

Lucas Y. Tian

Neuroscientist

Postdoc, Laboratory of Neural Systems

The Rockefeller University

ltian@rockefeller.edu

RESEARCH STATEMENT

I am interested in how brains allow us and other animals to be intelligent. My focus is on how we flexibly reason, plan, and imagine in order to solve new problems, create new ideas, imagine new concepts, and more. A key idea is that these abilities depend on *generalizing* from prior knowledge. It is particularly important to be able to generalize in a manner that is *compositional*, by recombining simpler components of knowledge into increasingly complex concepts and behaviors. Moreover, this process can often occur largely “in our heads”, without needing to slowly and painstakingly test them out in the real world. For example, in using language, we rapidly recombine words and syntactical rules to utter new sentences with new meanings. In short, I want to understand how the brain enables compositional generalization. What neural processes and mechanisms underlie the representation and recombination of prior knowledge? How do these mechanisms relate to sensory information and behavioral output relevant in a particular situation?

I study these mechanisms by combining approaches from cognitive science, computational modeling, and systems neuroscience. My main research thread is on neurophysiological processes in non-human primates performing a new cognitive task I am developing, involving drawing, that tests the ability to generate compositional action plans to solve new problems. In a parallel thread, I am studying these same cognitive tasks in humans and building computational models of neural processes and of behavior. My goal is a causal mechanistic explanation of compositional planning that links neurophysiology (in non-human primates) with cognition and behavior (in humans and non-human primates).

PROFESSIONAL APPOINTMENTS**The Rockefeller University**

2020 - present

Postdoc

Advisor: Winrich Freiwald

Collaborators: Josh Tenenbaum (MIT), Xiao Jing Wang (NYU), Brenden Lake (NYU)

Massachusetts Institute of Technology

2019

Visiting postdoc

Computational modeling of human cognition and behavior

Advisor: Joshua Tenenbaum

EDUCATION

University of California, San Francisco

2012 - 2019

Ph.D. in Neuroscience

Thesis title: Neural mechanisms of motor skill flexibility in songbirds ([pdf](#))

Advisor: Michael S. Brainard

Thesis committee: Michael S. Brainard, Loren Frank,
Andrea Hasenstaub, Karunesh Ganguly

University of Chicago

2007-2011

B.A. with Honors in Biology, specializing in Neuroscience

Minor in Physics

Honors thesis title: Discovery of a novel role for SOG2 in budding yeast meiosis using a conditional mutant suppressor screen ([pdf](#))

Honors thesis advisor: Douglas K. Bishop

PUBLICATIONS

Tian LY, Brainard MS (2017). Discrete circuits support generalized versus context-specific vocal learning in the songbird. **Neuron** 96, 1-10.

Link: [pdf](#)

IN REVISION OR IN PREPARATION:

Tian LY, Ellis K, Kryven M., Tenenbaum JB. Learning abstract structure in drawings by motor-efficient program induction. *In revision*.

Link: [pdf](#)

Tian LY, Mehaffey WM, Brainard MS. Inter-area interactions encode real-time adaptive biasing of performance during motor skill learning. *In preparation*.

Link: [Cosyne poster](#)

Warren TL, **Tian LY**, Charlesworth J, Brainard MS. Patterned activity from basal ganglia circuitry directs consolidation into motor cortex during practice but not sleep. *In preparation*.

Veit L, **Tian LY**, Hernandez CJM, Brainard MS. Songbirds can associate arbitrary visual cues with learned song modifications. *In preparation*.

AWARDS AND HONORS

Invited talk, UCSF Neuroscience Retreat

2016

UCSF Graduate Division Travel Award

2016

Herbert W. Boyer PIBS Fellowship, UCSF

2014

Outstanding Thesis Award (one of two in class) , University of Chicago	2011
Top Presentation in Biological Sciences , Chicago Area Undergraduate Research Symposium	2011
Amgen Scholarship , Caltech	2009
National Merit College-sponsored Scholarship	2007

CONFERENCE ABSTRACTS

Tian, L.Y., Mehaffey, W.H., Brainard, M.S. (2020) *Inter-area interactions encode real-time adaptive biasing of performance during motor skill learning*. **Poster**, COSYNE.

Link: [poster](#)

Tian, L.Y., Brainard, M.S. (2018) *Encoding of sequential context in a songbird cortical-basal ganglia circuit important for context-specific learning*. **Poster**, Society for Neuroscience.

Tian, L.Y., Brainard, M.S. (2016) *Songbird basal ganglia enable context-dependent motor skill adaptation*. **Poster**, Society for Neuroscience, 629.10.

Tian, L.Y., Brainard, M.S. (2016) *Songbird basal ganglia enable context-dependent motor skill adaptation*. **Oral presentation**, UCSF Neuroscience Program Retreat.

Tian, L.Y., Holzen, T., Zwick, D., Bishop, D.K. (2011) *Discovery of a novel role for SOG2 in meiosis using a conditional mutant screen*. **Poster (awarded top presentation in biological sciences)**, Chicago Area Undergraduate Research Symposium.

NOT PRESENTING AUTHOR:

Veit, L., **Tian, L.Y.**, Hernandez, C.J.M., Brainard, M.S. (2018) *Bengalese finches can use learned sensory cues to flexibly shift between opposing song modifications*. **Poster**, Society for Neuroscience.

ADVANCED COURSEWORK

Methods in Computational Neuroscience Marine Biological Laboratory, Woods Hole	Fall 2019
Junior Workshop on Mechanistic Cognitive Neuroscience Janelia Research Campus, Ashburn	Fall 2018
Brains, Minds and Machines Marine Biological Laboratory, Woods Hole	Summer 2018
Mining and Modeling of Neuroscience Data Redwood Center, UC Berkeley	Summer 2017
Statistical Learning Theory	Spring 2014

Instructor: Michael Jordan, UC Berkeley

LEADERSHIP

Co-founder (one of two)	2016 - present
Systems Neuroscience Research in Progress Seminar, UCSF	
Co-founder (one of two)	2013 – present
Special Topics Seminar, UCSF	
Tutor and Board Member	2008-2009
Chicago Adolescent Mentorship Program, Hyde Park Neighborhood Club, Chicago	

TEACHING/OUTREACH

Judge	2014
Synopsys Science and Technology Championship, San Jose	
Teacher's Assistant	Winter 2014
BMS117: Infection & Host Response (Neurophysiology unit), UCSF	
Invited speaker	2013
PITCH, UCSF Center for Education Partnerships	
Mentor	2013-2014
Fairposium at Burton High School, UCSF Center for Education Partnerships	
Scientist-Teacher	2012 - 2013
Raul Wallenberg High School, UCSF Science and Health Education Partnership	
English Teacher	May 2012
San Gabriel Kindergarten, Los Nogales, Peru	
Teacher	2010
Neuroscience of Illusions, Cascade!, University of Chicago	
Teacher's Assistant	2010
BIOS 20194: Developmental Biology, University of Chicago	
Tutor (ACT and SAT prep)	2009 - 2011
PrepMe	

LAB MENTORING

Eszter Kish, graduate rotation student, UCSF	2018
Christian Jose Monroy Hernandez, HHMI EXROP internship	2017
Rachel Care, graduate rotation student, UCSF	2014
Abe Shihadeh, undergraduate RA, University of Chicago	2012
Amir Hay, high school RA, University of Chicago	2010

REFERENCES

Michael Brainard, Professor, UCSF, msb@phy.ucsf.edu

Josh Tenenbaum, Professor, MIT, jbt@mit.edu

Andrea Hasenstaub, Associate Professor, UCSF, andrea.hasenstaub@ucsf.edu

Karunesh Ganguly, Associate Professor, UCSF, karunesh.ganguly@ucsf.edu