Katie Ferguson

Curriculum Vitae

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Google Scholar

Education and Academic Experience

2025-2026 **Visiting Scholar**, Yale School of Medicine, Department of Neuroscience, New Haven, CT, USA

2021-2024 **Associate Research Scientist**, Yale School of Medicine, Department of Neuroscience, New Haven, CT, USA

advisor Dr. Jessica Cardin

2015-2021 **Postdoctoral Associate**, Yale School of Medicine, Department of Neuroscience, New Haven, CT, USA

advisor Dr. Jessica Cardin

2009-2015 **PhD in Physiology, Specialization in Neuroscience**, University of Toronto, Faculty of Medicine, and Krembil Research Institute (UHN), Toronto, ON, Canada

thesis title *Mathematical models provide insight into the role of interneurons in hippocampal CA1 network theta rhythm generation*

advisor Dr. Frances K. Skinner

2007-2009 **Master of Mathematics, Applied Mathematics**, University of Waterloo, Faculty of Mathematics, Waterloo, ON, Canada

thesis title *A model of CA1 hippocampal neurons with astrocytic input*

advisor Dr. Sue Ann Campbell

2000-2006 **Honours Bachelor of Mathematics, Applied Mathematics, Co-op**, University of Waterloo, Faculty of Mathematics, Waterloo, ON, Canada
Minor: Psychology.

Scientific Consulting

2025-2026 **Neuroscience Domain Expert (Consultant)**, *Mercor*

Audited and validated "Deep Research" LLMs, evaluating reasoning on experimental design, causal inference, and data interpretation to ensure alignment with rigorous systems neuroscience standards.

Grants, Fellowships, and Awards

2019-2023 K99 NIH Pathway to Independence Award (from the National Eye Institute, NEI)

2018-2020 BBRF Young Investigator Grant (formerly known as NARSAD Young Investigator Grant)

2016-2017 James Hudson Brown - Alexander B. Coxe Fellowship

2014-2015 Ontario Graduate Scholarship

2013-2014 Ontario Graduate Scholarship

2011-2013 Canada Graduate Scholarship, from the Natural Sciences and Engineering Research Council of Canada (NSERC)

2011-2012 Ontario Graduate Scholarship (*declined*)

2009-2010 Ontario Graduate Scholarships in Science and Technology (OGSST)

2009-2010 University of Toronto Fellowship

2015 Marine Biological Laboratory, Neural Systems and Behavior Scholarship

2015 University of Toronto Brain Platform Day Poster Award

2014 Marine Biological Laboratory, Neurobiology Scholarship

(2011-2013) Organization for Computational Neurosciences Travel Award

2013 Toronto Western Research Institute Research Day Oral Presentation Award

2012 Office of Research Trainees Conference Travel Award

2012 Toronto Western Research Institute Research Day Poster Award

2012 Frontiers in Physiology Poster Award

2011 School of Graduate Studies Conference Grant

2011 Organization for Computational Neurosciences Poster Award

Publications

Google Scholar Profile:
`https://scholar.google.com/citations?user=ALrY-XUAAAAJ&hl=en`

In prep **K.A. Ferguson**, A. Wang, S. Sun, J.A. Cardin. Inhibitory regulation of gain modulation in visual processing.

C. Fang, **K.A. Ferguson**, J.A. Cardin. Diversity of visual processing across subpopulations of somatostatin interneurons.

Journal Articles A. Wang*, **K.A. Ferguson***, J. Gupta, V. Fan, S. Sun, D. Barson, M.J. Higley, J.A. Cardin (2025). Delayed integration of somatostatin interneurons into visual circuits. *Nature Communications*. 16, 9633. `https://doi.org/10.1038/s41467-025-64628-z`. (*authors contributed equally).

K.A. Ferguson, J. Salameh, C. Alba, H. Selwyn, C. Barnes, S. Lohani and J.A. Cardin (2023). VIP interneurons regulate cortical size tuning and visual perception. *Cell Reports*. 42(9): 113088. `https://doi.org/10.1016/j.celrep.2023.113088`

K.A. Ferguson and J.A. Cardin (2020). Mechanisms underlying gain modulation in the cortex. *Nature Reviews Neuroscience*. 21: 80–92. `https://doi.org/10.1038/s41583-019-0253-y`

R. Batista-Brito, M. Vinck, **K.A. Ferguson**, J.T. Chang, D. Laubender, G. Lur, J.M. Mossner, V.G. Hernandez, C. Ramakrishnan, K. Deisseroth, M.J. Higley, J.A. Cardin (2017). Developmental dysfunction of VIP interneurons impairs cortical circuits. *Neuron*. 95(4): 884-895. `https://doi.org/10.1016/j.neuron.2017.07.034`

K.A. Ferguson, A.P. Chatzikalymniou, F.K. Skinner (2017). Combining theory, model, and experiment to explain how intrinsic theta rhythms are generated in an in vitro whole hippocampus preparation without oscillatory inputs. *eNeuro.* 4(4) ENEURO.0131-17.2017. https://doi.org/10.1523/ENEURO.0131-17.2017

C.Y.L. Huh, B. Amilhon, **K.A. Ferguson**, J.P. Peach, F. Manseau, F.K. Skinner, S, Williams (2016). Excitatory inputs determine phase-locking strength and spike-timing of CA1 stratum oriens/alveus parvalbumin and somatostatin interneurons during intrinsically generated hippocampal theta rhythm. *Journal of Neuroscience.* 36(25): 6605-6622. https://doi.org/10.1523/JNEUROSCI.3951-13.2016

R. Hu, **K.A. Ferguson**, C. Whiteus, D. Meijer, R. Araneda (2016). Hyperpolarization-activated currents and subthreshold resonance in granule cells of the olfactory bulb. *eNeuro* 3(5). https://doi.org/10.1523/eneuro.0197-16.2016

K.A. Ferguson[*], F. Njap[*], W. Nicola[*], S.A. Campbell, and F.K. Skinner (2015). Examining the limits of cellular adaptation bursting mechanisms in biologically-based excitatory networks of the hippocampus. *Journal of Computational Neuroscience.* 39(3): 289-309. https://www.ncbi.nlm.nih.gov/pubmed/26464038 ([*]authors contributed equally)

K.A. Ferguson, C.Y.L. Huh, B. Amilhon, F. Manseau, S. Williams, and F.K. Skinner (2015). Network models provide insights into how oriens–lacunosum-moleculare and bistratified cell interactions influence the power of local hippocampal CA1 theta oscillations. *Frontiers in Systems Neuroscience* 9:110. https://doi.org/10.3389/fnsys.2015.00110

K.A. Ferguson, C.Y.L. Huh, B. Amilhon, S. Williams, and F.K. Skinner (2014). Simple biologically-constrained CA1 pyramidal cell models using an intact, whole hippocampus context. *F1000Research* **3**:104. https://doi.org/10.12688/f1000research.4170

K.A. Ferguson, C.Y.L. Huh, B. Amilhon, S. Williams, and F.K. Skinner (2013). Experimentally constrained CA1 fast-firing parvalbumin-positive interneuron network models exhibit sharp transitions into coherent high frequency rhythms. *Frontiers in Computational Neuroscience* **7**:144. https://doi.org/10.3389/fncom.2013.00144

F.K. Skinner and **K.A. Ferguson** (2013). Modeling oscillatory dynamics in brain microcircuits as a way to help uncover neurological disease mechanisms: A proposal. *Chaos: An Interdisciplinary Journal of Nonlinear Science* **23**:046108. https://doi.org/10.1063/1.4829620

Encyclopedia Articles

K.A. Ferguson and F.K. Skinner (2013). Hippocampal theta, gamma, and theta/gamma network models. In: D. Jaeger and R. Jung (Ed.) *Encyclopedia of Computational Neuroscience*: SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg. 2013-10-01 11:19:11 UTC

K.A. Ferguson and F.K. Skinner (2013). Hippocampus, model excitatory cells. In: D. Jaeger and R. Jung (Ed.) *Encyclopedia of Computational Neuroscience*: SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg. 2013-09-27 12:49:54 UTC

F.K. Skinner and **K.A. Ferguson** (2013). Hippocampus, model inhibitory cells. In: D. Jaeger and R. Jung (Ed.) *Encyclopedia of Computational Neuroscience*: SpringerReference (www.springerreference.com). Springer-Verlag Berlin Heidelberg. 2013-09-27 14:51:47 UTC

Conference Proceedings

K.A. Ferguson and S.A. Campbell (2009). A two compartment model of a CA1 pyramidal neuron. *Canadian Applied Mathematics Quarterly, Special Issue for the 30th Anniversary of CAIMS* 17(2): 293-307.

Invited Talks

2024 Applied Mathematics Seminar Series, University of Waterloo. Waterloo, ON, Canada.

2024 Bernstein Center for Computational Neuroscience Postdoc Seminar Series, Humboldt University. Berlin, Germany.

2024 University of Lisboa, Faculty of Medicine. Lisbon, Portugal.

2024 Krembil Computational Neuroscience Hub, Krembil Research Institute. Toronto, Canada.

2023 Computational and Systems Neuroscience (COSYNE) Meeting 2023. Workshop: How do interneurons control neural computations and memory processes? An integrated experimental-computational approach. Mont-Tremblant, Canada.

2022 Canadian Neuroscience Meeting. Toronto, Canada.

2020 Ernst Strüngmann Institute for Neuroscience Seminar, in co-operation with Max Planck Society. Virtual, Frankfurt, Germany.

2020 Weill Cornell Psychiatry Department Seminar. Virtual, New York City, NY, USA.

2019 Simons Collaboration on the Global Brain NY-Area Postdoc Meeting. New York City, NY, USA.

2017 Tools for acquisition and interpretation of whole brain functional data Meeting. *Short Talk*. Janelia Research Campus. Ashburn, VA, USA.

2015 Soltesz Laboratory, University of California Irvine School of Medicine. Irvine, CA, USA.

2014 Workshop on "Taking Advantage of Theory and Analyses in Neuroscience: A hippocampal microcircuit focus", Centre for Mathematical Medicine, The Fields Institute. Toronto, ON, Canada.

2012 Computational Neuroscience Meeting (OCNS) 2012. Decatur, GA, USA.

2012 Focus program "Towards mathematical modeling of neurological disease from cellular perspectives". The Fields Institute. Toronto, ON, Canada.

2010 Society for Autonomous Neurodynamics Conference (SAND) 2010. Toronto, ON, Canada.

2010 Workshop on "Normal and Diseased Neurological States". Computational Neuroscientists of Upper Canada, The Fields Institute. Toronto, ON, Canada.

Select Poster Presentations

2018-2020, 2023 Computational and Systems Neuroscience (Cosyne) Meeting (Denver, USA; Lisbon, Portugal; Montreal, Canada)

2017 Emerging Tools for Acquisition and Interpretation of Whole-Brain Functional Data Conference. Janelia Research Campus, Ashburn, VA, USA.

2017 CSHL Meeting: Wiring the Brain. Cold Spring Harbor, NY, USA.

2014 Society for Neuroscience Conference. Washington, DC, USA.

2013 Computational Neuroscience Meeting. Paris, France.

2013 Canadian Association for Neuroscience Conference 2013. Toronto, ON, Canada.

2012 Society for Neuroscience Conference. New Orelans, LA, USA.

2011 Computational Neuroscience Meeting. Stockholm, Sweden.

2011 Canadian Association for Neuroscience Conference. Quebec City, QC, Canada.

2010 Society for Neuroscience Conference. San Diego, CA, USA.

2008 Society for Mathematical Biology Conference. Toronto, ON, Canada.

Teaching Assistant Experience

2022 Neural Systems and Behavior, Marine Biological Laboratories, Woods Hole, MA, USA

2019-2022 Interdepartmental Neuroscience Program (INP) Data Analysis Boot Camp, Yale University

2021 Neuromatch Academy Mentor. Mentored international students through a final project for their 3-week online introductory computational neuroscience course (https://academy.neuromatch.io/)

2012-2014 PSL 432: Theoretical Physiology, University of Toronto

2008 MATH 137: Calculus 1 for Honours Math, University of Waterloo

MATH 212/ECE 206: Advanced Calculus 2 for Electrical Engineers, University of Waterloo

AMATH 382: Computational Modeling of Cellular Systems, University of Waterloo

AMATH 231: Calculus 4 - Vector Integral Calculus, University of Waterloo

2007 MATH 127: Calculus 1 for the Sciences, University of Waterloo

MATH 137: Calculus 1 for Honours Math, University of Waterloo

Professional Development

2019 **Suite 2P Workshop, Janelia Research Campus**, *Three day course*, Ashburn, VA, USA

2017 **Summer Workshop on the Dynamic Brain, Allen Institute for Brain Science**, *Two week course*, Friday Harbor Laboratories, University of Washington, WA, USA

2015 **Neural Systems and Behavior, Marine Biological Laboratory**, *Eight week course*, Woods Hole, MA, USA

2014 **Advances in Multineuronal Monitoring of Brain Activity, Society for Neuroscience Meeting**, *One day course, Satellite Symposium*, Washington, DC, USA

2014 **Neurobiology, Marine Biological Laboratory**, *Eight week course*, Woods Hole, MA, USA

2012 **Using NEURON to model cells and networks, Society for Neuroscience Meeting**, *One day course, Satellite Symposium*, New Orleans, LA, USA

2007 **Computational Neuroscience Summer School, Centre for Neural Dynamics**, *Two week course*, University of Ottawa, Ottawa, ON, Canada

Technical Skills

Computing 20+ years in Matlab

10+ years in Python, including NumPy, Pandas, scikit-learn, Jupyter Notebook, Matplotlib, PyTorch

Bash scripting, cluster computing (Slurm, PBS), pipeline development, git, Docker

Analysis and Modeling Regression methodologies, multi-level and predictive modeling, time series analyses, state-space models, dimensionality reduction, analysis of complex multi-modal datasets

Machine learning (unsupervised and supervised learning, deep neural networks)

Image processing (segmentation, object detection and classification, feature extraction, and registration)

	Biophysical point-process network models, mean-field models, multi-compartment modeling, dynamical systems
Scientific	Optical imaging (extensive experience in two-photon Ca2+ imaging), electrophysiology (Neuropixels), real-time closed-loop optogenetics, mouse behavior, intersectional genetics, experimental design
Other	Expertise in scientific communication and data visualization

Service to Neuroscience Community

2013-present **Peer Reviewer**, *COSYNE (Computational and Systems Neuroscience) Meeting (2017-2020, 2022), Neural Networks (2021), Peer Community in Circuit Neuroscience (2020), Association for Women in Mathematics (AWM) Proceedings (2018), eLife (2015, 2017), Journal of Computational Neuroscience (2013)*

2016-2023 **Women in Science at Yale (WISAY) Board Member**, Organized a campus-wide mentorship program for female identifying postdocs in STEM., Yale University, New Haven, CT, USA

2020-2023 **Board member, Yale Neuroscience Postdoc Committee**, Promoted professional development for postdocs, Department of Neuroscience, Yale University School of Medicine, New Haven, CT, USA

2020-2021 **Organizer, Simons Collaboration on the Global Brain (SCGB) NY-Area Postdoc Meeting**, New York City, NY, USA

2019 **Open Labs Video Series**, Calcium Imaging Section, Science education for high school students, Yale University, New Haven, CT, USA

2018-2019 **SYNAPSES (Seminars at Yale Neuroscience: Advanced PoStdoc Extramural Series) Organizer**, Yale University, New Haven, CT, USA

2013-2014 **Communications, Graduate Executive Committee**, Collaborative Program in Neuroscience, University of Toronto, Toronto, ON, Canada

2013 **Graduate Student Representative, Task Force on Innovation and Transformation in Graduate Education**, Faculty of Medicine, University of Toronto, Toronto, ON, Canada

2012 **Organizer**, Focus program towards mathematical modeling of neurological disease from cellular perspectives, The Fields Institute, Toronto, ON, Canada

2011-2012 **Maintained Website**, Centre for Mathematical Medicine, The Fields Institute, Toronto ON,Canada. *(www.fields.utoronto.ca/programs/scientific/CMM/)*

2010 **Workshop organizer**, Computational Neuroscientists of Upper Canada (CNUC's), Centre for Mathematical Medicine, Fields Institute, Toronto, ON, Canada