

# LIM, JING-XUAN

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

[limj2@janelia.hhmi.org](mailto:limj2@janelia.hhmi.org)  
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:** State modulation of sensorimotor transformations

**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

### State modulation of sensorimotor transformations

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 lmc neurons in barn owls**

Computational circuit models predict that reciprocal inhibition of inhibition between nucleus isthmi pars magnocellularis (lmc) neurons might underlie flexible categorization in stimulus selection. To test that hypothesis, I performed extracellular multiunit recordings from lmc neurons during iontophoresis of bicuculline. This work contributed to a paper that is currently under review.

Preprint available:  <https://www.biorxiv.org/content/10.1101/2020.03.13.990952v1>

Prof Ernst Niebur :: Zanvyl Krieger Mind/Brain Institute, JHU

Graduate Rotation Student

Aug 2017-Dec 2017

**State-space models for gambling behaviour in monkeys**

**Co-supervisor: Dr Pierre Sacre, Institute of Computational Medicine**

To better understand gambling behaviour in monkeys made to perform a multiattribute decision-making task, I constructed a generalised linear encoding model with present and past trial return and risk as covariates.

Dr Misha Ahrens :: Janelia Research Campus, HHMI

Graduate Rotation Student

Jun 2017-Aug 2017

**Role of Neuropil 4 oscillatory dynamics in heart rate and swim**


To draw functional connections between oscillations in Neuropil 4 and physiology, I performed two-photon calcium imaging at various planes spanning Neuropil 4 while electrophysiologically recording heart rate and fictive behaviour while the zebrafish performed a visuomotor response task. I also performed whole-brain light sheet imaging in order to characterize oscillations in Neuropil 4 with neural activity dynamics in other areas.

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>

Dr Beverley Clark :: Wolfson Institute for Biomedical Research, UCL

Undergraduate Thesis Project Researcher

Sep 2014-Apr 2015

**Patch-clamp analysis of miniature postsynaptic currents in cortical pyramidal cells of a Bardet-Biedl Syndrome mouse model**

**Co-supervisor: Dr Christoph Schmidt-Hieber, Institut Pasteur**

I performed whole-cell patch clamp on L5 cortical pyramidal neurons to investigate the functional changes in cortical wiring of the Bardet-Biedl Syndrome 5 knockout mouse, which were found to have decreased spine density. I also stained the neurons with biocytin and recovered their morphologies posthoc using NeuroLucida in order to check for other structural deficits. This work culminated in the writing of a dissertation and a talk given to faculty and peers.

Prof Sajikumar Sreedharan :: National University of Singapore

Undergraduate Researcher

Jul 2014-Sep 2014

**Molecular events underlying hippocampal LTP**

I performed field and patch-clamp recordings on organotypic slices to investigate the effects of various pharmacological agents on LTP and plasticity thresholds in CA1 pyramidal neurons. I also performed densitometric measurement of western blots using ImageJ to quantify the effects of LTP on protein phosphorylation levels.

Dr Anne Rifkin-Graboi :: Singapore Institute for Clinical Sciences,  
A\*STAR

Undergraduate Researcher

Jul 2013-Sep 2013

**The relation between temperament, distractibility and heart rate in toddlers**

I performed extensive analysis on Lab-TAB (Laboratory Temperament Assessment Battery, for the assessment of behaviour, emotion and attention), EEG, eye-tracking and heart rate data.

Prof Adam Claridge-Chang :: Duke-NUS Graduate Medical School

Assistant Laboratory Officer

Jan 2012-Mar 2012

I performed laboratory technician duties such as keeping stocks, collecting virgins, setting up and scoring crosses and cooking fly food. I also learned how to perform brain dissection on the *Drosophila melanogaster* and various molecular biology techniques such as gene cloning, cDNA library building, RNA isolation, Q-PCR, miniprep and gel electrophoresis. Finally, I designed and set-up an optogenetics-enabled behavioural rig for the movement tracking of fruit flies for the investigation of anxiety circuits.

---

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

Yan Zhang, Márton Rózsa, Yajie Liang, Daniel Bushey, Ziqiang Wei, Jihong Zheng, Daniel Reep, Gerard Joey Broussard, Arthur Tsang, Getahun Tsegaye, Sujatha Narayan, Christopher J. Obara, **Jing-Xuan Lim**, Ronak Patel, Rongwei Zhang, Misha B. Ahrens, Glenn C. Turner, Samuel S.-H. Wang, Wyatt L. Korff, Eric R. Schreiter, Karel Svoboda, Jeremy P. Hasseman, Ilya Kolb, Loren L. 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>

Siew Cheng Phua, Yu Lin Tan, Alison Maun Yeng Kok, Esra Senol, Christine Jin Hui Chiam, Chun-Yao Lee, Yanmin Peng, Auriel Theodora Jacobea Lim, Hasan Mohammad, **Jing-Xuan Lim**, Yu Fu (2021). **A distinct parabrachial-to-lateral hypothalamus circuit for motivational suppression of feeding by nociception.** *Sci. Adv.* 7, eabe4323.  <https://www.science.org/doi/10.1126/sciadv.abe4323>

Hannah M. Schryver, **Jing-Xuan Lim**, Shreesh P. Mysore (2020). **Distinct neural mechanisms construct classical versus extraclassical inhibitory surrounds in an inhibitory nucleus in the midbrain attention network.** *Under review. bioRxiv preprint available: bioRxiv* 2020.03.13.990952  <https://doi.org/10.1101/2020.03.13.990952>

Posters

Hannah M. Schryver, **Jing-Xuan Lim** & Shreesh P. Mysore (2021). **Distinct neural mechanisms construct classical versus extraclassical inhibitory surrounds in an inhibitory nucleus in the midbrain attention network.** *Cosyne 2021 (Lisbon)*

Hannah M. Schryver, **Jing-Xuan Lim** & Shreesh P. Mysore (2019). **Construction of classical and competitive surrounds in the owl isthmi pars magnocellularis.** *Neuroscience 2019 (Society for Neuroscience, Chicago)*

**Jing-Xuan Lim** & Misha Ahrens (2019). **State modulation of sensorimotor processing.** *29th annual Neuroscience Department and Neuroscience Training Program Retreat*  <https://jingxlim.github.io/jhu19.pdf>


**Jing-Xuan Lim**, Alireza Sheikhattar, Ziqiang Wei, Misha Ahrens (2018). **Neural oscillations in sensorimotor processing.** *28th annual Neuroscience Department and Neuroscience Training Program Retreat*  <https://jingxlim.github.io/jhu18.pdf>

Brendan Colvert, Yi Man, Shashank Pisupati, **Jing-Xuan Lim**, Matthew McHenry & Eva 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>


William W. Lytton, **Jing-Xuan Lim**, Salvador Dura-Bernal, George J. 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>

**Jing-Xuan Lim**, Salvador Dura-Bernal, Rena Orman, Christoph Kayser, George J. Augustine, William W. 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

Yan Zhang, Márton Rózsa, Daniel Bushey, Jihong Zheng, Daniel Reep, Yajie Liang, Gerard Joey Broussard, Arthur Tsang, Getahun Tsegaye, Ronak Patel, Sujatha Narayan, **Jing-Xuan Lim**, Rongwei Zhang, Misha B. Ahrens, Glenn C. Turner, Samuel S.-H. Wang, Karel Svoboda, Wyatt Korff, Eric R. Schreiter, Jeremy P. Hasseman, Ilya Kolb, Loren L. Looger (2020). **jGCaMP8 Fast Genetically Encoded Calcium Indicators.** *figshare*  <https://doi.org/10.25378/janelia.13148243.v4>

## Theses

**Jing-Xuan Lim** and Beverley A. 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

<b>Misha Ahrens</b>	<b>James Fitzgerald</b>	<b>George Augustine</b>
PhD Thesis advisor	PhD mentor	Postbaccalaureate advisor
+1 571 209 4174	+1 571 209 4358	+65 6778 2012
ahrensm@janelia.hhmi.org	fitzgeraldj@janelia.hhmi.org	george.augustine@ntu.edu.sg

