

Lane McIntosh

CONTACT INFORMATION	Fairchild Science Building 299 Campus Drive, Room D209 Stanford, CA 94305	Voice: (760) 889-1550 Email: lmcintosh@stanford.edu URL: www.lanemcintosh.com	
RESEARCH INTERESTS	Theoretical Neuroscience and Machine Learning. Searching for general principles that underlie neural organization and encoding. Information processing in single neurons and neural circuits, information theory and far-from-equilibrium statistical mechanics.		
EDUCATION	Ph.D., Neurosciences Ph.D. Minor, Computer Science M.A., Mathematics B.A., Biological Sciences, Computational Neuroscience	Stanford University Stanford University University of Hawaii University of Chicago	2012-present 2012-present 2010-2012 2006-2010
PROGRAMMING	Python, CUDA C/C++, MATLAB, R		
SELECTED HONORS	Ruth L. Kirschstein National Research Service Award NVIDIA Best Poster Award Top 10% Poster Award for <i>A deep learning model of the retina</i> NSF Mind, Brain, and Computation Graduate Fellowship Departmental Merit Scholarship NSF SUPER-M Graduate Fellowship Kotaro Kodama Scholarship Graduate Teaching Fellowship Innovative Funding Strategy Award Lerman-Neubauer Junior Teaching Fellowship NIH Neuroscience and Neuroengineering Fellowship Bank of America Mathematics Award Valedictorian	NIH SCIEN Conference Stanford University Stanford University University of Hawaii University of Hawaii University of Hawaii University of Hawaii University of Hawaii University of Chicago University of Chicago University of Chicago SFC High School SFC High School	2016-present 2015 2015 2013-2016 2012 2011-2012 2011-2012 2010-2011 2009 2008 2008 2006 2006
ACADEMIC EXPERIENCE	<div><div>Stanford Neurosciences</div><div>Stanford, CA</div><div>Baccus Laboratory</div><div>January, 2013 - Present</div><div>Dynamic predictive coding is the idea that, for a given stimulus point, neural circuits use nearby points in space and time to predict the local intensity and then adapt to that prediction. I am working to make this idea more rigorous both from theoretical and experimental perspectives. In the realm of theory, I am working with Surya Ganguli to derive filters that optimally maximize predictive information in a neural system. Experimentally, I aim to test hypotheses about what lateral inhibition is sufficient for dynamic predictive coding.</div></div> <div><div>Stanford Neurosciences</div><div>Stanford, CA</div><div>Ganguli Theoretical Neuroscience Group</div><div>August, 2012 - December, 2012</div><div>The concept that neurons maximize mutual information to increase their dynamic range and information capacity dates back to the 1980s. However, although feedback is ubiquitous in the brain, this “infomax” principle has yet to be generalized to channels with feedback. During this rotation project, I worked on generalizing infomax to cases with feedback.</div></div> <div><div>UH Department of Mathematics</div><div>Honolulu, HI</div><div>Machine Learning Group</div><div>August, 2010 - August, 2012</div><div>Includes graduate level coursework in mathematics and thesis research. Coursework has focused on information theory, stochastic processes, graph theory, and traditional graduate algebra and analysis.</div></div>		

University of Chicago

Chicago, IL

*MacLean Computational Neuroscience Lab**March, 2010 - August, 2010*

Research on neural circuits in Jason MacLean's 2-photon lab; developed an optogenetics software platform and electrophysiological cell classifier.

Institute for Advanced Study

Princeton, NJ

*Simons Center for Systems Biology**June, 2009 - September, 2009*

Research in bioinformatics looking at SNP-linkages in populations of sub-Saharan Africa; developed data mining software for gene copy number variation.

National Institutes of Health

Chicago, IL

*Neuroscience and Neuroengineering Summer Fellowship**June, 2008 - August, 2008*

Research in David Gallo's memory lab; analyzed fMRI data collected at Harvard and found cerebellar involvement in and coordination of episodic memory tasks.

**BIOTECHNOLOGY
EXPERIENCE****Prometheus Technologies**

San Diego, CA

*Co-founder**December, 2010 - January, 2012*

Developed new ways of delivering personal genomic information to the non-sequenced public via linkages in SNPs underlying unambiguous phenotypes.

Archinoetics

Honolulu, HI

*Internship**September, 2010 - September, 2012*

Provided neurobiology expertise for federal DoD- and Navy-funded contracts related to brain-computer interfaces and monitoring mental states. Projects included writing a review on the physiological dynamics of stress, creating better diagnostic tools for Post Traumatic Stress Disorder, and developing image processing components of in-house computer vision software.

Cytori Therapeutics

San Diego, CA

*Regenerative Cell Technology Internship**June, 2006 - August, 2007*

Research in adult stem cell differentiation; experimented with RNAi and super-cooling techniques.

**SUBMITTED
PAPERS**

Greenbaum B, Chan C, Naqvi A, McIntosh L, Levine A. A Novel Directional Method to Assess Selection in Copy Number Variants.

**PAPERS IN
PREPARATION**

McIntosh L, Still, S. Thermodynamics of Prediction in Single Neurons.

McIntosh L, Matthews R. Dynamics of Stress: Review.

PRESENTATIONS

McIntosh, Lane*, Niru Maheswaranathan*, Aran Nayebi, Surya Ganguli, and Stephen Baccus. (2016, February). Convolutional Neural Network Models of the Retina. Poster at Computational and Systems Neuroscience, Salt Lake City, UT.

McIntosh, Lane, Mihai Manu, David Kastner, Benjamin Naecker, and Stephen Baccus. (2015, October). Distinct Inhibitory Spatial Scales Improve Information Transmission in the Retina. Poster at Society for Neuroscience, Chicago, IL.

McIntosh, L. How do multiple spatial scales of inhibition improve information transmission in the retina? Math, Monkeys, & Machines Seminar Series. Stanford, CA. May 19, 2015.

McIntosh, L., and Maheswaranathan, N. (2015, March). A deep learning model of the retina. Poster presented at the Stanford Computer Science Department Convolutional Neural Networks Winter Poster Session, Stanford, CA. Top 10% poster award.

Ballard, I.* and McIntosh, L*. (2014, December). Video-based event recognition. Poster presented at the Stanford Computer Science Department Artificial Intelligence Fall Poster Session, Stanford, CA. *Co-first author.

McIntosh, L., Kastner, D., Manu, M., and Baccus, S. (2014, September). Efficient coding in non-linear systems. Poster presented at the annual Stanford Biosciences Student Association Poster Session, Stanford, CA.

McIntosh, L. (2013, December). Learning predictive filters. Poster presented at the annual Stanford Machine Learning Fall Poster Session, Stanford, CA.

McIntosh L, Brown J. (2012, February) Graph Theory and the Art of Searching. HCTM Conference.

McIntosh L, Gallo D. (2008, August) Memory Retrieval and Monitoring in the Cerebellum. NIH Research Brief and Presentation.

PROFESSIONAL
MEMBERSHIPS

American Mathematical Society
NSF Center for Science of Information

TEACHING

CS231n Conv. Neural Networks	TA	Stanford University	2016
Math Tools for Neuroscientists	Lecturer	Stanford University	2015, 2016
Introduction to Perception	TA	Stanford University	2014
Precalculus	Lecturer	University of Hawaii	2012
Precalculus	TA	University of Hawaii	2010-2011
Biophysics and Chemical Biology	TA	University of Chicago	2008