

Daniel A. Butts

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Research Positions

- Jan 2009- **Associate Professor of Biology**, *University of Maryland, College Park*. Affiliate faculty with *Institute of Systems Research, Applied Math and Scientific Computation, Biophysics, Neuroscience and Cognitive Science, and Psychology*
- 2006-2008 **Research Faculty**, *Institute of Computational Biomedicine, Weill Medical College of Cornell University*
- 2004-2006 **Postdoctoral Research Fellow**, *Division of Engineering and Applied Science, Harvard University*. PI: Dr. Garrett Stanley
- 2000-2004 **Postdoctoral Research Fellow**, *Department of Neurobiology, Harvard Medical School*. PI: Dr. Carla Shatz
- 1995-2000 **Graduate Research**, *Department of Physics, University of California, Berkeley*. Advisor: Dr. Daniel Rokhsar
- 1994-1995 **Physics Research**, *NKT Research Center (Denmark)*. Supervisor: Jørn Bindslev Hansen
- 1992-1994 **Undergraduate Physics Research** in plasma/fusion physics (California Inst. of Technology), nuclear physics (Notre Dame University), and solid-state theory (Oberlin College)

Education

- 1995-2000 **University of California, Berkeley, CA**
Ph.D. Physics. Thesis: Early development of the visual system
- 1998 **Marine Biological Laboratory, Woods Hole, MA**
Methods in Computational Neuroscience
- 1990-1994 **Oberlin College, Oberlin, OH**
B.A. Physics and Mathematics, Graduation with Highest Honors

Teaching

- *Computational Neuroscience*: original core graduate neuroscience course (2010-present)
- *Neurophysiology of Cells and Circuits*: original upper-level undergraduate course (2014)
- *Cellular Neurophysiology*: upper-level undergraduate course (2010, 2012)

Publications (lab members in **bold**)

- **Whiteway MR, Butts DA** (2017) Revealing unobserved factors underlying cortical activity using a rectified latent variable model applied to neural population recordings. *Journal of Neurophysiology* **117**: 919-36.
- **Cui Y, Wang YV, Demb JB, Butts DA** (2016) Divisive suppression explains high-precision firing and contrast adaptation in retinal ganglion cells. *eLife* **5**: e19460.
- **McFarland JM, Cumming BG, Butts DA** (2016) Variability and correlations in primary visual cortical neurons driven by fixational eye movements. *Journal of Neuroscience* **36**: 6225-41.
- **Butts DA, Cui Y, Casti ARR** (2016) Nonlinear computations shaping visual processing in pre-cortical vision. *Journal of Neurophysiology* **116**: 1344-57.
- **Cui Y, Liu L, McFarland JM, Pack CC, Butts DA** (2016) Inferring cortical variability from local field potentials. *Journal of Neuroscience* **36**: 4121-4135.
- **McFarland JM, Bondy AG, Saunders RC, Cumming BG, Butts DA** (2015) Saccadic modulation of visual cortical processing. *Nature Communications* **6**: 8110.
- **McFarland JM, Bondy AG, Cumming BG, Butts DA** (2014) High-resolution eye tracking using V1 neuron activity. *Nature Communications* **5**: 4605.
- Choi H, Zhang L, Cembrowski MS, **Sabottke CM**, Markowitz A, **Butts DA**, Kath WL, Singer JH, Rieke H (2014) Intrinsic bursting of AII amacrine cells underlies oscillations in the *rd1* mouse retina. *Journal of Neurophysiology* **112**: 1491-504.

- Ahn J, Kreeger LJ, Lubejko ST, **Butts DA**, Macleod KM (2014) Heterogeneity of intrinsic biophysical properties among cochlear nucleus neurons improves the population coding of temporal information. *Journal of Neurophysiology* **111**: 2320-31.
- **Cui Y**, Liu L, Khawaja FA, Pack CC, **Butts DA**. (2013) Diverse suppressive influences in area MT and selectivity to complex motion features. *Journal of Neuroscience* **33**: 16715-28.
- **McFarland JM**, **Cui Y**, **Butts DA** (2013) Inferring nonlinear neuronal computation based on physiologically plausible inputs. *PLoS Computational Biology* **9**: e1003143.
- **Lochmann T**, Blanche TJ, **Butts DA** (2013) Pooling of local features as a basis for direction selectivity in the primary visual cortex. *PLoS One* **8**: e58666.
- **Schinkel-Bielefeld N**, David SV, Shamma SA, **Butts DA** (2012) Inferring the roles of inhibition in auditory processing of natural stimuli. *Journal of Neurophysiology* **107**: 3296-3307.
- Mineault PJ, Khawaja FA, **Butts DA**, Pack CC (2012) Hierarchical processing of complex motion along the primate dorsal visual pathway. *PNAS* **109**: E972-80.
- **Butts DA**, Weng C, Jin J, Alonso JM, Paninski L (2011) Temporal Precision in the Visual Pathway through the Interplay of Excitation and Stimulus-Driven Suppression. *Journal of Neuroscience* **31**: 11313-27.
- Xu HP, Furman M, Minear YS, Chen H, King SL, Zenisek D, Zhou ZJ, **Butts DA**, Tian N, Piccotto MR, Crair MC (2011) An instructive role for patterned spontaneous retinal activity in mouse visual map development. *Neuron* **70**: 1115-27.
- **Butts DA**, Desbordes G, Jin JZ, Weng C, Alonso JM, Stanley GB (2010) The episodic nature of spike trains in the early visual pathway. *Journal of Neurophysiology* **104**: 3371-87.
- **Butts DA**, Kanold PO (2010) The applicability of spike time dependent plasticity to development. *Frontiers in Synaptic Neuroscience* **2**: 30. [invited review]
- **Butts DA**, Weng C, Jin JZ, Yeh CI, Lesica NA, Alonso JM, Stanley GB (2007) Temporal precision in the neural code and the time scales of natural vision. *Nature* **449**: 92-5.
- **Butts DA**, Kanold PO, Shatz CJ (2007) A burst-based “Hebbian” learning rule at retinogeniculate synapses links retinal waves to activity-dependent refinement. *PLoS Biology* **5**: e61.
- Goddard CA, **Butts DA**, Shatz CJ (2007) Requirement for MHC Class I in synaptic scaling. *PNAS* **104**: 6828-6833.
- Lesica NA, Jin JZ, Weng C, Yeh CI, **Butts DA**, Stanley GB, Alonso JM (2007) Adaptation to stimulus contrast and correlations in the early visual pathway during natural stimulation. *Neuron* **55**: 1-13.
- **Butts DA**, Goldman MS (2006) Tuning Curves, Neuronal Variability, and Sensory Coding. *PLoS Biology* **4**: e92. [Featured article in Apr. 2006 Issue]
- Lu HC, **Butts DA**, Kaeser PS, She WC, Janz R, Crair MC (2006) Role of efficient neurotransmitter release in barrel map development. *Journal of Neuroscience* **26**: 2692-703.
- **Butts DA** (2003) What is the information associated with a particular stimulus? *Network: Computation in Neural Systems* **14**: 177-87.
- **Butts DA** (2002) Retinal Waves: Implications for developmental learning rules. *Neuroscientist* **8**: 243-53.
- **Butts DA**, Rokhsar DS (2001) The information content of spontaneous retinal waves. *Journal of Neuroscience* **21**: 961-73.
- **Butts DA**, Feller MB, Shatz CJ, Rokhsar DS (1999) Retinal waves are governed by collective network properties. *Journal of Neuroscience* **19**: 3580-93.
- **Butts DA**, Rokhsar DS (1999) Predicted signatures of rotating Bose-Einstein condensates. *Nature* **397**: 327.
- **Butts DA**, Feller MB, Aaron HL, Shatz CJ, Rokhsar DS (1998) A two-layer model describes the spatiotemporal properties of spontaneous retinal waves. *Computational Neuroscience: Trends in Research* (ed. J. Bower, Plenum Press, New York): 337-42.
- Feller MB, **Butts DA**, Aaron HL, Rokhsar DS, Shatz CJ (1997) Dynamic processes shape spatiotemporal properties of retinal waves. *Neuron* **19**: 293-306.
- **Butts DA**, Rokhsar DS (1997) Trapped Fermi gases. *Physical Review A* **55**: 4346-50.
- Warner RE *et al.* (U. Michigan); **Butts D** *et al.* (Oberlin); Kolata JJ *et al.* (Notre Dame); Galonsky A *et al.* (MSU) (1995) Elastic scattering of 10 MeV ^6He from ^{12}C , $^{\text{nat}}\text{Ni}$, and ^{197}Au . *Physical Review C* **51**: 178.

In preparation

- **Cui Y**, Liu L, **McFarland JM**, Pack CC, **Butts DA**. Delta-band oscillations correlate with perceptual decisions and decision-related activity of sensory neurons.
- **Farias D**, **Cao F**, **Schinkel-Bielefeld NA**, Lesica NA, **Butts DA**. Nonlinear processing of temporal envelope in the inferior colliculus.
- **Rourke OLC**, **Butts DA**. Cortical computations via transient attractors.

Professional Activities

- Program Committee, *Computational and Systems Neuroscience Conference* (2015-present)
- Panelist for NSF *Neuronex Theory Panel* (2017), NIH BRAIN Initiative panels (2015, 2016), NSF/NIH *Collaborative Research in Computational Neuroscience* (6 times between 2004-2016), and NSF *Cyber-enabled Discovery and Innovation* (2009).
- Referee for *Neuron*, *Journal of Neuroscience*, *Nature Neuroscience*, *Current Biology*, *PLoS Biology*, *PLoS Computational Biology*, *Network*, *Journal of Neurophysiology*, and *Nature Communications*.
- Member, Society for Neuroscience (2000-present); American Physiological Society (2013-present)
- Board of Directors, Fenway Community Development Corporation, Boston, MA. 2001-2005

Awards and Honors

- NSF Early Career Award (2014)
- Outstanding Graduate Student Instructor Award, 1997-98
- Elected to Phi Beta Kappa (1993) and Sigma Xi (1994)
- Graduation with Highest Honors in Physics (Oberlin College), 1994
- Robert Weinstock Award in Theoretical Physics (Oberlin College), 1993
- Carl E. Howe Prize in Physics (Oberlin College), 1992

Funding

- NIH R21 (2/2016-1/2018, \$304 K): *Functional specialization of foveal visual cortex*.
- NSF Early Career Award (9/2014-8/2019, \$514 K): *Network modulation of cortical neuron computation*.
- NSF Collaborative Research in Computational Neuroscience Grant (8/2010-7/2014, \$455 K): *Characterizing cortical computation in the context of natural vision*.
- Charles A. King Trust Postdoctoral Fellowship, 2004-2006
- Leonard and Isabelle Goldenson Research Postdoctoral Fellowship, 2003-2004
- NSF Postdoctoral Fellowship in Biological Informatics, 2001-2003
- ARCS Graduate Fellowship, 1997-98