mehta, Fred Lado, and Michael Milham, with a team of interdisciplinary collaborators, we documented the relationship between fMRI and underlying physiology. fMRI is now in mainstream use, but the neurophysiology of positive and negatively correlated BOLD fluctuations – which consistently identify large scale networks implicated in cognitive, sensory, and motor functions, and which differentiate patients from healthy subjects in many neuropsychiatric diseases – is largely unknown and confounded by multiple artifacts that exist in these recordings. I directly demonstrated that the spatial distribution and magnitude of temporally correlated low-frequency BOLD fluctuations (‘resting fMRI’) predict the pattern and magnitude of evoked potentials measured intracranially following focal electrical stimulation. These findings were replicated across patients and functional subsystems and strengthened the notion that resting fMRI signals are grounded in neurophysiology. We furthermore demonstrated that positively and negatively correlated fluctuations of high gamma activity underlie positive and negative BOLD correlations, respectively, suggesting that both resting BOLD interactions have neurophysiological origins in slow power modulations of fast frequency activity. This work

has driven >20 groups across the world to begin collecting cortico-cortical evoked potentials (CCEPs), where a causal electrical disturbance in the brain elicits brief changes in neuronal excitability that can be measured in the local field potential.

- a. **Keller CJ**, Bickel S, Entz L, Ulbert I, Kelly C, Milham M, Mehta AD. *Intrinsic functional architecture predicts electrically-evoked responses in the human brain*. **Proceedings of the National Academy of Sciences** 108 (2011): 10308-13.
 - b. **Keller CJ**, Bickel S, Honey CJ, Groppe DM, Craddock CR, Kelley C, Lado FA, Milham M, Mehta AD. *Neurophysiological investigation of spontaneous correlated and anticorrelated fluctuations of the BOLD signal*. **Journal of Neuroscience**. 33 (2013): 6333-42.
 - c. **Keller CJ**, Honey CJ, Entz L, Bickel S, Groppe DM, Toth E, Lado FA, Ulbert I, Mehta AD. *Probing the human connectome: cortico-cortical evoked potentials reveal projectors and integrators within human brain networks*. **Journal of Neuroscience**. 34 (2014): 9152-63.
 - d. **Keller CJ**, Honey CJ, Megevand P, Entz L, Ulbert I, Mehta AD. *Mapping complex brain networks with cortico-cortical evoked potentials*. **Philosophical Transactions of the Royal Society B: Biological Sciences**. 1 (2014): 369 (1653).
3. As a post-doctoral fellow with Amit Etkin, I co-developed a fully automated analytic pipeline for analysis of concurrent transcranial magnetic stimulation (TMS) coupled with EEG. This toolbox is currently being used across 10 different projects examining plasticity abnormalities in multiple patient populations. We also performed a randomized, double-blind, placebo-controlled clinical trial to investigate the electrophysiological underpinnings of clinical effects of daily repetitive TMS (rTMS) treatment for depression. We utilized the toolbox developed to show that rTMS treatment modulates TMS-evoked potentials and the strength of modulation predicts clinical outcome. This work suggests that specific TMS-EEG brain-based biomarkers may be used to predict non-responders, monitor brain networks during intervention, and be used to propose novel targets and treatment paradigms.
- a. **Keller CJ***, Wu W*, Rogasch NC, Longwell P, Spigel E, Rolle CE, Etkin A. *ARTIST: A Fully Automated Artifact Rejection Algorithm for Single-Pulse TMS-EEG Data*. **Human Brain Mapping**. 00 (2018): 1-19. *These authors contributed equally.
 - b. **Keller CJ***, Kerwin L*, Wu W, Etkin A. *Test-Retest Reliability of Transcranial Magnetic Stimulation EEG Evoked Potentials*. **Brain Stimulation**: 3 (2018): 536-44. *These authors contributed equally.
 - c. **Keller CJ***, Fischer AS*, Etkin A. *The clinical applicability of functional connectivity in depression: Pathways toward more targeted intervention*. **Journal of Biological Psychiatry: Cognitive Neuroscience and Neuroimaging**. 3 (2016): 262-270. *These authors contributed equally.
 - d. **Keller CJ**, Huang D, Honey CJ, Du V, Fini M, Lado FA, Mehta AD. *Induction and quantification of excitability changes in human cortical networks*. **Journal of Neuroscience**: 23 (2018): 5384-98.
 - e. Huang D, Herrero J, Entz L, Fabo D, Hajnal B, Mehta A, **Keller CJ**. *Intracortical dynamics underlying repetitive stimulation predicts changes in network connectivity*. **Journal of Neuroscience**: 31 (2019): 6122-6135.

Thesis Work

PhD Dissertation: *Investigating the neurophysiological origins of spontaneous fluctuations of the BOLD signal, high frequency oscillations, and the default mode network.*

Dept of Neuroscience, Albert Einstein College of Medicine
07/2011 – 10-2013 ; High Honors
Mentors: Drs Fred Lado and Ashesh Mehta
Advisory Committee: Adam Kohn, Kamran Khodokakhah,
Joseph Arezzo, Charles Schroeder

Master's Thesis: *Seeking the Neuro-Hemodynamic Basis of Epilepsy: Evidence from Human Intracranial EEG, Laser Doppler Flowmetry, Cortical Point Spectroscopy, and Single Unit Activity*

Dept of Biomedical Engineering, Tufts University
09/2007 – 05-2009; Highest Honors
Mentors: Sergio Fantini (Tufts); Sydney Cash (Harvard)

D. CLINICAL TRIALS

NCT04388202. Leveraging EEG for Antidepressant Prediction With Sertaline and Escitalopram (LEAP-SE). Role: Principal Investigator.

NCT02843373. Brain-Based Biomarkers in Response to TMS in MDD. Role: Co-Investigator.

NCT02479906. A Safety and Efficacy Study with Deep Transcranial Magnetic Stimulation for the Treatment of Post-Traumatic Stress Disorder (PTSD). Role: Co-Investigator.