

Jason Sherfey

Curriculum Vitae

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Education

BOSTON UNIVERSITY Ph.D. in Computational Neuroscience Dissertation: Prefrontal rhythms for cognitive control	2011 - 2017
VANDERBILT UNIVERSITY Bachelor of Engineering in Biomedical Engineering	2002 - 2006

Academic Positions

Boston University, Department of Psychological and Brain Sciences <i>Research Assistant Professor</i> Funding supervisor: Michael Hasselmo	2019 - present
Massachusetts Institute of Technology, The Picower Institute for Learning and Memory <i>Postdoctoral Research Affiliate in the Laboratory of Earl Miller</i>	2018 - present
University of Waterloo, Centre for Theoretical Neuroscience <i>Visiting Scholar in the Laboratory of Chris Eliasmith</i>	2018 - present

Grants and Funding

Army Research Office grant W911NF1410374 (served as grant author). <i>Brain rhythms for rule-based decision making.</i> \$600,000	2014 - 2017
Computational Neuroscience Training Grant, Boston University	2013 - 2014
Travel grants, Center for Computational Neuroscience and Neural Technology, Boston University	2012 - 2015

Peer-reviewed publications

- Sherfey, J. S., Ardid, S., Miller, E. K., Hasselmo, M. E., & Kopell, N. J.** (2019). Prefrontal oscillations modulate the propagation of neuronal activity required for working memory. bioRxiv, 531574. Submitted to eLife (under review).
- Ardid, S., **Sherfey, J. S.**, McCarthy, M. M., Hass, J., Pittman-Polletta, B. R., & Kopell, N. (2019). Biased competition in the absence of input bias revealed through corticostriatal computation. *Proceedings of the National Academy of Sciences*, 116(17), 8564-8569.
- Sherfey, J. S.**, Ardid, S., Hass, J., Hasselmo, M. E., & Kopell, N. J. (2018). Flexible resonance in prefrontal networks with strong feedback inhibition. *PLoS computational biology*, 14(8), e1006357.
- Sherfey, J. S.**, Soplata, A. E., Ardid, S., Roberts, E. A., Stanley, D. A., Pittman-Polletta, B. R., & Kopell, N. J. (2018). DynaSim: a MATLAB Toolbox for neural modeling and simulation. *Frontiers in neuroinformatics*, 12, 10.

5. Hass, J., Ardid, S., **Sherfey**, J. S., & Kopell, N. J. (2019). Constraints on Persistent Activity in a Realistic Network Model of the Prefrontal Cortex with Heterogeneous Neurons. *PLoS Computational Biology* (under revision).
6. Adams*, N. E., **Sherfey***, J. S., Kopell, N. J., Whittington, M. A., & LeBeau, F. E. (2017). Heterogeneity in Neuronal Intrinsic Properties: A Possible Mechanism for Hub-Like Properties of the Rat Anterior Cingulate Cortex during Network Activity. *eNeuro*, 4(1), ENEURO-0313. *Both authors contributed equally to this work.
7. Soplata, A. E., McCarthy, M. M., **Sherfey**, J. S., Lee, S., Purdon, P. L., Brown, E. N., & Kopell, N. (2017). Thalamocortical control of propofol phase-amplitude coupling. *PLoS computational biology*, 13(12), e1005879.
8. Ardid, S., **Sherfey**, J. S., McCarthy, M. M., Hass, J., & Kopell, N. J. (2016). Unraveling action selection and inhibitory control mechanisms in a striatal microcircuit model. *International Journal of Psychophysiology*, 108, 18.
9. Kovacevic, S., Azma, S., Irimia, A., **Sherfey**, J., Halgren, E., & Marinkovic, K. (2012). Theta oscillations are sensitive to both early and late conflict processing stages: effects of alcohol intoxication. *PLoS One*, 7(8), e43957.
10. Thesen, T. T., McDonald, C. R., Carlson, C., Doyle, W., Cash, S., **Sherfey**, J. S., Felsevalyi, O., Girard H., Barr, W., Devinsky, O., Kuzniecky, R., & Halgren, E. (2012). Sequential then interactive processing of letters and words in the left fusiform gyrus. *Nature Communications*, 3, 1284.
11. Halgren, E., **Sherfey**, J., Irimia, A., Dale, A. M., & Marinkovic, K. (2011). Sequential temporo-fronto-temporal activation during monitoring of the auditory environment for temporal patterns. *Human brain mapping*, 32(8).
12. McDonald, C. R., Thesen, T., Carlson, C., Blumberg, M., Girard, H. M., Trongnetrpunya, A., **Sherfey**, J. S., Devinsky, O., Kuzniecky, R., Cash, S., Leonard, M. K., Hagler, D. J., Jr., Dale, A. M., & Halgren, E. (2010). Multimodal imaging of repetition priming: using fMRI, MEG, and intracranial EEG to reveal spatiotemporal profiles of word processing. *Neuroimage*, 53(2), 707-717.

Conference presentations

1. **Sherfey**, J. S. (2018). *DynaSim: Neural Modeling in Matlab*. Presented at the annual INCF Neuroinformatics Meeting, Montreal, QC.
2. **Sherfey**, J. S. (2018). *Neuroscience Modeling and Data Processing with Community-authored MATLAB-based Tools – The DynaSim Toolbox for Neural Modeling*. Presented at the Neuroscience Gateway workshop of the annual Computational Neuroscience Meeting, Seattle, WA.
3. **Sherfey**, J. S. (2016). *Competition versus cooperation in the anterior cingulate cortex*. Presented at the annual Cognitive Rhythms Collaborative Retreat, Boston, MA.
4. **Sherfey**, J. S. (2014). *Prefrontal brain rhythms for rule-based action*. Presented at the annual Gordon Research Seminar, Newry, ME.
5. **Sherfey**, J. S. (2014). *Cortical rhythms and interneurons for reading working memory: a computational study of laminar DLPFC*. Presented at the annual Cognitive Rhythms Collaborative Retreat, Boston, MA.

Selected Posters

1. **Sherfey**, J. S., Ardid, S., Miller, E. K., Hasselmo, M. E., Kopell, N. J. (2019). *Prefrontal oscillations modulate the propagation of neuronal activity required for working memory*. 2019 Society for Neuroscience Meeting, Chicago, IL.
2. **Sherfey**, J. S., Ardid, S., Hass, J., Kopell, N. J., Miller, E. K., Hasselmo, M. E. (2018). *Modeling of oscillatory gating for cognitive function*. 2018 Society for Neuroscience Meeting, San Diego, CA.
3. **Sherfey**, J. S., Ardid, S., Hass, J., Kopell, N. J., Hasselmo, M. E. (2018). *Prefrontal oscillations bias pathways for thought and action*. 2018 Computational Neuroscience Meeting, Seattle, WA.
4. **Sherfey**, J. S., Soplata, A. E., Ardid, S., Roberts, E. A., Stanley, D. A., and Kopell, N. J. (2018). *DynaSim: A Matlab Toolbox for Neural Modeling and Simulation*. 2018 INCF Neuroinformatics Meeting, Montreal, ON.
5. **Sherfey**, J. S. (2016). *DynaSim: a Matlab toolbox for rapidly building and exploring neural models*. 2016 Janelia conference on Collaborative Development of Data-Driven Models of Neural Systems, Ashburn, VA.
6. **Sherfey**, J. S., Ardid, S., McCarthy, M. M., Hass, J., Kopell, N. J. (2016). *Oscillations guide rule-based action in a laminar model of prefrontal cortex*. 2016 Society for Neuroscience Meeting, San Diego, CA.
7. Soplata, A., **Sherfey**, J. S., Purdon, P., Brown, E., Kopell, N. (2016). *Thalamic generation of propofol phase amplitude coupling*. 2016 Society for Neuroscience Meeting, San Diego, CA.

8. Ardid, S., **Sherfey**, J., McCarthy, M., Hass, J., Kopell, N. (2016). *Alpha oscillatory inputs and short-term depression underlie action inhibitory control in a model of the striatum*. 2016 Society for Neuroscience Meeting, San Diego, CA.
9. Hass, J., Ardid, S., **Sherfey, J. S.**, Kopell, N. (2016). *Constraints on Persistent Activity in a Biophysically Detailed Network Model of the Prefrontal Cortex with Heterogeneous Neurons*. Bernstein conference abstract.
10. **Sherfey**, J. S., Adams, N. E., LeBeau, F. E. N., Kopell, N. J. (2015). *Modeling neuronal diversity and fast network oscillations in rat anterior cingulate cortex (ACC)*. 2015 Society for Neuroscience Meeting, Chicago, IL.
11. Ardid, S., **Sherfey**, J. S., McCarthy, M. M., Kopell, N. J. (2015). *Context-dependent action selection mediated by specific temporal coordination between prefrontal cortex and striatum*. 2015 Society for Neuroscience Meeting.
12. **Sherfey**, J. S., Kopell, N. J. (2014). *Dynamic Neural Simulator - a simple tool for rapidly building and sharing large neural models*. 2014 Society for Neuroscience Meeting, Washington D.C.
13. **Sherfey**, J. S., Kopell, N. J. (2014). *Prefrontal brain rhythms for rule-based action*. 2014 Gordon Research Conference, Newry, ME.
14. **Sherfey**, J. S., Adams, N. E., Kopell, N. J. (2013). *Cortical rhythms and interneurons for reading working memory: a computational study of laminar DLPFC*. 2013 Society for Neuroscience Meeting, San Diego, CA.
15. Adams, N., **Sherfey**, J. S., Whittington, M. A., Kopell, N. J., LeBeau, F. E. N. (2013). *Alpha-2 adrenergic receptor activation and Ih channel blockade modulate fast network oscillations in the rodent prefrontal cortex in vitro*. 2013 Society for Neuroscience Meeting, San Diego, CA.
16. **Sherfey**, J. S., Yazdanbakhsh, A. (2012). *Fixational eye movements increase acuity in a retinal Bipolar-Amacrine-Ganglion circuit model*. 2012 Society for Neuroscience Meeting, New Orleans, LA.
17. Adams, N., **Sherfey**, J. S., LeBeau, F. E. N., Whittington, M. A., Kopell, N. J. (2012). *Prolonged decay time for GABA_A receptor-mediated inhibition promotes abnormal interlaminar communication: Implications for altered cortical dynamics in schizophrenia*. 2012 Society for Neuroscience Meeting, New Orleans, LA.
18. **Sherfey**, J. S., Cash, S., Dehghani, N., Halgren, E. (2010). *Are human cortical slow oscillations during NREM sleep traveling waves or are they synchronized across the cortex?* 2010 Society for Neuroscience Meeting, San Diego, CA.
19. Halgren, E., Ulbert, I., **Sherfey**, J., Dehghani, N., Tuan, A., Irimia, A., Cash, S. (2010). *Divergences between MEG and EEG during sleep rhythms: Neurobiology and biophysics*. 2010 Biomag International Conference on Biomagnetism, Dubrovnik, Croatia.
20. Kovacevic, S., Azma, S., **Sherfey**, J., Sheldon, S., Irimia, A., Marinkovic, K. (2010). *Effects of alcohol on cognitive control: MEG analysis in temporal and spectral domains*. 2010 Biomag International Conference on Biomagnetism, Dubrovnik, Croatia.
21. Kovacevic, S., Azma, S., **Sherfey**, J., Sheldon, S., Irimia, A., Halgren, E., Marinkovic, K. (2010). *Alcohol modulates oscillatory activity during cognitive control: Anatomically-constrained magnetoencephalography*. 2010 Society for Neuroscience Meeting, San Diego, CA.
22. **Sherfey**, J., Mecklenborg, J., Lobdell, N., Reynolds, A., Baudenbacher, F., Wikswow, J. (2007). *Force Displacement Measurements Using Magnetic Tweezers to Investigate the Role of E-Cadherins in Cell-Cell Adhesion*. 2007 Biomedical Engineering Society Annual Fall Meeting, Los Angeles, CA.
23. **Sherfey**, J. (2007). *Magnetic Tweezer System Development*. Poster presented at the Annual Workshop on Building Mathematical Models of Cancer Across Biological Scales of the Vanderbilt Integrative Cancer Biology Center, Vanderbilt University, Nashville, TN.
24. **Sherfey**, J., Irimia, A., Shanahan, P., Lobdell, N., Reynolds, A., Baudenbacher, F., Wikswow, J. (August 2005). *Investigating the role of E-Cadherins in cell-cell adhesion using magnetic tweezers and particle tracking algorithms*. Poster presented at the Summer Research Fellowship Poster Session, Biomedical Engineering, Vanderbilt University, Nashville, TN.

Seminars and colloquia

Modeling of oscillatory gating for cognitive function. Computational Neuroscience Research Group, University of Waterloo	2018
Resonance enables prefrontal rhythms to bias pathways for thought and action. Jones Lab for Human Electrophysiology and Computational Neuroscience, Brown University	2017
Prefrontal rhythms for cognitive control. Miller Lab, Massachusetts Institute of Technology	2017

Modeling dynamical systems in MATLAB using DynaSim. Dynamics and PDE Seminar, Brown University	2015
Modeling heterogeneous data. Neural Data Analysis Group, Boston University	2014
Regional differences in prefrontal rhythms. Cognitive Rhythms Collaborative Beta Group, Massachusetts Institute of Technology	2013
Neuroinformatics for modeling neural systems in schizophrenia. Neural Systems Laboratory, Boston University	2013
Inhibition kinetics control pathological interlaminar coherence in rhythmic cortical activity. Kopell Lab, Boston University	2012
Modeling the slow oscillation: competing perspectives. Kopell Lab, Boston University	2012
Inferring functional connectivity networks using bivariate phase-locking and Monte Carlo methods. Cortical Physiology Laboratory, Massachusetts General Hospital	2011
Fusiform area inhibits novel processing when letters are recognized. Guenther Lab, Boston University	2011

Teaching Experience

Tutorials

Modeling biological neural networks. Computational Neuroscience Student Organization, Boston University, Boston, MA	2017
MEG, EEG, ECoG, LFP, spike train, and spike-field analyses using FieldTrip. Computational Neuroscience Student Organization, Boston University, Boston, MA	2013

Demonstrations

Modeling biological neural systems using DynaSim. INCF Neuroinformatics Meeting, Exhibit Hall MathWorks booth, Montreal, QC	2018
Modeling biological neural systems using DynaSim. Society for Neuroscience Meeting, Exhibit Hall MathWorks booth	2016-2017

Leadership experience

Managed 6-person DynaSim development team	2016-2018
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Professional activities and service

Ad-hoc reviewer: <i>eLife</i> , <i>Frontiers in Systems Neuroscience</i> , <i>Human Brain Mapping</i>	2013-2019
Manage mailing list to assist global DynaSim users with model implementation and exploration	2016-2019
Panel on <i>Multiscale modeling - connecting the levels</i> at INCF Neuroinformatics Meeting	2018
Organized CompNet meetings to troubleshoot modeling, simulation, and data analysis	2013-2017
Treasurer of the Computational Neuroscience Student Organization at Boston University	2012

Membership in professional organizations

International Neuroinformatics Coordinating Facility
 Organization for Computational Neuroscience
 Society for Neuroscience

EXPERIENCE

Boston University, Psychological and Brain Sciences

Research Assistant Professor

Developing data-driven, parameter estimation tools in MATLAB and Python. Optimizing multi-scale, biological models to study brain dynamics in health and disease (e.g., frontotemporal dementia).

2019 -
present

Massachusetts Institute of Technology, The Picower Institute for Learning and Memory

Postdoctoral Research Affiliate

Developing experimentally-motivated models of neuronal network dynamics that support cognition. Analyzed data from monkey prefrontal cortex; used results to constrain a biophysically-detailed, laminar model of the same region. Established a theory of brain rhythm emergence during learning.

2018 -
present

University of Waterloo, Centre for Theoretical Neuroscience

Visiting Scholar

Researching brain rhythms for symbolic processing with application to neuromorphic technology. Explored the functional utility of oscillatory gating in working memory using the Nengo simulator and the Neural Engineering Framework.

2018 -
present

Boston University, Graduate Program for Neuroscience

Doctoral Candidate

- Developed dynamical modeling and simulation software (DynasimToolbox.org) with 1000+ downloads, users in 7+ countries, and an active mailing list; coded in MATLAB and C++; promoted by MathWorks. Dynasim enables models of ordinary differential equations (ODEs) to be specified at a high level in terms of interpretable mechanisms composing biological pathways and systems.
- Led 6-person team to further develop software with source control (github.com/Dynasim).
- Designed 3-year research project and wrote proposal for \$600,000 grant awarded to fund doctoral work and 2 postdoctoral fellows studying biological rhythms in health and disease.
- Discovered how brain rhythms can guide thought based on resonance. This work leveraged Dynasim for modeling constrained by *in vitro* and *in vivo* animal data; led to 5 papers in competitive journals.
- Modeled abnormal brain rhythms in schizophrenia. Discovered that dysregulation of glutamate decarboxylase disrupted cortical communication by synchronizing activity in different layers.
- Designed and ran human brain-computer interface experiments for decoding imagined speech.

2011 - 2017

Multimodal Imaging Laboratory, University of California San Diego

Neuroimaging Research Associate

- Created neuroimaging analysis software used by labs at UCSD and Massachusetts General Hospital.
- Analyzed large collections of Magnetic Resonance Imaging, EEG, and intracranial data using R, SPM, FreeSurfer, custom software, and other tools leading to 4 papers in top peer-reviewed journals.
- Facilitated collaboration between academic and clinical research labs throughout the US and UK.

2008 - 2011

Schering-Plough Corporation, Merck and Co.

Validation Engineer and Research Scientist

Worked with team on scientific investigations salvaging \$3,000,000 in product value. Participated in all phases of more than one dozen validation studies for aerosol and drug products.

2007 - 2008

Vanderbilt Institute for Integrative Biosystems Research and Education

Biomedical Engineering Research Assistant

Developed biomedical instrumentation to quantify effects of pathological intracellular signaling on single cell mechanics; interpreted findings using mathematical models of signaling pathways in cancer.

2005 - 2007