

Craig Kelley

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		Websites	ResearchGate , Google Scholar

Education

- 2018-2023** PhD Biomedical Engineering
SUNY Downstate Health Sciences University & NYU Tandon School of Engineering
Advisor: William W. Lytton
Thesis Project: Multiscale modeling of brain excitability: applications to spreading depression and dendritic impedance
- 2010-2014** BS Biomedical Engineering
Boston University
Senior Project: Using stochastic resonance to alleviate apnea in premature infants.

Research Experience

- 2023-present** Postdoctoral Research Scientist
Neural Engineering & Control (Wang) Lab, Columbia University
- 2018-2023** Graduate Assistant
Neurosim (Lytton) Lab, SUNY Downstate Health Sciences University
- 2016-2018** Programmer Analyst
Hasselmo Lab, Center for Memory and Brain, Boston University
- 2016-2018** Contract Researcher
Translational Neuropharmacology (Hajos) Lab, Yale School of Medicine
- 2015-2016** Postgraduate Research Associate
Translational Neuropharmacology (Hajos) Lab, Yale School of Medicine
- 2014-2015** Physics Department Fellow (intern)
Prentiss Lab, Harvard University
- 2013-2014** Undergraduate Research Fellow
Wyss Institute for Biologically Inspired Engineering at Harvard University

Honors/Awards

- Finalist, Chancellor's Distinguished Dissertation Award (SUNY-wide, 2025)
The Robert F. Furchgott Award for Excellence in Research (SUNY Downstate Best Thesis, 2024)
Second Prize - SUNY Downstate Annual Research Day Poster Competition (2022)
Museum of Science Boston Service Award (2012)
Boston University Engineering Scholars Scholarship (2010)

Publications

Peer-Reviewed

1. Rammohan Shukla, Marissa Smail, Sapuni Chandrasena, Xiaolu Zhang, Vineet Reddy, **Craig Kelley**, James Herman, Mohamed Sherif, and Robert McCullumsmith. 2025. "Cell Type-Specific Vulnerabilities and Drug Effects in Psychiatric Disorders: A Systems-Level Analysis Using Sn-RNaseq." *Biological Psychiatry* 97 (9): S15–16. May 2025. <https://doi.org/10.1016/j.biopsych.2025.02.051>
2. **Craig Kelley**, Srdjan D. Antic, Nicholas T. Carnevale, John L. Kubie, and William Lytton. Simulations predict differing phase responses to excitation vs. inhibition in theta-resonant pyramidal neurons. *J. Neurophysiology*, October 2023. <https://doi.org/10.1152/jn.00160.2023>
Github: https://github.com/suny-downstate-medical-center/nonlinear_impedance_phase
3. **Craig Kelley**, Adam J. H. Newton, Sabina Hrabetova, Robert A. McDougal, and William W. Lytton. Multiscale computer modeling of spreading depolarization in brain slices. *eNeuro* 9 (4). August 2022. <https://doi.org/10.1523/eneuro.0082-22.2022>
GitHub: <https://github.com/suny-downstate-medical-center/SDinSlice>

4. Marissa A. Smail, Sapuni S. Chandrasena, Xiaolu Zhang, Vineet Reddy, **Craig Kelley**, James P. Herman, Mohamed Sherif, Robert E. McCullumsmith, and Rammohan Shukla. Differential Vulnerability of Anterior Cingulate Cortex Cell Types to Diseases and Drugs. *Molecular Psychiatry*, June 2022. <https://doi.org/10.1038/s41380-022-01657-w>
5. **Craig Kelley**, Salvador Dura-Bernal, Samuel A Neymotin, Srdjan D Antic, Nicholas T Carnevale, Michele Migliore, and William W Lytton. Effects of I_h and TASK-like shunting current on dendritic impedance in layer 5 pyramidal-tract neurons. *J. Neurophysiology*, 125(4):1501–1516, April 2021. <https://doi.org/10.1152/jn.00015.2021>
GitHub: https://github.com/suny-downstate-medical-center/L5PYR_Resonance
6. Milan Stoiljkovic, Karel Otero Gutierrez, **Craig Kelley**, Tamas L. Horvath, and Mihaly Hajos. TREM2 deficiency disrupts network oscillations leading to epileptic activity and aggravates amyloid- β -related hippocampal pathophysiology in mice. *Journal of Alzheimer's Disease: JAD*, June 2021. <https://doi.org/10.3233/jad-210041>
7. Ying Tan, Fu Hang, Zhong-Wu Liu, Milan Stoiljkovic, Mingxing Wu, Yue Tu, Wenfei Han, Angela M Lee, **Craig Kelley**, Mihaly Hajos, Lingeng Lu, Luis de Lecea, Ivan de Araujo, Marina Picciotto, Tamas L Horvath, and Xiao-Bing Gao. Impaired hypocretin/orexin system alters responses to salient stimuli in obese male mice. *J. Clin. Invest.*, June 2020. <https://doi.org/10.1172/jci130889>
8. David Nagy, Laura Herl Martens, Liza Leventhal, Angela Chen, **Craig Kelley**, Milan Stoiljkovic, and Mihaly Hajos. Age-dependent emergence of neurophysiological and behavioral abnormalities in progranulin-deficient mice. *Alzheimers. Res. Ther.*, 11(1):88, October 2019. <https://doi.org/10.1186/s13195-019-0540-x>
9. Milan Stoiljkovic, **Craig Kelley**, Bernardo Stutz, Tamas L Horvath, and Mihaly Hajos. Altered cortical and hippocampal excitability in TgF344-AD rats modeling Alzheimer's disease pathology. *Cereb. Cortex*, 29(6):2716–2727, June 2019. <https://doi.org/10.1093/cercor/bhy140>
10. Holger Dannenberg, **Craig Kelley**, Alec Hoyland, Caitlin K Monaghan, and Michael E Hasselmo. The firing rate speed code of entorhinal speed cells differs across behaviorally relevant time scales and does not depend on medial septum inputs. *J. Neurosci.*, 39(18):3434–3453, May 2019. <https://doi.org/10.1523/jneurosci.1450-18.2019>
GitHub: https://github.com/hasselmonians/Speed_Coding
11. Milan Stoiljkovic, **Craig Kelley**, Tamas L Horvath, and Mihaly Hajos. Neurophysiological signals as predictive translational biomarkers for Alzheimer's disease treatment: Effects of donepezil on neuronal network oscillations in TgF344-AD rats. *Alzheimers. Res. Ther.*, 10(1):105, October 2018. <https://alzres.biomedcentral.com/articles/10.1186/s13195-018-0433-4>
12. Milan Stoiljkovic, **Craig Kelley**, David Nagy, Raymond Hurst, and Mihaly Hajos. Activation of $\alpha 7$ nicotinic acetylcholine receptors facilitates long-term potentiation at the hippocampal-prefrontal cortex synapses in vivo. *Eur. Neuropsychopharmacology.*, 26(12):2018–2023, December 2016. <https://doi.org/10.1016/j.euroneuro.2016.11.003>
13. Milan Stoiljkovic, **Craig Kelley**, David Nagy, Liza Leventhal, and Mihaly Hajos. Selective activation of $\alpha 7$ nicotinic acetylcholine receptors augments hippocampal oscillations. *Neuropharmacology*, 110(PtA):102–108, November 2016. <https://doi.org/10.1016/j.neuropharm.2016.07.010>
14. Milan Stoiljkovic, **Craig Kelley**, Gabor Patrick Hajos, David Nagy, Gerhard Koenig, Liza Leventhal, and Mihaly Hajos. Hippocampal network dynamics in response to $\alpha 7$ nACh receptors activation in amyloid- β overproducing transgenic mice. *Neurobiol. Aging*, 45:161–168, September 2016. <https://doi.org/10.1016/j.neurobiolaging.2016.05.021>
15. Milan Stoiljkovic, **Craig Kelley**, David Nagy, and Mihaly Hajos. Modulation of hippocampal neuronal network oscillations by $\alpha 7$ nACh receptors. *Biochem. Pharmacol.*, 97(4):445–453, October 2015. <https://doi.org/10.1016/j.bcp.2015.06.031>
16. Claudia Danilowicz, Darren Yang, **Craig Kelley**, Chantal Prevost, and Mara Prentiss. The poor homology stringency in the heteroduplex allows strand exchange to incorporate desirable mismatches without sacrificing recognition in vivo. *Nucleic Acids Res.*, 43(13):6473–6485, July 2015. <https://doi.org/10.1093/nar/gkv610>

Preprints

1. **Craig Kelley**, Cody Slater, Marc Sorrentino, Dillon Noone, Jocelyn Hung, Paul Sajda, and Qi Wang. 2025. Alpha Modulation of Spiking Activity across Multiple Brain Regions in Mice Performing a Tactile Selective Detection Task. *bioRxiv*, March 2025. <https://doi.org/10.1101/2025.03.07.642074>
GitHub: https://github.com/Neural-Control-Engineering/AlphaModulation_SelectiveDetection.
2. Siobhan Lawless, **Craig Kelley**, Elena Nikulina, David Havlicek, and Peter J. Bergold. Analysis of Markerless Limb Tracking Reveals Chronic and Progressive Motor Deficits after a Single Closed Head Injury in Mice. *bioRxiv*, February 2023. <https://doi.org/10.1101/2021.08.04.45508>
GitHub: <https://github.com/suny-downstate-medical-center/CHIanalysis>

Presentations

Invited Talks

1. “Alpha modulation of spiking activity across multiple brain regions during a tactile selective detection task”. Zuckerman Institute Postdoctoral Seminar Series. March 19, 2025.
2. “Neural Correlates of Task Performance in Mice during a Tactile Decision Making Task”. Annual Air Force Research Laboratory Center of Excellence Meeting. New York, NY. September 11, 2024.
3. Session Co-Chair “Computational Modeling in Health and Disease”. Virtual Physiological Human Conference. VPH Institute; Porto, Portugal. September 7, 2022.
4. “Exploring Health Careers: Graduate School, Biomedical Research, & Computational Neuroscience”. SUNY Downstate Office of Diversity Education and Research. July 13, 2021.

Posters

1. **Craig Kelley**, Cody Slater, Marc Sorrentino, Dillon Noone, Qi Wang. Noradrenergic modulation of population activity in the primary somatosensory cortex, striatum, and amygdala in a tactile decision making task. Presented at: Neuroscience 2024. Society for Neuroscience; October 5-9. Chicago, IL.
2. Marc Sorrentino, Cody Slater, **Craig Kelley**, Brett Youngerman, Qi Wang. Leveraging large-scale electrophysiology array recordings to identify neural biomarkers for improved closed-loop neuromodulation for chronic pain. Presented at: Neuroscience 2024. Society for Neuroscience; October 5-9. Chicago, IL.
3. Adam JH Newton, **Craig Kelley**, Joy Wang, Sydney Zink, Marcello M Distasio, Robert A McDougal, William W Lytton. Human capillary identification used to simulate spreading depression in control and ischemic neocortical microcircuits. Presented at: Neuroscience 2024. Society for Neuroscience; October 5-9. Chicago, IL.
4. Tahmid Khandaker, Jia Min Li, **Craig Kelley**, Samanta B Torres, Daniel Rosenthal, Juan Marcos Alarcon, Jenny Lieben. Bridging the gap: the impact of teaching computational modeling to foster diversity of neuroscience. Presented at: Neuroscience 2023. Society for Neuroscience; November 11-15. Washington D.C.
5. **Craig Kelley**, John L Kubie, Srdjan D Antic, William W Lytton. Oscillatory stimuli produce nonstationary spiking activity in computer model of neocortical pyramidal neuron: spike-phase advance and retreat. Presented at: Neuroscience 2022. Society for Neuroscience; November 12-16. San Diego, Ca.
6. Adam JH Newton, **Craig Kelley**, Robert A McDougal, William W Lytton. Multiscale simulations of spreading depolarization with ischemic effects. Presented at: Neuroscience 2022. Society for Neuroscience; November 12-16. San Diego, Ca.
7. V. Bragani, E. Urdapilletai, J. W. Graham, D. Del Piano, N. Gomez, P. Faivre, F. Leda, A. Sinha, E. Y. Griffith, **C. Kelley**, A. JH Newton, S. Gupta, S. A. Neymotin, M. L. Hines, W. W. Lytton, P. Gleeson, M. Cantarelli, S. Dura-Bernal. The NetPyNE multiscale modeling tool: latest features and models. Presented at: Neuroscience 2022. Society for Neuroscience; November 12-16. San Diego, Ca.
8. **Craig Kelley**, Adam JH Newton, Sabina Hrabetova, Robert A McDougal, William W Lytton. Multiscale modeling of spreading depolarization and depression in brain slices. Presented at: Virtual Physiological Human Conference 2022. VPH Institute; Porto, Portugal. September 7, 2022.

9. **Craig Kelley**, Adam JH Newton, Michael L Hines, Robert A McDougal, William W Lytton. Modeling of spreading depolarization suggests different propagation dynamics based on brain region and slice preparation. Presented at: ICSD 2021. Co-operative Studies on Brain Injury Depolarizations; September 20-22. Lyon, France.
10. **Craig Kelley**, Adam JH Newton, Michael L Hines, Robert A McDougal, William W Lytton. Tissue-scale computer modeling of spreading depolarization, ischemia and cytotoxic edema. Presented at: Neuroscience 2021. Society for Neuroscience; November 13-16. Chicago, IL.
11. Milan Stoiljkovic, KO Gutierrez, **Craig Kelley**, Tamas L Horvath, Mihaly Hajos. Impact of TREM2 on hippocampal network oscillations in Tg2576 mice modeling amyloid- β pathology. 2021 Alzheimer's Association International Conference; July 25-30. Denver, CO.
12. Siobhan Lawless, Alan Siefert, John F. Crary, David F. Havlicek, **Craig Kelley**, Elena Nikulina, Peter J. Bergold. Chronic and progressive motor deficits and cerebral atrophy following a single traumatic brain injury in mice. 2021. The 38th Annual National Neurotrauma Symposium; July 11-14. Online.
13. **Craig Kelley**, Salvador Dura-Bernal, Samuel Neymotin, William W Lytton. Dendritic resonance in a detailed model of pyramidal tract neuron of mouse primary motor cortex. Neuroscience 2019. Society for Neuroscience; October 19-23. Chicago, IL.
14. Salvador Dura-Bernal, Samuel Neymotin, Benjamin Suter, **Craig Kelley**, Ramazan Tekin, Gordon Shepherd, William W Lytton. Response to simultaneous long-range inputs and oscillatory inputs in a multiscale model of M1 microcircuits. Neuroscience 2019. Society for Neuroscience; October 19-23. Chicago, IL.
15. Milan Stoiljkovic, Ying Tan, **Craig Kelley**, Mihaly Hajos, Tamas L Horvath, Xia-Bing Gao. Linking impaired neural oscillations in hypothalamus and hippocampus to hypocretinergic system in high-fat diet-induced obesity in mice. Neuroscience 2019. Society for Neuroscience; October 19-23. Chicago, IL.
16. Holger Dannenberg, **Craig Kelley**, Alec Hoyland, Monaghan C, Michael Hasselmo. Speed coding by entorhinal cortex speed cells differs across behaviorally relevant time scales and is independent of cholinergic modulation. Neuroscience 2018. Society for Neuroscience; November 3-7. San Diego, Ca.
17. Milan Stoiljkovic, **Craig Kelley**, Bernardo Stutz, Tamas L Horvath, Mihaly Hajos. Neurophysiological signals as predictive translational biomarkers for Alzheimer's disease treatment: Effects of donepezil on neuronal network oscillations in TgF344-AD rats. Neuroscience 2018. Society for Neuroscience; November 3-7. San Diego, Ca.
18. Kimberly Young, Michael Brown, **Craig Kelley**, Michael Hasselmo. Cholinergic modulation of interneurons in the medial entorhinal cortex. Presented at: Neuroscience 2017. Society for Neuroscience; November 11-15. Washington, DC.
19. Milan Stoiljkovic, **Craig Kelley**, Bernardo Stutz, Tamas L Horvath, Mihaly Hajos. Altered cortical and hippocampal excitability in TgF344-AD rats modeling Alzheimer's disease pathology. Presented at: Neuroscience 2017. Society for Neuroscience; November 11-15. Washington, DC.
20. Milan Stoiljkovic, **Craig Kelley**, Mihaly Hajos. Abnormal cortical and hippocampal neuronal activity in TgF344-AD rats modeling Alzheimer's disease pathology. Presented at: 23rd World Congress of Neurology; September 16-21, 2017; Kyoto, Japan.
21. David Nagy, Lauren H Martens, Liza Leventhal, Angela Chen, **Craig Kelley**, Milan Stoiljkovic, Mihaly Hajos. Age dependent emergence of neurophysiological and behavioral abnormalities in progranulin deficient mice. Presented at: Boston Children's Hospital Translational Neuroscience Center Symposium. Harvard Medical School; April 6, 2017; Boston, Ma.
22. Brian D Harvey, Eva Morozova, **Craig Kelley**, Mihaly Hajos. Spontaneous cortical gamma oscillation and the auditory evoked steady state response: A pharmacological investigation. Presented at: Neuroscience 2016. Society for Neuroscience; November 12-16; San Diego, Ca.
23. Mihaly Hajos, **Craig Kelley**, Milan Stoiljkovic. Diminished hippocampal oscillations in TgF344-AD rat model of Alzheimer's disease. Presented at: The Lancet Neurology Conference 2016; October 19-21; London, UK.

24. Milan Stoiljkovic, David Nagy, Gabor Patrick Hajos, **Craig Kelley**, Gerhard Koenig, Timothy Piser, Liza Leventhal, Mihaly Hajos. Activation of $\alpha 7$ nACh receptors in $A\beta$ overproducing mice augments hippocampal theta oscillation. Presented at: Neuroscience 2015. Society for Neuroscience; October 17-21; Chicago, IL.
25. Mihaly Hajos, **Craig Kelley**, David Nagy, Liza Leventhal Milan Stoiljkovic. Effects of nicotinic acetylcholine receptors activation on neurophysiological markers of cognition. Presented at: Neuroscience 2015. Society for Neuroscience; October 17-21; Chicago, IL.

Teaching Experience

1. Graduate Student Mentor, Research Experience in Autism for College and High School Students Program (HS & undergraduate levels), Summer '22
2. Tutor, 2021 NetPyNE Course (undergrad – faculty), Spring '21
3. Teaching Assistant, Neuroanatomy (medical students / graduate level), Fall '21
4. Teaching Assistant, Elements of Neuroscience (graduate level), Fall '19
5. Teaching Assistant, Computational Neuroscience (graduate level), Spring '19 & '20

Service

Guest Editor

Frontiers in Cellular Neuroscience collection: "Dendritic Influence on Neuronal Input-Output Transformation Dynamics"

Ad Hoc Reviewer

PLOS Computational Biology, Neurobiology of Aging, Brain Sciences, IEEE Transactions on Neural Networks and Learning Systems

Skills

Programming Languages: Python, MATLAB/Simulink, C/C++

Software: NEURON, NetPyNE, scikit-learn, Tensorflow, Linux/Unix, Arduino, L^AT_EX, Slurm, PBS, Git

Experimental/Other: *In vivo* electrophysiology (EEG/LFP, single unit recordings) in rats and mice, behavior, electronics, real-time embedded systems, histology, confocal microscopy

Advanced Coursework

Machine Learning, Real-Time Embedded Systems, Digital Signal Processing, Biomaterials, Neuroanatomy

Other Professional Experience

2008-2016 Program Presenter
Museum of Science Boston
Act as the lead educator in an exhibit intended for children and the people who accompany them to experience hands-on science and engineering.
Created/enhanced exhibit components, developed training materials, and helped run a professional development workshop for high school interns.

Professional Memberships

2022–present Member, Virtual Physiological Human Institute
2020–present Member, Organization for Computational Neuroscience
2019–present Member, Society for Neuroscience
2018–present Member, New York Academy of Sciences