LIM, JING-XUAN

JHU-JANELIA JOINT GRADUATE STUDENT
*A*STAR NATIONAL SCIENCE FELLOW*

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Personal webpage
Google Scholar // GitHub

Profile

I am a PhD candidate co-supervised by Misha Ahrens and Dwight Bergles, and co-mentored by James Fitzgerald, at the HHMI Janelia Research Campus, where I study state-modulation of sensorimotor transformations in larval zebrafish. I am interested in how past experiences, such as past locomotor efficacy and sensory/motor histories, can influence brain representations and animal behavior, and the mechanisms that underlie such modulations.

Skills

Functional imaging

Whole-brain *in vivo* light-sheet and two-photon calcium and voltage imaging of larval zebrafish fictively-behaving in a virtual reality environment. Craniotomy, stereotaxic viral injection, fiber implantation and *in vivo* calcium fiber photometry in freely-moving mice.

Neural data

Distributed computation for simulation and analysis of biological data. Development, simulation and analysis of multiscale models of biological neuronal networks in NEURON, using NetPyNE. Encoding models for calcium imaging and multi-electrode spiking data. Compartmental modeling of neuronal morphologies. Python, MATLAB, R, HPC.

Electrophysiology

Rodent surgery and preparation of acute brain slices. *In vitro* patch clamp and field recordings. Biocytin labelling and post-hoc recovery of cell morphologies using Neurolucida. Extracellular multiunit recordings and iontophoresis in head-fixed, non-anesthetized barn owls.

Education

Johns Hopkins University, United States of America

PhD Neuroscience **2017-present**

Thesis advisors: Misha Ahrens (Janelia) and Dwight Bergles (Hopkins)
Co-mentor: James Fitzgerald (Janelia)
Thesis: Reconfiguration of brain-wide computation by astrocyte-driven internal states
Fellowship: National Science Scholarship (PhD) from A*STAR, Singapore
Rotations: Ernst Niebur, Shreesh Mysore

University College London, United Kingdom

BSc Neuroscience **2012-2015**

Classification: First Class Honours
Thesis advisor: Beverley Clark
Thesis: Patch-clamp analysis of miniature synaptic currents in layer 5 cortical pyramidal cells of a Bardet-Biedl Syndrome mouse model
Scholarship: National Science Scholarship (BS) from A*STAR, Singapore

Experience

Dr Misha Ahrens :: Janelia Research Campus, HHMI

JHU-Janelia Joint Graduate Student **Jun 2018-present**

Reconfiguration of brain-wide computation by astrocyte-driven internal states
Animals frequently switch between behavioral states in response to changes in their environment, in which they execute different sets of spontaneous and sensory-evoked behaviors. Using functional imaging methods, I aim to provide a computational description of how whole-brain information processing is altered by past experience. Harnessing the power of molecular techniques, I will also perform perturbation experiments in order to understand the underlying network and circuit mechanisms that allow neuromodulatory systems to exert widespread control.

Prof Shreesh Mysore :: Johns Hopkins University

Graduate Rotation Student **Jan 2018-May 2018**

Inactivation of reciprocal inhibition between Imc neurons in barn owls
Computational circuit models predict that reciprocal inhibition of inhibition between nucleus isthmi pars magnocellularis (Imc) neurons might underlie flexible categorization in stimulus selection. To test that hypothesis, I performed extracellular multiunit recordings from Imc neurons during iontophoresis of bicuculline. Preprint:
https://www.biorxiv.org/content/10.1101/2020.03.13.990952v1

Prof Fu Yu :: Singapore Bioimaging Consortium, A*STAR

Research Officer **Dec 2016-Jun 2017**

Role of ventrolateral hypothalamic SST neurons in feeding behaviors
I developed a custom data visualization and acquisition software for fiber photometry and used it to investigate the effects of sleep-wake cycle on the activity of GCaMP-expressing ventrolateral hypothalamic SST neurons, whose activity controls feeding behaviour. This work contributed to a paper: https://www.science.org/doi/10.1126/sciadv.abe4323

Prof George Augustine :: Nanyang Technological University

Research Officer **Jun 2015-Dec 2016**

Reconstruction and simulation of the claustral network
Co-supervisor: Prof William Lytton, SUNY Downstate Medical Center
I developed an *in silico* model of the claustrum with simplified integrate-and-fire spiking neurons tuned to intrinsic electrophysiological properties of different cell types and with connectivity based on optogenetic circuit-mapping data. I then performed a multitude of simulations in exploration of the dynamical features of the network. I presented this work at RIKEN Brain Science Institute Summer Program 2016 and Society for Claustrum Research Annual Symposium 2016.
Conference proceedings:
https://www.tandfonline.com/doi/full/10.1080/20023294.2017.1349859

Awards

Fellowships

A*STAR National Science Scholarship (BS) **2012-2015**
A*STAR National Science Scholarship (PhD) **2017-2022**

Travel Scholarships

A*STAR-RIKEN Brain Science Institute Summer Program Travel Award **2016**

Publications

Journal Articles

JX Lim*, Z Wei*, S Narayan, X Mi, W Zheng, DE Bergles, G Yu, M Rubinov, JE Fitzgerald† & MB Ahrens†. **Reconfiguration of brain-wide computation by astrocyte-driven internal states.** *Manuscript in preparation.*

Y Zhang, M Rózsa, Y Liang, D Bushey, Z Wei, J Zheng, D Reep, GJ Broussard, A Tsang, G Tsegaye, S Narayan, CJ Obara, **JX Lim**, R Patel, R Zhang, MB Ahrens, GC Turner, SSH Wang, WL Korff, ER Schreiter, K Svoboda, JP Hasseman, I Kolb & LL Looger (2023). **Fast and sensitive GCaMP calcium indicators for imaging neural populations.** *Nature 615 (7954), 884-891.*

X Mi, M Wang, ABY Chen, **JX Lim**, Y Wang, MB Ahrens, G Yu (2022). **BILCO: An Efficient Algorithm for Joint Alignment of Time Series.** *Advances in Neural Information Processing Systems 35 (NeurIPS 2022).* https://proceedings.neurips.cc/paper_files/paper/2022/hash/eb5d9195b201ec7ba66c8e20b396d349-Abstract-Conference.html

Y Zhang, M Rózsa, Y Liang, D Bushey, Z Wei, J Zheng, D Reep, GJ Broussard, A Tsang, G Tsegaye, S Narayan, CJ Obara, **JX Lim**, R Patel, R Zhang, MB Ahrens, GC Turner, SSH Wang, WL Korff, ER Schreiter, K Svoboda, JP Hasseman, I Kolb, LL Looger (2021). **Fast and sensitive GCaMP calcium indicators for imaging neural populations.** *bioRxiv 2021.11.08.467793*
https://doi.org/10.1101/2021.11.08.467793

SC Phua, YL Tan, AMY Kok, E Senol, CJH Chiam, CY Lee, Y Peng, ATJ Lim, H Mohammad, **JX Lim**, Y Fu (2021). **A distinct parabrachial–to–lateral hypothalamus circuit for motivational suppression of feeding by nociception.** *Science Advances 7 (19), eabe4323.* https://www.science.org/doi/10.1126/sciadv.abe4323

HM Schryver, **JX Lim**, SP Mysore (2020). **Distinct neural mechanisms construct classical versus extraclassical inhibitory surrounds in an inhibitory nucleus in the midbrain attention network.** *bioRxiv 2020.03.13.990952*
https://doi.org/10.1101/2020.03.13.990952

Talks

JX Lim*, Z Wei*, S Narayan, X Mi, W Zheng, DE Bergles, G Yu, M Rubinov, JE Fitzgerald† & MB Ahrens†. **Hidden internal states modulate sensorimotor circuits brainwide.** *15th Annual Janelia Symposium (Virginia)*

JX Lim*, Z Wei*, S Narayan, X Mi, W Zheng, DE Bergles, G Yu, M Rubinov, JE Fitzgerald† & MB Ahrens†. **Behavioral state-dependent visuomotor processing in larval zebrafish.** *2022 Baier Lab Retreat (Lisbon)*

Posters

JX Lim*, Z Wei*, S Narayan, X Mi, W Zheng, DE Bergles, G Yu, M Rubinov, JE Fitzgerald† & MB Ahrens†. **Experience-dependent modulation of brain-wide visuomotor processing and behavior.** *COSYNE 2023 (Montreal).*

X Mi, **JX Lim**, ABY Chen, Y Wang, MB Ahrens, G Yu (2022). **AQuA2: Quantify complex fluorescent brain activity with improved accuracy, scalability, versatility, and more functions.** *Glia in Health & Disease 2022.*

JX Lim*, Z Wei*, S Narayan, X Mi, W Zheng, DE Bergles, G Yu, M Rubinov, JE Fitzgerald† & MB Ahrens†. **Experience-dependent visuomotor processing and behavior.** *30th annual Neuroscience Department and Neuroscience Training Program Retreat.*

HM Schryver, **JX Lim** & SP Mysore (2021). **Distinct neural mechanisms construct classical versus extraclassical inhibitory surrounds in an inhibitory nucleus in the midbrain attention network.** *Cosyne 2021 (Lisbon).*

HM Schryver, **JX Lim** & SP Mysore (2019). **Construction of classical and competitive surrounds in the owl isthmi pars magnocellularis.** *Neuroscience 2019 (Society for Neuroscience, Chicago).*

JX Lim & MB Ahrens (2019). **State modulation of sensorimotor processing.** *29th annual Neuroscience Department and Neuroscience Training Program Retreat.* https://jingxlim.github.io/jhu19.pdf

JX Lim, A Sheikhattar, Z Wei, MB Ahrens (2018). **Neural oscillations in sensorimotor processing.** *28th annual Neuroscience Department and Neuroscience Training Program Retreat.* https://jingxlim.github.io/jhu18.pdf

B Colvert, Y Man, S Pisupati, **JX Lim**, M McHenry & E Kanso (2018). **Evasion strategies of zebrafish larvae.** *Bulletin of the American Physical Society.*, Volume 63, Number 13. http://meetings.aps.org/link/BAPS.2018.DFD.F20.4

WW Lytton, **JX Lim**, S Dura-Bernal, GJ Augustine (2016). **Computational models of claustrum subnetworks.** *Conference Proceedings: 3rd Annual Society for Claustrum Research Meeting, Claustrum.*
https://www.tandfonline.com/doi/full/10.1080/20023294.2017.1349859
https://jingxlim.github.io/scr16.pdf

JX Lim, S Dura-Bernal, R Orman, C Kayser, GJ Augustine, WW Lytton (2016). **Reconstruction and simulation of claustral microcircuitry based on optogenetic mapping.** *RIKEN Brain Science Institute Summer Program 2016.*
https://jingxlim.github.io/riken16.pdf

Resource

Y Zhang, M Rózsa, D Bushey, J Zheng, D Reep, Y Liang, GJ Broussard, A Tsang, G Tsegaye, R Patel, S Narayan, **JX Lim**, R Zhang, MB Ahrens, GC Turner, SSH Wang, K Svoboda, W Korff, ER Schreiter, JP Hasseman, I Kolb, LL Looger (2020). **jGCaMP8 Fast Genetically Encoded Calcium Indicators.** *figshare*
https://doi.org/10.25378/janelia.13148243.v4

Theses

JX Lim and BA Clark (2015). **Patch-clamp analysis of miniature synaptic currents in layer 5 cortical pyramidal cells of a Bardet-Biedl Syndrome mouse model.** *BSc dissertation, University College London.* https://jingxlim.github.io/ucl15.pdf

Coursework

Advanced training

RIKEN BSI Summer Program		**2016**
Janelia-MSRI Summer Graduate School on Mathematical Analysis of Behavior		**2018**
Janelia Fundamental Principles of Microscopy for Biologists		**2019**
Janelia FIJI Image Processing and Analysis Workshop		**2019**
Neuromatch Academy		**2020**

Accepted but unable to attend

MBL Methods in Computational Neuroscience	COVID-19	**2020**

Teaching

JHU Neuroscience Boot Camp	Instructor	**2019**
Mathematical methods for neuroscience and machine learning	TA	**2019**
Learning to use Suite2p workshop	TA	**2019**

References

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