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### **Education**

New York University (NYU)

PhD Mathematics, 2006

PhD thesis: *Wave-driven vortex dynamics in the surf zone* (Advisor: Oliver Bühler)

Rensselaer Polytechnic Institute (RPI)

MS Applied Mathematics, 2001; BS Mathematics and Computer Science, 2000

### **Academic and Scientific Positions**

Southern Methodist University (SMU), Mathematics

Associate Professor, September 2018-present.

Assistant Professor, August 2011-2018.

University of Washington (UW), Applied Mathematics

Acting Assistant Professor, September 2008-July 2011.

University of Illinois at Urbana-Champaign (UIUC), Mathematics

Visiting Assistant Professor, Nov. 2006-Aug. 2008; Visiting Lecturer, Aug.-Nov. 2006.

### **Honors**

MBI Early Career Award, January-May 2013.

National Science Foundation Graduate Fellowship, 2001-2004.

### **External Funding**

NSF Award #1912320 CRCNS Research Proposal: Collaborative Research: Mechanisms and dynamics of retronasal olfactory coding (2019-2022)

NSF Award #1840260 RTG: Modeling and Computations for Complex Systems at Southern Methodist University (2019-2024)

Burroughs Wellcome Fund (BWF) Collaborative Research Travel Grant (CRTG): “Modulation of Correlations by Cortical UP-DOWN Transitions”, 2018-2019 (Extended through 2020).

Co-organizer of 5-day workshop on “Connecting Network Architecture and Network Computation”; Banff International Research Station (BIRS), December 2015.

### **Selected Publications**

1. C. Ly, W.L. Shew and A.K. Barreiro (2019). Efficient calculation of heterogeneous non-equilibrium statistics in coupled firing-rate models. *Journal of Mathematical Neuroscience*, 9(2).
2. Barreiro, A.K., J.C. Bronski, and Z. Rapti (2019). Applications of a class of Herglotz operator pencils. *SIAM Journal of Mathematical Analysis*, 51(1)
3. Barreiro, A.K. and C. Ly (2018). Investigating the Correlation–Firing Rate Relationship in Heterogeneous Recurrent Networks. *Journal of Mathematical Neuroscience*, 8(8). DOI: 10.1186/s13408-018-0063-y
4. Barreiro, A.K., S.H. Gautam, W.L. Shew, and C. Ly (2017). A theoretical framework for analyzing coupled neuronal networks: Application to the olfactory system. *PLoS Computational Biology*, 13(10):e1005780. DOI: 10.1371/journal.pcbi.1005780

5. Barreiro, A.K., J.N. Kutz and E. Shlizerman (2017). Symmetries constrain dynamics in a family of balanced neural networks. *Journal of Mathematical Neuroscience*, 7(10). DOI: 10.1186/s13408-017-0052-6.
6. Anastasio, T.J., A.K. Barreiro and J.C. Bronski (2017). A geometric method for eigenvalue problems with low rank perturbations. *Royal Society Open Science*, Vol. 4. DOI: 10.1098/rsos.170390
7. Barreiro, A.K. and C. Ly (2017). Practical approximation method for firing-rate models of coupled neural networks with correlated inputs. *Physical Review E*, Vol. 96 (2), No. 022413. DOI: 10.1103/PhysRevE.96.022413
8. Barreiro, A.K. and C. Ly (2017). When do correlations increase with firing rates in recurrent networks? *PLoS Computational Biology*, Vol. 13, No. 4. DOI: 10.1371/journal.pcbi.1005506
9. Barreiro, A.K., J. Gjorgjieva, F. Rieke and E. T. Shea-Brown (2014), When do microcircuits produce beyond-pairwise correlations? *Frontiers in Computational Neuroscience*, Vol. 8, No. 10. DOI: 10.3389/fncom.2014.00010
10. Barreiro, A.K., E.L. Thilo and E.T. Shea-Brown (2012), The A-current and Type I / Type II transition determine collective spiking from common input. *Journal of Neurophysiology*, Vol. 108, pp. 1631-1645. DOI: 10.1152/jn.00928.2011
11. Fairhall, A., Shea-Brown, E. and A. Barreiro (2012), Information theoretic approaches to understanding circuit function. *Current Opinion in Neurobiology*, Vol. 22 (4), pp. 653-659. DOI: 10.1016/j.conb.2012.06.005
12. Barreiro, A.K. (2012), Mechanisms of neural integration: recent results and relevance to nystagmus modeling. In: *The Challenge of Nystagmus* (Proceedings of the Second International Research Workshop on Nystagmus 2009), Eds. C.M. Harris, I. Gottlob, J. Sanders. ISBN: 978-0-9558940-2-2
13. Barreiro, A.K., E.T. Shea-Brown and E.L. Thilo (2010), Timescales of spike-train correlation for neural oscillators with common drive. *Physical Review E*, Vol. 81 (1), No. 011916.
14. Barreiro, A., J.C. Bronski and P.K. Newton (2010), Spectral gradient flow and equilibrium configurations of point vortices. *Proceedings of the Royal Society of London A*, Vol. 466, Issue 2118, pp. 1687-1702. DOI: 10.1098/rspa.2009.0419
15. Barreiro, A.K., J.C. Bronski and T.J. Anastasio (2009), Bifurcation theory explains waveform variability in a congenital eye movement disorder. *Journal of Computational Neuroscience*, Vol. 26 (2), p. 321-329. DOI: 10.1007/s10827-008-0113-7

### **Selected Invited Talks**

- Workshop on “Advanced methods in theoretical neuroscience: *Dynamics of learning and computations in neuronal circuits*”, Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany (June 2018).
- Workshop on “Complex Systems in Neuroscience: Bridging Theory and Experiment”, University of Pittsburgh (March 2018).
- BIRS-CMO Workshop on “Geometrical Methods, non Self-Adjoint Spectral Problems, and Stability of Periodic Structures”, Oaxaca, Mexico (June 2017).
- Dallas County Community College District (DCCCD) STEM Summit (April 2016).
- Gulf Coast Consortium (Houston) for Theoretical and Computational Neuroscience Annual Conference (February 2016).
- 24th Annual Computational Neuroscience Meeting (Workshops), "Impact of Single-Neuron Dynamics on Transfer of Correlations from Common Input." (July 2015)

### **Service**

- Organizing Committee for SIAM Conf. on Nonlinear Waves and Coherent Structures (2018)
- SIAM Activity Group on the Life Sciences, Secretary (2015-2016)
- Scientific Program Committee for 9th, 10th IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory (2015, 2017)

## **Teaching (2011-present)**

### Undergraduate (junior)

Calculus II (Math 1338: Fall 2011-Fall 2012, Fall 2013, Spring 2016, Fall 2019)

Linear Algebra (Math 3304 (formerly 3353): Fall 2013, Spring 2014, Fall 2015, Fall 2016-Fall 2018)

Introduction to Proof and Analysis (Math 3311): Fall 2019

Differential Equations (Math 3313): Fall 2020

### Undergraduate (senior)

Functions of a Complex Variable (Math 4339 (formerly 5331): Spring 2012, 2014, 2016, 2017, 2018, 2020)

Introduction to Partial Differential Equations (Math 5334: Fall 2015)

### Graduate

Mathematical Neuroscience (Math 6391: Fall 2012)

Applied Stochastic Differential Equations (Math 6355: Fall 2018, Fall 2020)

## **Mentoring (2011-present)**

### PhD students

Abdullah Saifee, *TBD*, Fall 2020-Spring 2024 (expected)

Duc Truong, *Cell assembly detection in low firing-rate spike trains data*, PhD awarded Summer 2020.

### PhD students - Summer/Rotation Projects

Molly Robinson and Elyssa Sliheet, *Adapting correlation network analysis (WGCNA) for next generation sequencing*, Spring/Summer 2020

Sihao Wang, *A computational model for retinal correlations*, Summer 2017

### PhD students - Committee membership

Yuanning Chen, *Growth and Decay of Solitons Interacting with Rayleigh-Jeans Distributed Waves*, Fall 2018-Spring 2021 (expected)

Sasan Moyhaddin, *Fast Evaluation for Poisson Equation in Three-Dimensional Complex Geometries*, December 2018-Spring 2021 (expected).

Brian City, *TBD*, November 2018-Fall 2020 (expected).

### Undergraduate Research

Roman Stolyarov (Hamilton Scholar), *An efficient and accurate solver for large neural networks*, Fall 2012-Spring 2013 (joint with S. Norris).

Sara Kendrick (Hamilton Scholar), *Statistical correlations in large neural networks*, Fall 2013 (joint with S. Norris).

Arya McCarthy, *Statistical correlations in large neural networks*, Fall 2013-Spring 2014 (joint with S. Norris).

Keon Ebrahimi (Hamilton Scholar), *Mechanisms for higher-order correlations in retinal ganglion cells*, Summer 2015.

Margot Tollefsen (Hamilton Scholar), *Dynamics and computation in near-symmetric random networks*, Fall 2016-Spring 2017.

Andy Lu, *Single-cell neuron models for large-scale computation*, Spring 2018.