Volkan Ozcoban

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OVERVIEW

My overarching research interests lie at the intersection of computational biology, experimental biology, and mathematical modelling, particularly in multi-scale and highly dynamic cellular systems. These broadly include, but are not limited to:

- Developing new software methodologies, such as simulation and unsupervised learning, to reduce the necessity of manual annotation of large biological datasets.
- Designing interpretable machine learning tools to uncover novel insights from large-scale microscopy and multi-omics data and applying these to hybrid models for prediction and hypothesis testing in biomedical research.
- Harnessing machine learning methodologies to develop data-driven models to understand subcellular processes, dynamic systems, and multi-scale biology.
- Integrating biological data, including that captured by high-resolution microscopy, and biophysical modelling frameworks to identify emergent behaviour in complex subcellular systems.

By combining biological, computational, and mathematical tools together, I aim to advance strategies in modelling cellular dynamics by bridging basic science and clinical applications.

To learn more about me, feel free to explore my research website at: volkanozcoban.github.io

UNIVERSITY EDUCATION

November 2023 – Current: Doctor of Philosophy – Engineering and IT (Biomedical Engineering)
Thesis Title: Constructing the Bridge between Mitochondrial Dynamics and Cell Migration
Supervisors: A/Prof. Vijay Rajagopal (University of Melbourne), Dr. Senthil Arumugam (Monash University), Dr. Stanley Stylli (Royal Melbourne Hospital)

July 2021 – July 2022: Bachelor of Science (Honours), University of Melbourne
Department: Biochemistry & Pharmacology
Final Grade: First Class Honours (H1, 89%)
Thesis Title: Unravelling the Mechanisms of GPCR-G Protein Promiscuity
Thesis Grade: First Class Honours (H1, 90.7%)

March 2018 – June 2021: Bachelor of Science, University of Melbourne
Major: Biochemistry & Molecular Biology
Final Grade: First Class Honours (H1, 87.208%)

March 2018 – June 2021: Diploma in Mathematical Sciences, University of Melbourne
Major: Mathematics and Statistics (Applied Mathematics)
Final Grade: First Class Honours (H1, 89.5%)

RESEARCH EXPERIENCE

October 2024 – Current: Research Assistant (Department of Mathematics and Statistics, The University of Melbourne)
Supervisors: Dr. Michael Pan (Department of Mathematics and Statistics)
Project Description: Undertaking research in both an academic and industry start-up to develop novel tools for GPCR-based nanobody therapeutics.

October 2022 – April 2023: Research Assistant (LASEREDD Therapeutics (*now* Alkira Bio), The Florey Institute of Mental Health and Neuroscience)
Supervisors: A/Prof. Daniel Scott (CEO, Co-Founder) and Dr. Christopher Draper-Joyce (CSO, Co-Founder)
Project Description: Undertaking research in both an academic and industry start-up to develop novel tools for GPCR-based nanobody therapeutics.

January 2021 – May 2021: Research Assistant (Systems Biology Laboratory, The University of Melbourne)
Supervisors: Dr. Stuart Johnston (Department of Mathematics and Statistics), Dr. Matt Faria (Department of Biomedical Engineering), and Prof. Edmund Crampin (Deceased) (Department of Mathematics and Statistics)
Project Description: Continued the Vacation Research Scholarship Program project as a research assistant in the System Biology laboratory. Collected experimental data to determine the effectiveness of the PDE model of nanoparticle-cell uptake.

January 2020 – May 2021: Research Project Internship (The Florey Institute of Mental Health and Neuroscience)
Supervisors: A/Prof. Daniel Scott and Dr. Jonathan Siah (Receptor Structure and Drug Discovery Laboratory)
Project Description: Was undertaken as part of the highly competitive UROP. The project aimed to develop a novel method for evolving GPCRs to allow for increased receptor expression.

December 2020 – January 2021: Vacation Research Scholarship Program (Department of Mathematics and Statistics)
Supervisor: Dr. Stuart Johnston (The University of Melbourne)
Project Description: Adapted a partial differential equation model of nanoparticle-cell uptake in cells to one which incorporates phases of the cell cycle for a better understanding of nanoparticle transport and the physical processes dictating transport into cells.

November 2019 – February 2020: Research Project Internship (Peter MacCallum Cancer Centre)
Supervisors: Dr. David Goode and Dr. Anna Trigos (Computational Biology/Goode Laboratory, Peter MacCallum Cancer Centre).
Project Description: Developed an R package (SPIAT) to determine interactions of immune cells with tumours in tissues. This open-source software was made available to all researchers, particularly those without technical programming knowledge.

PUBLICATIONS

Yuzhou Feng, Tianpei Yang, John Zhu, Mabel Li, Maria Doyle, **Volkan Ozcoban**, Greg Bass, Angela Pizzolla, Lachlan Cain, Sirui Weng, Anupama Pasam, Nikolce Kocovski, Yu-Kuan Huang, Simon Keam, Terence Speed, Paul Neeson, Richard Pearson, Shahneen Sandhu, David Goode. Spatial analysis with SPIAT and spaSim to characterize and simulate tissue microenvironments. *Nature Communications* **14**, 2697 (2023). https://doi.org/10.1038/s41467-023-37822-0

AWARDS

- University of Melbourne Research Training Program Scholarship (Stipend and Fee Offset) (2023-2027)
- Melbourne Access Scholarship (2018-2022)
- Dean's Honours List – Bachelor of Science – Third Year (2021)
- Dean's Honours List – Bachelor of Science – Second Year (2019)
- 1st Place in the Department of Biochemistry & Pharmacology Honours Program (2021-2022)
- Undergraduate Research Opportunities Program (UROP) Scholar – CSIRO (January 2020 – May 2021)
- School of Mathematics and Statistics Vacation Research Scholarship (2020)
- Cancer Council Victoria – Summer Vacation Studentship (November 2019 – February 2020)
- Peter MacCallum Summer Scholarship (November 2019 – February 2020)
- Certificate of Merit (Second Year) – Biochemistry & Molecular Biology Major (2019)
- Science Start Up Scholarship (2018)

SKILLS

- **Computational:** Coding (Python, MATLAB, R, Git, Bash), High Performance Computing (Slurm, CPU/GPU Parallelisation), Machine/Deep Learning (Pytorch, SciPy, NumPy, Pandas, Scikit Learn, Scikit Image)
- **Wet Laboratory:** Bacterial Cell Culture, Bioluminescence/Fluorescence Resonance Energy Transfer Assays, DNA Cloning, Enzyme-Linked Immunosorbent Assays, Flow Cytometry, Mammalian Cell Culture, Protein Analysis (Fluorescence Size Exclusion Chromatography, High-Performance Liquid Chromatography, SDS-PAGE, Western Blotting), Protein Purification (Mammalian and Bacterial, particularly GPCRs and Nanobodies)
- **Mathematics:** Biophysical Models, Partial Differential Equations (Reaction-Diffusion, Elasticity, Continuum Mechanics, Biomechanics), Ordinary Differential Equations (Bond Graphs, Numerical Integration Methods), Finite Element Analysis, Spatial Statistics, Stochastic Simulations (Monte Carlo, Gillespie Algorithm)