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Education

Columbia University

Center for Theoretical Neuroscience

Ph.D., Neurobiology & Behavior

Degrees: M.A. (2006), M.Phil. (2008), Ph.D. (2009)

Advisor: L. F. Abbott, Ph.D.

Collaborators: Isabel Muzzio, Ph.D., Eric R. Kandel, Ph.D. (2006–8)

New York, NY
2005–9

Brandeis University

Volen Center for Complex Systems

- Graduate Program in Neuroscience, *Continued at Columbia University*

Advisor: L. F. Abbott, Ph.D.

Collaborator: Michael J. Kahana, Ph.D. (2004–6)

Waltham, MA
2003–5

University of Virginia

Laboratory of Computational Neurodynamics

- Degrees: B.A. Cognitive Science; B.A. Mathematics

Advisor: W. B. Levy, Ph.D.

Echols Scholar

Charlottesville, VA
1999–2003

Positions

Johns Hopkins University School of Medicine

Postdoctoral Fellow

- Biomedical Engineering Department

PI: Kechen Zhang, Ph.D.

Collaborators: Hugh T. Blair, Ph.D.; David J. Foster, Ph.D.; Mark N. Wu, Ph.D.

2013–present

Johns Hopkins University

Postdoctoral Fellow

- Zanvyl Krieger Mind/Brain Institute

PI: James J. Knierim, Ph.D.

Collaborator: Kechen Zhang, Ph.D.

2009–13

Publications

Monaco JD, De Guzman RM, Blair HT, and Zhang K. (2019). Spatial synchronization codes from coupled rate-phase neurons. *PLOS Computational Biology*. doi: 10.1371/journal.pcbi.1006741.

Tabuchi M, **Monaco JD**, Duan G, Bell BJ, Liu S, Zhang K, and Wu MN. (2018). Clock-generated temporal codes determine synaptic plasticity to control sleep. *Cell*, 175(5), 1213–27. doi: 10.1016/j.cell.2018.09.016.

Monaco JD, Rao G, Roth ED, and Knierim JJ. (2014). Attentive scanning behavior drives one-trial potentiation of hippocampal place fields. *Nature Neuroscience*, 17(5), 725–731. doi: 10.1038/nn.3687.

Monaco JD, Knierim JJ, and Zhang K. (2011). Sensory feedback, error correction, and remapping in a multiple oscillator model of place cell activity. *Frontiers in Computational Neuroscience*, 5:39. doi: 10.3389/fncom.2011.00039.

Monaco JD and Abbott LF. (2011). Modular realignment of entorhinal grid cell activity as a basis for hippocampal remapping. *Journal of Neuroscience*, 31(25), 9414–25. doi: 10.1523/jneurosci.1433-11.2011.

Muzzio IA, Levita L, Kulkarni J, **Monaco J**, Kentros CG, Stead M, Abbott LF, and Kandel ER. (2009). Attention enhances the retrieval and stability of visuospatial and olfactory representations in the dorsal hippocampus. *PLoS Biology*, 7(6), e1000140. doi: 10.1371/journal.pbio.1000140.

Monaco JD, Abbott LF, and Kahana MJ. (2007). Lexico-semantic structure and the recognition word-frequency effect. *Learning & Memory*, 14(3), 204–213. doi: 10.1101/lm.363207.

Monaco JD and Levy WB. (2003). T-maze training of a recurrent CA3 model reveals the necessity of novelty-based modulation of LTP in hippocampal region CA3. *Proceedings of the International Joint Conference on Neural Networks*, 1655–1660. doi: 10.1109/IJCNN.2003.1223655.

Preprints

Monaco JD, Blair HT, and Zhang K. (2017). Spatial theta cells in competitive burst synchronization networks: Reference frames from phase codes. *bioRxiv*. doi: 10.1101/211458.

Thesis

Monaco JD. (2009). Models and mechanisms for integrating cortical feature spaces. Ph.D. Dissertation, Columbia University. *ProQuest Publication No. AAT 3393609*.

Funding

- NSF/NCS FOUNDATIONS (BRAIN Initiative) Award No. 1835279, 2018–2020
 - *NCS-FO: Spatial intelligence for swarms based on hippocampal dynamics*
 - **PI:** Kechen Zhang, **Co-PIs:** Grace Hwang (JHU/APL); Robert W. Chalmers (JHU/APL), and Kevin Schultz (JHU/APL); **Research Associate:** Joseph D. Monaco
- NIH/NINDS R03 Award No. NS109923–01, 2018–2020
 - *Spiking network models of sharp-wave ripple sequences with gamma-locked attractor dynamics*
 - **PI:** Kechen Zhang; **Research Associate:** Joseph D. Monaco
- Johns Hopkins Discovery Award, 2018–2019
 - *A dynamical systems approach to understanding the neural computations underlying our sense of direction*
 - **PIs:** Kathleen Cullen, James J. Knierim, and Kechen Zhang; **Research Associate:** Joseph D. Monaco
- Johns Hopkins Science of Learning Institute Award, 2016–2018
 - *Learning to explore paths through space*
 - **PI:** Kechen Zhang, **Co-PI:** David J. Foster, **Research Associate:** Joseph D. Monaco

Presentations

Talks

Joseph Monaco, “Hippocampal circuits for space, memory, and navigation: From minimal models to biologically inferred networks.” *Invited Talk*. Department of Pharmacology, University of Maryland, Baltimore, MD. January 22, 2016.

Joseph Monaco, “Stopping to look: How attentive scanning behavior reveals the formation of new memories.” *Research Talk*. Neuroscience Department, Johns Hopkins University, St. Michaels, MD. September 6, 2014.

Joseph Monaco, “Landmark influence: How attention to sensory cues stabilizes and updates the hippocampal cognitive representation of space.” *Advanced Researcher Seminar*. Krieger Mind/Brain Institute, Johns Hopkins University, Baltimore, MD. April 21, 2014.

Joseph Monaco, “Head scans drive the formation and potentiation of place fields during exploration.” *Data Blitz*. Winter Conference on Learning & Memory, Park City, UT. January 3, 2014.

Joseph Monaco, “Medial versus lateral modes for reconfiguring hippocampal representations.” *Grid Cells: Formation and Function*. Gatsby Computational Neuroscience Unit, UCL, UK. July 1, 2010.

Joseph Monaco, “Rapid spatial map formation and remapping by competing over grid cell inputs.” *Thesis Seminar*. Columbia University Medical Center, New York, NY. April 10, 2009.

Posters

Hwang GM, Schultz K, **Monaco JD**, Chalmers RW, Lau SW, Yeh BY, and Zhang K. (2018). Self-organized swarm control using neural principles of spatial phase coding. *Society for Neuroscience 2018*. San Diego, CA. November 2018.

Monaco J, Blair HT, and Zhang K. (2017). Decoding septohippocampal theta cells during exploration reveals unbiased environmental cues in firing phase. *Society for Neuroscience 2017*. Washington, D.C. November 2017.

Monaco JD, Blair HT, and Zhang K. (2015). Spatial rate/phase correlations in theta cells can stabilize randomly drifting path integrators. *COSYNE 2015*. Salt Lake City, UT. March 2015.

Monaco J, Blair HT, and Zhang K. (2014). Spatial rate/phase codes provide landmark-based error correction in a temporal model of theta cells. *Society for Neuroscience 2014*, 752.07/UU25. Washington, D.C. November 2014.

Wang CH, Rao G, **Monaco JD**, Deshmukh SS, and Knierim JJ. (2014). Potentiation of place fields along the CA1 transverse axis by investigatory head-scanning behavior. *Society for Neuroscience 2014*, 848.15/UU30. Washington, D.C. November 2014.

Monaco J, Rao G, and Knierim JJ. (2013). Scanning behavior in novel environments promotes *de novo* formation of hippocampal place fields in rats. *Society for Neuroscience 2013*, 670.07/JJJ44. San Diego, CA. November 2013.

Monaco J, Rao G, and Knierim JJ. (2012). Hippocampal LFP during rodent head-scanning behavior: Theta and sharp-wave ripples. *Society for Neuroscience 2012*, 812.14/FFF24. New Orleans, LA. October 2012.

Monaco J, Rao G, and Knierim JJ. (2011). Hippocampal place cell firing during head-scanning movements is associated with the formation of new place fields. *Society for Neuroscience 2011*, 97.13/WW28. Washington, D.C. November 2011.

Rao G, **Monaco J**, and Knierim JJ. (2011). Environmental novelty promotes rodent head-scanning behavior linked to enhanced entorhinal activity. *Society for Neuroscience 2011*, 97.12/WW27. Washington, D.C. November 2011.

Monaco JD, Zhang K, Blair HT and Knierim JJ. (2010). Cue-based feedback enables remapping in a multiple oscillator model of place cell activity. *COSYNE 2010*. Salt Lake City, UT. February 2010.

Monaco JD and Abbott LF. (2009). Dynamic hippocampal remapping using recurrent inhibition on realigning grid cell inputs. *COSYNE 2009*. Salt Lake City, UT. February 2009.

Monaco JD, Muzzio IA, Levita L and Abbott LF. (2006). Entorhinal input and global remapping of hippocampal place fields. *CNS 2006*. Edinburgh, UK. July 2006.

Monaco JD and Abbott LF. (2006). Entorhinal input and the remapping of hippocampal place fields. *COSYNE 2006*. Salt Lake City, UT. March 2006.

Monaco JD and Levy WB. (2003). T-maze training of a recurrent CA3 model reveals the necessity of novelty-based modulation of LTP in hippocampal region CA3. *IJCNN 2003*. Portland, OR. July 2003.

Monaco JD and Perlestein RP. (1997). Monte-Carlo analysis of deoxyhypusine synthase inhibitor ligand conformations. *NIH Poster Day*. Bethesda, MD. August 1997.

Professional

- Neuron, *Ad hoc reviewer*
- Neural Computation, *Ad hoc reviewer*

- PeerJ, *Ad-hoc reviewer*
- PLOS ONE, *Ad hoc reviewer*
- IEEE Transactions in Biomedical Engineering, *Ad-hoc reviewer*
- IEEE/INNS Neural Networks, *Ad-hoc reviewer*
- Neuroscience, *Ad-hoc reviewer*
- Neurocomputing, *Ad-hoc reviewer*
- Biological Cybernetics, *Ad-hoc reviewer*
- COSYNE 2016, *Review committee*
- Society for Neuroscience, *Postdoc Member (2011–present)*

Mentoring/Teaching

- Chia-Hsuan Wang, *Graduate student, Johns Hopkins University (2013–5)*
- Manning Zhang, *Undergraduate student, Shanghai Jiao Tong University (Summer 2014)*
- Teaching Assistant, *Biology Laboratory, Brandeis University (Spring 2005)*
- Teaching Assistant (for Eve Marder), *Introduction to Neuroscience, Brandeis University (Fall 2004)*

Awards

- IEEE/INNS IJCNN Student Paper Competition, First Place (2003)
- University of Virginia John A. Harrison III Undergraduate Research Award (2002)
- Echols Scholar at the University of Virginia (1999–2003)
- Pre-university: Maryland Distinguished Scholar (1999), Johns Hopkins Mathematics Competition (2nd Place Individual Calculus, 1999), National Merit Scholarship Commended Student, AP Scholar with Distinction, State of Maryland Merit Scholastic Award