

Salwan Butrus

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<https://salwanbutrus.github.io/>

EDUCATION

University of California, Berkeley, CA

August 2019-September 2024

Ph.D. Chemical and Biomolecular Engineering

Designated Emphasis in Computational and Genomic Biology

Thesis: *Single-cell molecular profiling of experience-dependent cell type development in mouse retina and cortex*

Advisor: Prof. Karthik Shekhar

University of Michigan, Ann Arbor, MI

September 2015-May 2019

B.S.E. Chemical Engineering, *Summa Cum Laude*

AWARDS AND HONORS

- NIH Ruth L. Kirschstein NRSA Predoctoral Fellowship (F31) ([2023](#))
- INSPIRE Symposium Awardee. Washington University School of Medicine ([2023](#))
- NIH Outstanding Scholars in Neuroscience Award ([2022](#))
- Society for Neuroscience Trainee Professional Development Award ([2022](#))
- Best Talk Award at the 2021 Computational Biology Retreat. UC Berkeley (2021)
- NSF Graduate Research Fellowship ([2019](#))
- 1st place, ChE UG Research Poster Competition. Ann Arbor, MI (2019)
- Sinnott Prize, Outstanding ChE Senior for academics and leadership. Ann Arbor, MI ([2019](#))
- Instructor of the Year, Organic Chemistry II, Science Learning Center. Ann Arbor, MI (2018) ([Student testimonials](#))
- 1st place, UROP Summer Symposium Poster Competition. Ann Arbor, MI (2016)
- 1st Place Award, The Landes Contest in Technical Communication, Best Senior Design Final Report, Poster, and Presentation. Ann Arbor, MI ([2019](#))

INDUSTRY WORK EXPERIENCE

Curve Biosciences

September 2024-Present

Senior Computational Scientist

- Design and implement epigenomic data featurization and modeling strategies by integrating domain knowledge and literature insights into tailored solutions for liquid biopsy-based disease detection.
- Build scalable bioinformatics and ML workflows that are cost-effective, flexible, and efficient by utilizing custom parallelization, Dask, and multiprocessing in GCP/AWS HPC environments.
- Develop lightweight MLOps practices, including CI/CD, environment management (poetry, Makefiles), and modular, reproducible code, with version control and documentation.

BEVC Venture Capital

November 2023-May 2024

AI/ML in Pharmaceutical R&D Innovation Intern

- Identify emerging trends, map inventors, academic institutes, and emerging startups in AI/ML
- Develop investment themes and thesis based on the latest scientific findings and market trends
- Conduct scientific and technical assessment, including evaluating validity and differentiation

Genentech Research and Early Development (gRED)

May-August 2022

Data Science and Statistical Computing Intern

- Collaborated with researchers from the Data Science, Cellular and Tissue Genomics, and Neuroscience divisions on interdisciplinary projects

- Developed a transfer learning pipeline to investigate cell type-specific effects of genetic perturbations using single-cell RNA-seq and ATAC-seq datasets
- Generated results that informed development of cellular platforms for high-throughput drug discovery

ACADEMIC WORK EXPERIENCE

University of California, Berkeley | Shekhar Lab

October 2019-September 2024

Graduate Student Researcher

- Assembled and managed multi-institutional efforts combining experimental and computational researchers at the nexus of neuroscience, molecular biology, and computational biology
- Developed a suite of unsupervised and supervised ML tools that enabled the assembly of the first developmental scRNA-seq atlas of mouse visual (V1) and somatosensory (S1) cortex
- Mined scRNA-seq data using a transfer learning pipeline that revealed most cell types in V1 and S1 are genetically hardwired apart from a few that mature gradually in a vision-dependent fashion
- Developed a time-series analysis pipeline for inferring gene regulatory mechanisms of V1 development from snapshot scRNA/ATAC-seq measurements
- Developed ML models to predict transcriptional responses to experimental perturbations in neuronal cell types using single-cell transcriptomics data

University of California, Berkeley | Landry Lab

May-August 2018

Amgen Scholar

- Conceived and executed a project to systematically probe the influence of gold nanoparticle physicochemical properties on bio-cargo loading efficiency
- Developed two separate nanoplatforms for the delivery of siRNA and pDNA to intact leaves

Massachusetts Institute of Technology | Hammond Lab

June-August 2017

EBICS REU Intern

- Synthesized and characterized a library of polymers to identify candidates with maximum uptake to cytotoxicity ratios in cartilage for applications in osteoarthritis drug delivery
- Elucidated relationships between the physicochemical properties of polymers and their transport properties and toxicity in cartilage.

University of Michigan Biointerfaces Institute | Lahann Lab

September 2016-October 2018

Undergraduate Researcher

- Harnessed nanoindentation to probe the interfacial properties that govern how synthetic polymer brushes support human embryonic stem cells (hESCs)
- Through a statistical DOE, developed a relationship between bulk and nanomechanical properties that explained the behavior of hESCs on polymer brush surfaces

PUBLICATIONS (*equal contribution)

- 1) ***Butrus, S.**, Jain, S., Yoo, J., Shekhar, K., Zipursky, L. Gene regulatory mechanisms of experience-dependent cell type development in visual cortex. *Submitting in 2024*.
- 2) ***Butrus, S.**, *Monday, H., Feldman, D., Shekhar, K. Molecular dissection of development and plasticity in mouse barrel cortex. *Submitting in 2024*.
- 3) **Butrus, S.**, Sagireddy, S., Shekhar, K. Defining selective neuronal resilience and identifying targets of neuroprotection and axon regeneration using single-cell RNA sequencing – computational approaches. *Methods in Molecular Biology* (2023), vol 2636. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-3012-9_2
- 4) ***Whitney, I.**, ***Butrus, S.**, Sanes, J.R., Shekhar, K. Vision-dependent and -independent molecular maturation of mouse retinal ganglion cells. *European Journal of Neuroscience* (2022) 508; pp. 153-173.

- 5) Shekhar, K., Whitney, I., **Butrus, S.**, Peng, Y., Sanes, J.R. Diversification of multipotential postmitotic mouse retinal ganglion cell precursors into discrete types. *eLife* (2022) 11; e73809.
- 6) *Cheng, S., ***Butrus, S.**, *Tan, L., Sagireddy, S., Trachtenberg, J.T., Shekhar, K., Zipursky, L. Vision-dependent specification of cell types and function in the developing cortex. *Cell* (2022) 185, 2: pp. 311-327.
 - Highlighted in [Nature](#) by Puiggros and Jabaudon (2022).
 - Highlighted in *UC Berkeley, College of Chemistry Press Release* (2022).
 - Highlighted in [EurekAlert](#) (2022).
- 7) Zhang, H.* Goh, N.S.*, Wang, J., Demirer, G.S., **Butrus, S.**, Park, S-J, Landry, M.P. Nanoparticle Cellular Internalization is Not Required for RNA Delivery to Mature Plant Leaves. *Nature Nanotechnology* (2021)
 - Conceived and generated preliminary data for this project as part of the 2018 summer I spent in Prof. Landry's group
 - Submitted and received funding for the NSF GRFP grant based on this work
- 8) Kölsch, Y., Hahn, J., Sappington, A., Stemmer, M., Fernandes, A.M., Helmbrecht, T.O., Lele, S., **Butrus, S.**, Laurell, E., Arnold, I., Shekhar, K., Sanes, J.R., Baier, H. Molecular classification of zebrafish retinal ganglion cells links genes to cell types to behavior. *Neuron* (2020) 109, 4: pp. 645-662.
- 9) **Butrus, S.**, Greenman, K., Kopyeva, I., Khera, Eshita., Nishii, A. An Undergraduate-Led, Research-Based Course that Complements a Traditional Chemical Engineering Curriculum. *Chemical Engineering Education* (2020) 54, 2; pp. 97-106.
- 10) Wang, J.W., Grandio, E.G., Newkirk, G.M., Demirer, G.S., **Butrus, S.**, Giraldo, J.P., Landry, M.P. Nanoparticle-mediated genetic engineering of plants. *Molecular Plant* (2019) 12; pp. 1037-1040.

PRESENTATIONS

- 1) ***Butrus, S.**, *Jain, S., *Yoo, K., Shekhar, K., Zipursky, L. *Gene regulatory mechanisms of experience-dependent cell type development in visual cortex*. Visual System Development GRS/GRC. Italy (2024).
- 2) **Butrus, S.**, *Monday, H., Feldman, D., Shekhar, K. *Single-cell transcriptomic analysis of experience-dependent plasticity in whisker somatosensory cortex*. Society for Neuroscience. Washington, DC (2023)
- 3) ***Butrus, S.**, *Cheng, S., *Tan, L., Sagireddy, S., Trachtenberg, J.T., Shekhar, K., Zipursky, L. *Vision-dependent specification of cell types and function in the developing cortex*. INSPIRE Invited Seminar. Washington University, St. Louis, MO (2022).
- 4) ***Butrus, S.**, *Cheng, S., *Tan, L., Sagireddy, S., Trachtenberg, J.T., Shekhar, K., Zipursky, L. *Vision-dependent specification of cell types and function in the developing cortex*. NIH OSNAP Invited Seminar. Bethesda, MD (2022).
- 5) ***Butrus, S.**, *Cheng, S., *Tan, L., Sagireddy, S., Trachtenberg, J.T., Shekhar, K., Zipursky, L. *Vision-dependent specification of cell types and function in the developing cortex*. Visual System Development GRS/GRC. Southbridge, MA (2022).
- 6) **Butrus, S.**, Shekhar, K. *Vision mediates molecular patterning in the developing visual cortex*. UC Berkeley Center for Computational Biology Retreat (2021).
- 7) **Butrus, S.**, Shekhar, K. *Single-Cell Transcriptional Dynamics of Retinal Ganglion Cell Diversification*. 2020 AIChE Meeting.

TEACHING EXPERIENCE

Lumiere Education | *Research Mentor* June 2023-Present

- Design and manage projects that guide high schools students through research papers focused on the use of machine learning in science

Berkeley Bioinformatics Bootcamp | *Lecturer and TA* January 2022

- Lead Python programming sessions on various bioinformatics concepts

InspiritAI | *AI Scholars Instructor* December 2021-Present

- Immerse high school students in machine learning through lectures, assignments, and projects

UC Berkeley Chemical and Biomolecular Engineering Department | *Graduate Student Instructor*

ChemEng 142: Chemical Kinetics and Reaction Engineering

August 2019-December 2019

ChemEng 150A: Transport Processes (4.7/5 rating, 93 students, [testimonials](#))

January 2021-May 2021

University of Michigan Chemical Engineering Department | *Teaching Assistant*

ChE 496: Introduction to Experimental and Computational Research in ChE

March 2018-May 2019

- Assembled a group of 10 undergraduate and graduate peers in collaboration with faculty members and researchers to design a research-focused course in our ChemE department
 - Guided efforts in organizing meetings, developing content, and securing resources and instructors; Secured a \$15,000 departmental grant to support course launch
- Developed and tested laboratory modules, held weekly office hours, and graded assignments

ChE 344: Reactor Design and Engineering

September 2018-May 2019

University of Michigan Science Learning Center

January 2017-May 2019

Organic Chemistry II Course Leader

Organic Chemistry II Study Group Facilitator (4.9/5 rating, 86 students, [testimonials](#))

SERVICE EXPERIENCE

College of Chemistry Transfer Student Mentorship Program | *Mentor*

August 2022-May 2023

- Meet monthly with transfer student mentees to support their academic transition to UC Berkeley

College of Chemistry Undergraduate Research Incubator | *Supervisor*

September 2021-May 2022

- Supervised experiments carried out by students and maintained the safety and cleanliness of the laboratory working environment

Be A Scientist! and GOLD Science Fair | *Mentor*

January 2021-May 2022

- Support and mentor middle school and high school students on the design, execution, and communication of science projects

Undergraduate Research Symposium Committee | *Founder*

November 2018-May 2019

- Assembled a team of 8 undergraduate peers to organize the first campus-wide undergraduate research symposium at the University of Michigan
- Fundraised over \$12,000 from 16 entities to support an event of 150 presenters and 100 judges

Camp Kesem | *Camp Counselor and Unit Leader*

July 2016-August 2019

- Fundraised \$500 annually to send children whose families are affected by cancer to a free summer camp; supported the well-being of several children and counselors throughout camp activities

ChemE Undergraduate Program Committee | *Member*

October 2017-May 2019

- Addressed improvements to the ChemE program and funding requests for students and organizations

University of Michigan Student Life Housing

August 2017-May 2018

Residential Advisor, First Generation Student Theme Community

- Support residents academically, personally, and professionally

SKILLS

Programming: Python | R | C++

Research and coursework: single-cell genomics experiment design and optimization | cloud computing (HPC, GCP, AWS) | management of large datasets (>1M samples) | GitLab/GitHub | data visualization | PyTorch/TensorFlow/scikit-learn ecosystem | time-series analysis | deep learning | probabilistic/generative models | NLP | computer vision

PERSONAL

Languages: English (fluent) | Arabic (fluent) | Neo-Aramaic (fluent) | Spanish (intermediate)

Hobbies: Cycling | Piano | Soccer | Hiking | Camping | Skiing