

Alexander Z. Wang

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RESEARCH INTERESTS Synthetic biology, biomolecular engineering, biophysics, molecular dynamics, precision medicine, computational biology, epigenetics, single-cell multi-omics, statistical machine learning

EDUCATION **Harvard-MIT Health Sciences and Technology** Cambridge, Massachusetts, USA
Ph.D. Candidate, Medical Engineering and Medical Physics September 2022 – June 2028
Thesis Advisor: Prof. James J. Collins
Technical Concentration Area: Computer Science

Massachusetts Institute of Technology Cambridge, Massachusetts, USA
S.M., Computational Science and Engineering September 2022 – June 2024

California Institute of Technology Pasadena, California, USA
B.S., Computer Science October 2018 – June 2022
Research Advisors: Prof. Henry A. Lester, Prof. Viviana Gradinaru
Concentrations: Machine Learning & Artificial Intelligence, Biocomputes
Henry Ford II Scholar Award - Best Academic Record in Engineering and Applied Science

University of Cambridge, St. John's College Cambridge, England, UK
Study Abroad, Computer Science Tripos October 2021 – December 2021

EXPERIENCE **Massachusetts Institute of Technology** Cambridge, Massachusetts, USA
INSTITUTE FOR MEDICAL ENGINEERING AND SCIENCE – COLLINS LAB
Graduate Student Researcher April 2023 - Present
Visiting Graduate Student (Rotation) January 2023 - April 2023

- Advisors: Prof. James Collins, Dr. Felix Wong, Dr. Aarti Krishnan
- Developing computational methodology for *in silico* design of RNA aptamers for novel targets based on RNA tertiary structure.
- Constructing molecular docking simulations for small molecule-RNA and protein-RNA interactions.
- Designing novel RNA riboswitches based on tertiary structure via computational augmentation of library-based screens.

Harvard Medical School Boston, Massachusetts, USA
WYSS INSTITUTE FOR BIOLOGICALLY INSPIRED ENGINEERING – CHURCH LAB
Visiting Graduate Student (Rotation) September 2022 – December 2022

- Advisors: Prof. George Church, Dr. Jenny Tam, Umesh Padia
- Identified specific epigenetic signatures associated with disease for use in precision diagnostics and targeted therapeutics.
- Applied epigenomic and transcriptomic analyses to identify biomarkers for characterizing acute myeloid leukemia and Alzheimer's disease.

California Institute of Technology

Pasadena, California, USA

CENTER FOR MOLECULAR AND CELLULAR NEUROSCIENCE – GRADINARU LAB

Research Assistant

May 2020 – August 2022

- Advisors: Prof. Viviana Gradinaru, Dr. Min Jee Jang, Dr. Anat Kahan, Dr. David Brown
- Worked on development of a single-cell sequencing and machine learning pipeline to characterize adeno-associated viral (AAV) tropisms at high resolution.
- Trained imbalanced classification models to pioneer a "virtual knockout" methodology for identification of genes whose expression facilitates or inhibits AAV transduction.
- Worked on development of an experimental and computational pipeline leveraging fluorescence *in situ* hybridization and spatial transcriptomics to characterize AAV tropisms.
- Developed machine learning models for classification of VIP neurons in the suprachiasmatic nucleus and prediction of neuron type based on calcium imaging.
- Published as co-author in *Nature Biotechnology* and *Frontiers of Immunology*.

DIVISION OF BIOLOGY AND BIOLOGICAL ENGINEERING – LESTER RESEARCH GROUP

Research Assistant

February 2020 – August 2022

- Advisors: Prof. Henry Lester, Anand Muthusamy
- Worked on development of INSIDE-OUT, a suite of web apps for simulation of drug concentrations and receptor activity during ingestion and elimination of commonly abused drugs.
- Analyzed effects of nicotine dose and cytochrome P450 2A6 polymorphisms on activation and chaperoning pathways of nicotine addiction.
- Engineered genetically encodable opioid biosensors via directed evolution.
- Pioneered computational methods for automating detection of ethologically relevant behavioral responses to opioids in mice from markerless pose estimation readout.

DECISION, OPTIMIZATION AND LEARNING AT CALTECH (DOLCIT) – YUE GROUP

Research Assistant

October 2019 – June 2020

- Advisors: Prof. Yisong Yue, Dr. Jialin Song, Dr. Yury Tokpanov
- Integrated deep kernel learning into multi-fidelity Bayesian Optimization algorithms to improve performance and applied algorithms to analyze astronomy and nanophotonics datasets.

McGill University

Montreal, Québec, Canada

DEPARTMENT OF PSYCHIATRY – LIFSHITZ GROUP

Research Assistant

August 2020 – December 2020

- Advisor: Prof. Michael Lifshitz
- Studied the structural and functional correlates of imaginative suggestibility via analysis of behavioral and fMRI data.

Stanford University

Stanford, California, USA

DEPARTMENT OF ANTHROPOLOGY – LUHRMANN RESEARCH GROUP

Research Assistant

June 2018 – August 2020

- Advisors: Prof. Tanya Luhrmann, Prof. Michael Lifshitz
- Worked on design and development of a neuroimaging paradigm to investigate brain mechanisms involved in auditory verbal hallucinations in hallucination-prone individuals.
- Built psychological tasks integrated into an fMRI protocol to simultaneously evaluate behavioral and brain activity data.

CENTER FOR GENOMICS AND PERSONALIZED MEDICINE – URBAN LAB

Research Assistant

June 2017 – June 2019

- Advisors: Prof. Alexander Urban, Dr. Xiaowei Zhu
- Trained an imbalanced classifier of germline mobile element insertions (MEIs) that achieved 0.96 Area Under Precision-Recall Curve (AUPRC).
- Generalized germline MEI classifier to somatic MEIs for RETROSom, a tool for MEI detection.
- Acknowledged in *Nature Neuroscience* paper.

CHAN ZUCKERBERG BIOHUB – ELIAS LAB

Research Assistant

June 2016 – February 2017

- Advisors: Prof. Joshua Elias, Dr. Lichao Zhang
- Trained neural networks to filter out the effects of noise and interference on proteomic cancer biomarker detection within tandem mass tags mass spectrometry data.

PUBLICATIONS	Jang, M. J., Coughlin, G. M., Jackson, C. R., Chen, X., Chuapoco, M. R., Vendemiatti, J. L., Wang, A. Z. , & Gradinaru, V. (2023). Spatial transcriptomics for profiling the tropism of viral vectors in tissues. <i>Nature Biotechnology</i> , 1-15.
	Brown, D., Altermatt, M., Dobрева, T., Chen, S., Wang, A. , Thomson, M., & Gradinaru, V. (2021). Deep parallel characterization of AAV tropism and AAV-mediated transcriptional changes via single-cell RNA sequencing. <i>Frontiers in Immunology</i> , 4117.
PAPERS UNDER REVIEW	Kahan, A., Dutta, S., Mahe, K., Kassraian, P., Wang, A. , Altermatt, M., & Gradinaru, V. Immediate responses to ambient light in suprachiasmatic VIP neurons reveal distinct activity profiles and retinal connectivity.
PAPERS IN PREPARATION	Muthusamy, A, Rosenberg, M., Wang, A. , Kim, C., Knox, H., Marvin, J., Nichols, A., Cohen, B., Dougherty, D., Looger, L., Meister, M., & Lester, H. Evolution of opioid biosensors for the continuous measurement of brain fentanyl alongside behavior reveals a detrimental stereotyped locomotor effect.
	Lester, H., Lukas, H., Nichols, A., Marotta, C., Wang, A. , Mayo, S., Dougherty, D., Benowitz, N., Gao, W., & Muthusamy, A. Progress toward devices for continuous personal nicotine pharmacokinetics: uses, invasiveness, specifications, feasibility, business aspects.
PRESENTATIONS	Wang, A. , Jeon, J, Buyukozturk, F., & Lester, H. (2022). Pharmacokinetic simulations for nicotine ingestion and nicotine dependence as influenced by cytochrome P450 2A6 polymorphisms. <i>Caltech CMS + IST Meeting of the Minds</i>
AWARDS AND FELLOWSHIPS	National Science Foundation Graduate Research Fellowship2022
	Caltech Cambridge Scholar2021
	Richard T. Jones Summer Undergraduate Research Fellowship2021
	Henry Ford II Scholar Award2021
	SCIAC All-Academic Team – Men’s Water Polo2021 & 2020
	Summer Undergraduate Research Fellowship2020
	USA Biology Olympiad Semifinalist2018

	American Philosophy Olympiad Finalist	2018
	USA Computing Olympiad Gold Division	2017
SKILLS	PROGRAMMING: Python, Java, C/C++, MATLAB TOOLS: PsychoPy, DeepLabCut, Mathematica, \LaTeX	
TEACHING	California Institute of Technology IDS/ACM/CS 157: STATISTICAL INFERENCE <i>Head Teaching Assistant</i> ACM/IDS 216: MARKOV CHAINS, DISCRETE STOCHASTIC PROCESSES AND APPLICATIONS <i>Teaching Assistant</i> DEANS OFFICE <i>Peer Tutor</i>	Pasadena, California, USA <i>April 2022 – June 2022</i> <i>January 2022 – March 2022</i> <i>January 2020 – June 2022</i>