Alexander Z. Wang

Research Interests	Biomolecular engineering, biophysics, synthetic biology, molecular docking, precision medicine, computational biology, epigenetics, single-cell multi-omics, design optimization, inference		
Education	Harvard-MIT Health Sciences and Technology (HST) Ph.D. Candidate, Medical Engineering and Medical Physics <i>Thesis Advisor:</i> Prof. James J. Collins <i>Technical Concentration Area:</i> Computer Science	Cambridge, Massachusetts, USA September 2022 – May 2026	
	Massachusetts Institute of Technology S.M., Computational Science and Engineering <i>Thesis Advisors:</i> Prof. James J. Collins, Prof. Markus J. Buehl <i>Thesis:</i> "Structure-guided <i>in silico</i> design of RNA aptamers"	Cambridge, Massachusetts, USA September 2022 - May 2024 er	
	California Institute of TechnologyPasadena, California, USAB.S., Computer ScienceOctober 2018 – June 2022Research Advisors: Prof. Henry A. Lester, Prof. Viviana GradinaruConcentrations: Machine Learning & Artificial Intelligence, BiocomputesHenry Ford II Scholar Award - Best Academic Record in Engineering and Applied Science		
	University of Cambridge , <i>St. John's College</i> Study Abroad, Computer Science Tripos	Cambridge, England, UK October 2021 – December 2021	
Experience	Broad Institute of MIT and Harvard	Cambridge, Massachusetts, USA	
	 INFECTIOUS DISEASE AND MICROBIOME PROGRAM - COLLINS LAB Graduate Student Researcher April 2023 - Present Visiting Graduate Student (Rotation) January 2023 - April 2023 Advisors: Prof. James Collins, Dr. Aarti Krishnan, Dr. Felix Wong, Dr. Andreas Luttens Designing small molecules for targeting RNA tertiary structures. Developing computational methodology for <i>in silico</i> design of RNA aptamers for novel targets based on RNA tertiary structure. Constructing small molecule-RNA and protein-RNA molecular docking simulations. 		
	Massachusetts Institute of Technology	Cambridge, Massachusetts, USA	
	 INSTITUTE FOR MEDICAL ENGINEERING AND SCIENCE - COLLINS LA Graduate Student Researcher Visiting Graduate Student (Rotation) Advisors: Prof. James Collins, Dr. Jonathan Chen, Dr. Shiva Characterizing and modeling the tertiary structures of RNA Designing novel RNA riboswitches based on tertiary struct tion of library-based screens. 	B April 2023 - Present January 2023 - April 2023 Razavi A as dynamic ensembles. cure via computational augmenta-	

Harvard Medical School

Wyss Institute for Biologically Inspired Engineering – Church LabVisiting 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

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 prediction of neuron type based on calcium imaging.
- Published as co-author in Nature Biotechnology, Frontiers of Immunology, and iScience.

Division of Biology and Biological Engineering – Lester Research Group Research Assistant February

- Advisors: Prof. Henry Lester, Dr. 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

DEPARTMENT OF PSYCHIATRY – LIFSHITZ GROUP Research Assistant

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

Grave

February 2020 – August 2022

Pasadena, California, USA

Boston, Massachusetts, USA

Montreal, Québec, Canada August 2020 – December 2020

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Research Assistant • Advisors: Prof. Tanya Luhrmann, Dr. Michael Lifshitz · Worked on design and development of a neuroimaging paradigm to investigate brain mechanisms involved in auditory verbal hallucinations in hallucination-prone individuals.

Stanford University

 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

DEPARTMENT OF ANTHROPOLOGY - LUHRMANN RESEARCH GROUP

- 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

- 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 Kahan, A., Mahe, K., Dutta, S., Kassraian, P., Wang, A., & Gradinaru, V. (2023). Immediate responses to ambient light in vivo reveal distinct subpopulations of suprachiasmatic VIP neurons. iScience, 107865.

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. Nature Biotechnology, 1-15.

Brown, D., Altermatt, M., Dobreva, 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. Frontiers in Immunology, 4117.

PAPERS UNDER Wong, F., He, D., Krishnan, A., Hong, L., Wang, A., Wang, J., Hu, Z., Omori, S., Li, A., Rao, J., Yu, Q., Jin, W., Zhang, T., Ilia, K., Chen, J., Zheng, S., King, I., Li, Y., & Collins, J. Structure-guided, Review deep learning-enabled generative design of RNA aptamers.

> Muthusamy, A, Rosenberg, M., Kim, C., Wang, A., Ebisu, H., Chin, T., Koranne, A., Marvin, J., Cohen, B., Looger, L., Oka, Y., Meister, M., & Lester, H. Correspondence of fentanyl brain pharmacokinetics and behavior measured via engineering opioids biosensors and computational ethology.

PAPERS IN 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 pharmacoki-PREPARATION netics: uses, invasiveness, specifications, feasibility, business aspects.

Stanford, California, USA

June 2018 – August 2020

June 2017 – June 2019

June 2016 – February 2017

Presentations	Wang, A. , Jeon, J, Buyukozturk, F., & Lester, H. (2022). Phar tine ingestion and nicotine dependence as influenced by cytor <i>Caltech CMS + IST Meeting of the Minds</i>	macokinetic simulations for nico- chrome P450 2A6 polymorphisms.	
Awards and	MIT Sandbox Innovation Fund Award	2024	
Fellowships	National Science Foundation Graduate Research Fellowship	2022-2025	
	Caltech Cambridge Scholar	2021	
	Richard T. Jones Summer Undergraduate Research Fellowship	2021	
	Henry Ford II Scholar Award	2021	
	SCIAC All-Academic Team – Men's Water Polo	2021 & 2020	
	Summer Undergraduate Research Fellowship	2020	
	USA Biology Olympiad Semifinalist	2018	
	American Philosophy Olympiad Finalist	2018	
	USA Computing Olympiad Gold Division	2017	
Skills	Programming: Python, Java, C/C++, MATLAB, Julia		
	Tools: PsychoPy, DeepLabCut, Mathematica, &TEX		
Teaching and Mentoring	Massachusetts Institute of Technology	Cambridge, Massachusetts, USA	
	Rotation Students		
	Jett Liu – MIT Microbiology (joined lab)	February 2024 – April 2024	
	California Institute of Technology	Pasadena, California, USA	
	IDS/ACM/CS 157: Statistical Inference		
	Head Teaching Assistant	April 2022 – June 2022	
	ACM/IDS 216: Markov Chains, Discrete Stochastic Processes and Applications		
	Teaching Assistant	January 2022 – March 2022	
	Deans Office		
	Peer Tutor	January 2020 – June 2022	