

Sangyu Xu 徐翔

Computational Behaviour Scientist

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Computational behaviour scientist with 15+ years building measurement tools for internal states: automated tracking, effect-size estimation, and high-dimensional behavioral benchmarking. Currently building agentic LLM evaluation workflows for scientific reasoning. Also works with electrophysiology time-series — spike sorting, LFP analysis, and signal conditioning.

EXPERIENCE

Senior Research Fellow — Duke-NUS Medical School, Singapore

2026–present

Computational ethomics pipelines for internal state inference and epitranscriptomics workflows for native RNA modification mapping. Developing agentic LLM evaluation systems for scientific reasoning — grounded analytical outputs feed adversarial multi-agent critique and structured manuscript assessment pipelines.

Senior Research Fellow / Research Fellow — IMCB, A*STAR Singapore

2017–2026

Co-developed DABEST 2.0, an estimation statistics framework for visualising effect sizes and uncertainty; predecessor has 2,000+ citations. Built DESTRA, a ground-truth-referenced benchmarking approach for high-dimensional behavioural states, showing that perturbations can shift individual metrics without recapitulating the full target state — presented as an invited talk at APDNC3 / RIKEN 2024.

Developed automated behavioural classification pipelines for large-scale ethological data; contributed to novel optogenetic silencing tools (*Nature Communications* 2024) and long-Stokes-shift fluorescent markers for two-photon imaging (bioRxiv 2026).

Principal Investigator, Young Individual Researcher Grant (SGD \$300,000; National Medical Research Council): led a cross-disciplinary team combining genetics, deep-learning pose estimation (DeepLabCut, SLEAP), and epitranscriptomics to study the neural underpinnings of socially facilitated feeding behaviour in *Drosophila*.

Postdoctoral Associate — Tonegawa Lab, MIT

2016–2017

Designed the first olfactory-cued rodent intertemporal choice task, translating a paradigm from human preference evaluation to allow precise neural recording at the decision point, including *in vivo* optrode electrophysiology of dorsal raphe neurons. Built a psychometric model predicting choice probability as a function of delay; dorsal raphe serotonergic activation increased patience while silencing drove impulsivity (*Current Biology* 2017, co-corresponding). Also contributed to studies of noradrenergic attentional circuits (*PNAS* 2020) and basolateral amygdala valence encoding (*Nature Neuroscience* 2016).

EDUCATION

PhD Systems Neuroscience — MIT

2016

Supervisor: Susumu Tonegawa. Dissertation: *Control of Intertemporal Choice by Dorsal Raphe Serotonergic Neurons*.

BS Biology (Minor: Music) — UC San Diego

2007

Supervisor: Charles Zuker. Undergraduate dissertation: A Novel Trans-Synaptic Neuronal Tracing Strategy.

SELECTED PUBLICATIONS

Xu S, Zhang X, Stewart JC, Ho J, Choudhury D, Wang Z, Claridge-Chang A. Contextualized phenovectors reveal a *Drosophila* serotonergic circuit controlling satiety. (in revision, *Science Advances*). bioRxiv 2026.

Zhang X, **Xu S**, Ho J, Stewart JC, Claridge-Chang A. A mushroom-body output neuron that mediates octopamine-driven and hunger-motivated feeding in *Drosophila*. bioRxiv 2026.

Xu S, Zhang X, Cheung KY, Mai Y, Wu Y, Claridge-Chang A. Long-Stokes-Shift mScarlet3 as a structural marker for two-photon imaging. bioRxiv 2026. (accepted, *Micropublication Biology*).

Lu Z*, Anns J*, Mai Y*, Zhang R, Lian K, Lee NM, Hashir S, Wang L, Li Y, Castillo-Gonzalez AR, Ho J, Choi H, **Xu S***†, Claridge-Chang A†. Getting over ANOVA: Estimation graphics for multi-group comparisons. (co-corresponding, accepted, *Nature Methods*). bioRxiv 2026.

Ott S, **Xu S**, Lee N, Hong I, Anns J, Suresh DD, Zhang Z, Zhang X, Harion R, Ye W, Chandramouli V, Jesuthasan S, Saheki Y, Claridge-Chang A. Kalium channelrhodopsins effectively inhibit neurons. *Nature Communications* 2024; 15:3480.

Bari A, **Xu S**, Pignatelli M, Takeuchi D, Feng J, Li Y, Tonegawa S. Differential attentional control mechanisms by two distinct noradrenergic pathways. *PNAS* 2020; 117(46):29080–29089.

Xu S†, Das G, Hueske E, Tonegawa S†. Dorsal raphe serotonergic neurons control intertemporal choice under trade-off. *Current Biology* 2017; 27(22):3440–3451. (Co-corresponding.)

Kim J, Pignatelli M, **Xu S**, Itoharu S, Tonegawa S. Antagonistic negative and positive neurons of the basolateral amygdala. *Nature Neuroscience* 2016; 19(12):1636–1646.

RECOGNITION

Outstanding Short Talk Award — Neuroscience Singapore 2025

Young Individual Research Grant (SGD \$300,000) — National Medical Research Council, Singapore, 2021–2025

Walle Nauta Award for Excellence in Graduate Teaching — MIT, 2011

National Science Scholarship — A*STAR, Singapore, 2004–2013

Honourable Mention — Singapore Physics Olympiad, 2002

TECHNICAL SKILLS

Python · R · Git · nbdev · Quarto · pandas · NumPy · SciPy · PyTorch · matplotlib · LLM-as-Judge · DSPy · LangGraph · Claude API · agentic evals · adversarial red-teaming · bootstrap CI · effect size estimation · uncertainty quantification · causal inference · A/B testing · experimental design · Oxford Nanopore · direct RNA-seq · epitranscriptomics · DeepLabCut · SLEAP · SQL

TEACHING

GMS6812 Modern Data Analysis for Biomedical Research (TA) *Duke-NUS, Feb 2023*

YSC4229 Molecular Neuroscience — Genes, Brains, and Behaviour (Guest Lecturer) *Yale-NUS, Mar 2023*

GMS6812 Modern Data Analysis for Biomedical Research (TA) *Duke-NUS, Feb 2022*

9.013 Molecular and Cellular Neuroscience II (TA) *MIT, Spring 2011*

9.301 Neural Plasticity in Learning and Memory (TA) *MIT, Spring 2010*

9.150 Biochemistry and Pharmacology of Synaptic Transmission (TA) *MIT, Fall 2009*