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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 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

1 Preprints

Monaco JD, Blair HT, and Zhang K. (2017). Spatial theta cells in competitive burst synchronization networks: Reference frames from phase codes¹. bioRxiv 211458; doi: 10.1101/211458

2 Publications

Monaco JD, Blair HT, and Zhang K. (under review). Spatial synchrony of coupled firing rate and theta phase in hippocampal-septal circuits. PLOS Computational Biology.

Tabuchi M, Monaco JD, Duan G, Bell BJ, Liu S, Zhang K, and Wu MN. (in press). Clock-Generated Temporal Codes Determine Synaptic Plasticity to Control Sleep. Cell.

¹<https://www.biorxiv.org/content/early/2017/10/30/211458>

Monaco JD, Rao G, Roth ED, and Knierim JJ. (2014). Attentive scanning behavior drives one-trial potentiation of hippocampal place fields². *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 activity³. *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 remapping⁴. *Journal of Neuroscience*, 31(25), 9414–25.

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 hippocampus⁵. *PLoS Biology*, 7(6), e1000140.

Monaco JD, Abbott LF, and Kahana MJ. (2007). Lexico-semantic structure and the recognition word-frequency effect⁶. *Learning & Memory*, 14(3), 204–213.

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 CA3⁷. *Proceedings International Joint Conference on Neural Networks*, 1655–1660.

3 Thesis

Monaco JD. (2009). Models and mechanisms for integrating cortical feature spaces⁸. Ph.D. Dissertation, Columbia University. ProQuest Publication No. AAT 3393609.

4 Funding

- NSF/NCS 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 R03 NS109923–01 (Pending), 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 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

²<http://www.nature.com/neuro/journal/v17/n5/full/nn.3687.html>

³<http://www.frontiersin.org/computational%20neuroscience/10.3389/fncom.2011.00039/abstract>

⁴<http://www.jneurosci.org/content/31/25/9414>

⁵<http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000140>

⁶<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1838560>

⁷http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1223655&tag=1

⁸<http://gradworks.umi.com/33/93/3393609.html>

5 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.” *Retreat 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 space⁹.” *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.¹⁰” 38th Annual Winter Conference on Neurobiology of Learning & Memory, Park City, UT. January 3, 2014. [slide¹¹]
- **Joseph Monaco**, “Medial versus lateral modes for reconfiguring hippocampal representations.¹²” 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.¹³” Thesis Seminar. Columbia University Medical Center, New York, NY. April 10, 2009. [figshare¹⁴]

6 Poster Presentations

- **Monaco JD**, Blair HT, and Zhang K. (2015). Spatial rate/phase correlations in theta cells can stabilize randomly drifting path integrators¹⁵. Cosyne 2015. Salt Lake City, UT. March 2015. [poster¹⁶, paper¹⁷]
- **Monaco J**, Blair HT, and Zhang K. (2014). Spatial rate/phase codes provide landmark-based error correction in a temporal model of theta cells¹⁸. Society for Neuroscience 2014, 752.07/UU25. Washington, D.C. November 2014. [poster¹⁹, figshare²⁰, github²¹]
- 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 behavior²². 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 rats²³. Society for Neuroscience 2013, 670.07/JJJ44. San Diego, CA. November 2013. [pdf²⁴]

⁹<http://jdmonaco.com/files/mbi-seminar-abstract.pdf>

¹⁰<http://www.nyu.edu/projects/neurobio-winterconf/>

¹¹<http://jdmonaco.com/files/ScanningSlide.pdf>

¹²<http://www.gatsby.ucl.ac.uk/workshopjune2010/abstractmonaco.htm>

¹³<http://calendar.columbia.edu/sundial/webapi/get.php?vt=detail&id=31847&con=standalone&br=cumc>

¹⁴<http://dx.doi.org/10.6084/m9.figshare.693750>

¹⁵http://www.cosyne.org/c/index.php?title=Cosyne2015_posters_3

¹⁶<http://jdmonaco.com/files/monaco-poster-cosyne15.pdf>

¹⁷<http://jdmonaco.com/files/monaco-paper-cosyne15.pdf>

¹⁸<http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=973d2662-ba7a-4ad2-aff9-fe0d4b77c262&cKey=9917ffaf-9e31-4213-acb9-4aab498ab4cd&mKey=54c85d94-6d69-4b09-afaa-502c0e680ca7>

¹⁹http://jdmonaco.com/files/landmark_poster_sfn14.pdf

²⁰<http://dx.doi.org/10.6084/m9.figshare.1249615>

²¹<http://github.com/jdmonaco/lcomodel>

²²<http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=bf59866-8deb-44a6-9515-a7aab630507b&cKey=d201b3aa-7725-452e-b0dd-c41d204b5b54&mKey=54c85d94-6d69-4b09-afaa-502c0e680ca7>

²³<http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=32eccac1-4e1d-4e81-bf5c-f39bcb605757&cKey=4710dece-cc8e-4b48-8764-49ea174b91ef&mKey=8d2a5bec-4825-4cd6-9439-b42bb151d1cf>

²⁴http://jdmonaco.com/files/scanning_poster_sfn13.pdf

- **Monaco J**, Rao G, and Knierim JJ. (2012). Hippocampal LFP during rodent head-scanning behavior: Theta and sharp-wave ripples²⁵. Society for Neuroscience 2012, 812.14/FFF24. New Orleans, LA. October 2012. [poster²⁶]
- **Monaco J**, Rao G, and Knierim JJ. (2011). Hippocampal place cell firing during head-scanning movements is associated with the formation of new place fields²⁷. Society for Neuroscience 2011, 97.13/WW28. Washington, D.C. November 2011. [poster²⁸]
- Rao G, **Monaco J**, and Knierim JJ. (2011). Environmental novelty promotes rodent head-scanning behavior linked to enhanced entorhinal activity²⁹. Society for Neuroscience 2011, 97.12/WW27. Washington, D.C. November 2011. [poster³⁰]
- **Monaco JD**, Zhang K, Blair HT and Knierim JJ. (2010). Cue-based feedback enables remapping in a multiple oscillator model of place cell activity³¹. COSYNE 2010. Salt Lake City, UT. February 2010. [poster³²]
- **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 Perlstein RP. (1997). Monte-Carlo analysis of deoxyhypusine synthase inhibitor ligand conformations. NIH Poster Day. Bethesda, MD. August 1997.

7 Professional

- COSYNE 2016, *Review committee*
- Neural Computation, *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*
- Society for Neuroscience, *Postdoc Member (2011–present)*

²⁵<http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=f5b9fa94-7d15-48c7-9d67-b89cd2883025&cKey=a53349ca-41b1-4664-b022-85d0d1fe59b8&mKey=%7b70007181-01C9-4DE9-A0A2-EEBFA14CD9F1%7d>

²⁶http://jdmonaco.com/files/scanning_poster_sfn12.pdf

²⁷<http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=c48e9f5f-1274-4486-85bf-38ee591629e1&cKey=190bd951-c183-428d-a4c5-01eb61556d79&mKey=%7b8334BE29-8911-4991-8C31-32B32DD5E6C8%7d>

²⁸http://jdmonaco.com/files/scanning_poster_sfn11.pdf

²⁹<http://www.abstractsonline.com/Plan/ViewAbstract.aspx?sKey=c48e9f5f-1274-4486-85bf-38ee591629e1&cKey=3ec26e6f-8c59-4be2-bad3-e1572d75e07e&mKey=%7b8334BE29-8911-4991-8C31-32B32DD5E6C8%7d>

³⁰http://jdmonaco.com/files/rao_monaco_knierim_sfn11.pdf

³¹http://www.frontiersin.org/10.3389/conf.fnins.2010.03.00192/event_abstract

³²http://jdmonaco.com/files/oscillator_poster_cosyne10.pdf

8 Mentoring/Teaching

- Chia-Hsuan Wang, *Graduate student, Johns Hopkins University (2013–2015)*
- 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)*

9 Awards

- IJCNN Student Paper Competition, First Place (2003)
- John A. Harrison III Undergraduate Research Award (U.Va., 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