LIM, JING-XUAN

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

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Profile

I am a PhD candidate co-supervised by Misha Ahrens and 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), James Fitzgerald (Janelia) and Dwight Bergles (Hopkins)
Thesis: State modulation of sensorimotor transformations
Fellowship: National Science Scholarship (PhD) from A*STAR, Singapore

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 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. This work contributed to a paper that is currently under review. Preprint available: Rχ 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.

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 Society for Claustrum Research Annual Symposium 2016 and RIKEN Brain Science Institute Summer Program 2016.

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 BSI Summer Program Travel Award **2016**

Publications

Journal Articles
Hannah M. Schryver, **Jing-Xuan Lim**, Shreesh P. Mysore. **Distinct neural mechanisms construct classical versus extraclassical inhibitory surrounds in an inhibitory nucleus in the midbrain attention network.** *Under review. bioRxiv preprint available:* https://www.biorxiv.org/content/10.1101/2020.03.13.990952v1.full.pdf

Siew Cheng Phua, Yu Lin Tan, Esra Senol, Chun-Yao Lee, Jin Hui C. Chiam, Yanmin Peng, Hasan Mohammad, **Jing-Xuan Lim**, Yu Fu. **A distinct parabrachial circuit for motical suppression by acute pain.** *In preparation for re-submission.*

Jing-Xuan Lim, Salvador Dura-Bernal, George J. Augustine, William W. Lytton. **Computational models of claustrum subnetworks.** *In preparation.*

Abstracts

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.

Posters

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

Jing-Xuan Lim, Salvador Dura-Bernal, George J. Augustine, William W. Lytton (2016). **Computational models of claustrum subnetworks.** *Society for Claustrum Research Annual Symposium 2016* 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

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**
Fundamental Principles of Microscopy for Biologists	**2019**
FIJI Image Processing and Analysis Workshop	**2019**

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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George Augustine

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