Kimberly Lauren Stachenfeld

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Education

June 2018 — Princeton University
Ph.D. Quantitative & Computational Neuroscience
Advisor: Dr. Matthew Botvinick

Dissertation: *Learning Neural Representations that Support Efficient Reinforcement Learning*

May 2013 — Tufts University
B.S. Chemical & Biological Engineering
B.A. Mathematics

Positions

2023 – present	Adjunct Assistant Professor, Center for Theoretical Neuroscience, Mortimer B. Zuckerman Mind Brain Behavior Institute, Department of Neuroscience, Columbia University
2016 – present	Senior Research Scientist, Google DeepMind
2015	Research Science Intern, DeepMind
2012	Research Assistant, Computational Neurobiology Lab, Yale School of Medicine
2011	Intern, Analytical Research & Development, Pfizer, Inc.
2010 – 2011	Research Assistant, Tissue & Metabolic Engineering Lab, Tufts University

Awards

- 2019 MIT Technology Review 35 Under 35. Link.
- 2014 WiML (Women in Machine Learning) Travel Grant to attend NeurIPS 2014 WiML Workshop.
- 2014 Google Travel Grant to attend NeurIPS 2014.
- 2014 NSF Graduate Research Fellowship Program (GRFP) Honorable Mention.
- 2012 Tau Beta Pi (Engineering Honor Society).
- 2012 Meritorious Award in COMAP International Mathematical Contest in Modeling.

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- 2010 Karno Dean's Award for Academic Excellence and Leadership. Tufts University.

Journal Articles

Full list of publications can be found on Google Scholar.

Jonathan Kasdin, Alison Duffy, Nathan Nadler, Arnav Raha, Adrienne L. Fairhall, Kimberly L. Stachenfeld, Vikram Gadagkar (2025). Natural behaviour is learned through dopamine-mediated reinforcement. *Nature*. article.

Lennart Luettgau, Tore Erdmann, Sebastijan Veselic, Kimberly L Stachenfeld, Zeb Kurth-Nelson, Rani Moran, Raymond J Dolan (2024). Decomposing dynamical subprocesses for compositional generalization. *PNAS*. article.

Jesse P. Geerts, Samuel J. Gershman, Neil Burgess, Kimberly L. Stachenfeld (2023). A probabilistic successor representation for context-dependent prediction. *Psychological Review.*

Tom George, Will de Cothi, Claudia Clopath*, Kimberly L. Stachenfeld*, Caswell Barry* (2023). RatInABox: A toolkit for modelling locomotion and neuronal activity in continuous environments. *eLife.*

Tom George, Will de Cothi, Kimberly L. Stachenfeld, Caswell Barry (2023). Rapid approximation of Successor Representations with STDP and theta phase precession. *eLife.*

LT Hunt, ND Daw, P Kaanders, MA MacIver, U Mugan, E Procyk, AD Redish, E Russo, J Scholl, KL Stachenfeld, CRE Wilson, N Kolling. (2021). Formalizing planning and information search in naturalistic decision-making. *Nature Neuroscience.* article.

Daniel C. McNamee, Kimberly L. Stachenfeld, Matthew M. Botvinick, Samuel J. Gershman. (2021). Flexible modulation of sequence generation in the entorhinal–hippocampal system. *Nature Neuroscience* **24**(6): 851—862. article.

Jesse P. Geerts, Fabian Chersi, Kimberly L. Stachenfeld, Neil Burgess. (2020). A general model of hippocampal and dorsal striatal learning and decision making. *PNAS* **117**(49): 31427—31437. article.

Timothy E. J. Behrens, Timothy H. Muller, James C.R. Whittington, Shirley Mark, Alon B. Baram, Kimberly L. Stachenfeld, Zeb Kurth-Nelson. (2018). What is a cognitive map? Organising knowledge for flexible behavior. *Neuron* **100**(2): 490–509. article, preprint.

Jeremy Manning, Xia Zhu, Theodore L. Willke, Rajesh Ranganath, Kimberly L. Stachenfeld, Uri Hasson, David M. Blei, Kenneth A. Norman. (2018). A probabilistic approach to discovering dynamic full-brain functional connectivity patterns. *NeuroImage* **180**(A):243—252. article, preprint.

Kimberly L. Stachenfeld, Matthew M. Botvinick, & Samuel J. Gershman. (2017). The hippocampus as a predictive map. *Nature Neuroscience* **20**: 1643–165. article, preprint.

Refereed Conference Proceedings

Full list of publications can be found on Google Scholar.

Pablo Samuel Castro, Nenad Tomasev, Ankit Anand, Navodita Sharma, Rishika Mohanta, Aparna Dev, Kuba Perlin, Siddhant Jain, Kyle Levin, Noémi Éltető, Will Dabney, Alexander Novikov, Glenn C Turner, Maria K Eckstein, Nathaniel D Daw, Kevin J Miller*, Kimberly L

Stachenfeld*. Discovering Symbolic Cognitive Models from Human and Animal Behavior, *ICML*, 2025 bioRxiv.

Samuel Lippl, Kim Stachenfeld. When does compositional structure yield compositional generalization? a kernel theory. *ICLR*, 2025. arXiv.

Yulia Rubanova, Tatiana Lopez-Guevara, Kelsey R Allen, William F Whitney, Kimberly Stachenfeld*, Tobias Pfaff*. Learning rigid-body simulators over implicit shapes for large-scale scenes and vision, NeurIPS, 2024. arXiv. **Oral**.

Ching Fang, Kimberly L Stachenfeld. Predictive auxiliary objectives in deep RL mimic learning in the brain, *ICLR*, 2024. arXiv. **Oral.**

Kelsey R. Allen*, Tatiana Lopez-Guevara*, Kimberly Stachenfeld*, Alvaro Sanchez-Gonzalez, Peter Battaglia, Jessica Hamrick, Tobias Pfaff. Inverse Design for Fluid-Structure Interactions using Graph Network Simulators, *NeurIPS 2023*. arXiv.

William F Whitney, Tatiana Lopez-Guevara, Tobias Pfaff, Yulia Rubanova, Thomas Kipf, Kim Stachenfeld, Kelsey R Allen. Learning 3D Particle-based Simulators from RGB-D Videos, *ICLR*, 2024. arXiv.

Marin Vlastelica, Tatiana López-Guevara, Kelsey Allen, Peter Battaglia, Arnaud Doucet, Kimberley Stachenfeld. Diffusion Generative Inverse Design, 2023, ICML workshop on Structured Probabilistic Inference & Generative Modeling. arXiv.

Kimberly L. Stachenfeld, Alvaro Sanchez-Gonzalez*, Drummond B. Fielding, Dmitrii Kochkov, Miles Cranmer, Tobias Pfaff, Jonathan Godwin, Can Cui, Shirley Ho, Peter Battaglia. Learning General-Purpose CNN-based Simulators for Astrophysical Turbulence. *Workshop on Deep Learning for Simulation, ICLR*, 2021. Link. **Contributed talk.**

Kimberly L. Stachenfeld, Jonathan Godwin, Peter Battaglia. Graph Networks with Spectral Message Passing. *Workshop on Interpretable Inductive Biases and Physically Structured Learning, NeurIPS, 2020*. arXiv. **Contributed talk.**

Jesse Geerts, Kimberly L. Stachenfeld, Neil Burgess. Probabilistic Successor Representations with Kalman Temporal Differences. *Cognitive Computational Neuroscience*, 2019. arXiv.

Victor Bapst, Alvaro Sanchez-Gonzalez, Omar Shams, Kimberly L. Stachenfeld, Peter W Battaglia, Satinder Singh, Jessica B Hamrick. (2019). Object-oriented state editing for HRL. *Workshop on Perception as Generative Reasoning, NeurIPS*. arXiv.

Victor Bapst, Alvaro Sanchez-Gonzalez, Carl Doersch, Kimberly L. Stachenfeld, Pushmeet Kohli, Peter W. Battaglia, Jessica B. Hamrick. Structured Agents for Physical Construction. *International Conference on Machine Learning (ICML),* 2019. arXiv.

David Pfau, Stig Petersen, Ashish Agarwal, David G. T. Barrett, Kimberly L. Stachenfeld. (2019). Spectral Inference Networks: Unifying Deep and Spectral Learning. In *International Conference on Learning Representations (ICLR),* 2019. arXiv.

Kimberly L. Stachenfeld, Matthew M. Botvinick, & Samuel J. Gershman. Design principles of the hippocampal cognitive map. *Advances in Neural Information Processing Systems (NeurIPS), 2014*. Link. **Spotlight presentation.**

**Authors contributed equally*

Podcasts

- Brain Inspired podcast, by The Transmitter. 2024.
- Super Data Science: ML & AI Podcast with Jon Krohn. 2024.
- DataFramed podcast with Richie Cotton. 2024.

- Of Brains and Machines by Carry the One Radio. 6 July 2020.
- Mind over Matter. GSN Munich podcast with Ekaterina Sytnik. 22 April 2019.

Press + Outreach

- The new NeuroAI. Editorial by Nature Machine Intelligence. 22 March 2024.
- Several brain regions help us anticipate what's going to happen next by PNAS. 30 April 2021.
- EmTech by MIT Technology Review. 18 September 2019.
- What is AI Anyway? AI panel at Cheltenham Science Festival. 8 June 2019.
- A Hexagonal Theory of Memory. The Atlantic (reprint of Quanta article). 18 January 2019.
- The Brain Maps Out Ideas and Memories Like Spaces. Quanta Magazine. 14 January 2019.
- The Surprising Relativism of the Brain's GPS. Nautilus. 22 March 2018.
- The hippocampus as a 'predictive map'. DeepMind Blog. 2 October 2017.
- DeepMind's New Way to Think About the Brain Could Improve How AI Makes Plans. MIT Technology Review. 3 October 2017.

Ad hoc Reviewer

Journals	Nature, Neuron, Nature Communications, Scientific Reports, eLife, PLOS Computational Biology, Hippocampus, IEEE Transactions on Neural Networks and Learning Systems
Conferences	CoSyNe, ICML, NeurIPS, ICLR, UAI, RLDM, CCN

Organization

2026	Program Chair, Cosyne 2026
2025	Organizer, IT'S ALL CONNECTED: Graph approaches to geometric complexity in neuroscience, Cosyne Workshop
2025	Undergraduate Travel Award Chair, Cosyne '25
2024	Organizer, UniReps: Unifying Representations in Neural Models, NeurIPS Workshop
2024	Communications Chair, Cognitive Computational Neuroscience (CCN) 24
2025	Undergraduate Travel Award Chair, Cosyne '24
2023	Communications Chair, Cognitive Computational Neuroscience (CCN) '23
2022	Communications Rising Chair, Cognitive Computational Neuroscience (CCN) '22
2022	Program Committee, Reinforcement Learning & Decision-Making (RLDM) 2022
2021	Co-Organizer, How does the brain combine generative models and direct discriminative computations in high-level vision? CCN GAC Workshop '21
2020	Organizer, Structure learning: graphs, manifolds, and geometries, Cosyne Workshop
2019	Organizer, Generative Modeling & Model-Based reasoning for Robotics and AI, ICML Workshop
2018	Organizer, Model-Based Cognition: Model-Based Cognition: Hierarchical Reasoning and Sequential Planning, Cosyne Workshop
2015	Organizer, Princeton Neuroscience Department Retreat

Teaching

Aug 2023	Keynote + Tutorial, Cognitive Computational Neuroscience.
July 2023	Reinforcement Learning Lecture, Cajal Course on Machine Learning in Neuroscience.
Mar 2023	Reinforcement Learning, Cosyne Tutorial.
Sep 2022	RL Tutorial, Barcelona Summer School for Advanced Modeling of Behavior
Dec 2020	Guest Lecture, SWC Graduate Course in Neuroscience, UCL
Sep 2019	Tutorial, Representing States & Spaces, Cognitive Computational Neuroscience. Video.
Aug 2019	Pop-up PI, Tutorial + Lab, Methods in Neuroscience at Dartmouth, Summer School. Lecture.
Spring 2015	Teaching Assistant, NEU259: Intro to Cognitive Neuroscience, Princeton University
Fall 2014	Teaching Assistant, NEU258: Fundamentals of Neuroscience, Princeton University
Fall 2014	Instructor, Math 135 & 37, Prison Teaching Initiative, Princeton University In an NJ university? Get involved!
2010 – 2012	Tutor, Physics, Chemistry, & Calculus, Academic Resource Center, Tufts University

Students

Dec 2020 – present	Tom George, PhD Student, UCL (Secondary Advisor)
Mar 2018 – 2021	Jesse Geerts, PhD Student, UCL (Tertiary Advisor)

Mentoring

2019 – 2021	Mentor, DeepMind Scholars Program
2021	LatinX in AI Mentorship Program
2020	Neuromatch Academy Mentor
2012	Engineers, Tufts Chemical & Biological Engineering Senior Mentor

Beyond Science

Martial Arts. Blackbelts in Tae Kwon Do (2009—15, 1st dan) & Isshinryu Karate (1998—2009, 3rd dan)

Painting & drawing. I especially like life drawing, aka drawing people.

Going outside. I like running, hiking, trekking, canyoning, and skiing, particularly with friends.