Suzan Farhang-Sardroodi, PhD

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LinkedIn · GitHub · Website · Twitter/X (@FarhangSuzan) · Google Scholar · PubMed

Research Interests

Statistical Genetics · Psychiatric Genetics · Genetic Epidemiology · Pharmacogenomics · Computational Biology · Machine Learning for Health · Neuropsychopharmacology

Professional Experience

Research Associate *Jan 2024 – Present*

University of Toronto — Department of Pharmacology & Toxicology

- Led multi-trait genomic analyses (MTAG) integrating schizophrenia and smoking behaviour GWAS, identifying **novel risk loci** for CigDay and smoking cessation; performed **statistical fine-mapping and eQTL colocalization** to prioritize candidate genes (e.g., SYNDIG1L, TMEM163) and conducted integrative analyses linking genetic findings to **psychiatric drug targets and biological pathways**.
- Developed and validated **population pharmacokinetic (PopPK) models** of nicotine in African green monkeys using nonlinear mixed-effects (NLME) modeling (Phoenix NLME), incorporating **noncompartmental analysis (NCA)** and covariate modeling (age, sex, body weight) to quantify interindividual variability in nicotine disposition.

Postdoctoral Researcher *Mar 2022 – Jan 2024*

University of Manitoba & Université de Montréal

- Developed **mechanistic mathematical models** of B cell and antibody dynamics following primary and secondary SARS-CoV-2 infections using **ODE-based frameworks**, modeling germinal center B cells, plasma cells, memory B cells, and antibody kinetics; calibrated models to clinical data to quantify **antibody production, waning immunity, and variant-specific neutralization.**

Postdoctoral Researcher *Sep 2020 – Feb 2022*

York University

- Developed **machine learning models** in collaboration with the National Research Council Canada (NRCC) to distinguish COVID-19 and influenza, leveraging synthetic datasets generated from **mechanistic viral infection models** for supervised learning and feature selection.
- Built **compartmental epidemiological models** incorporating vaccination, behavioural dynamics, and waning immunity to reproduce COVID-19 transmission in Ontario.
- Modeled **immune response to adenovirus-based vaccines** using ODE systems to evaluate dosing strategies and immunological outcomes.

Postdoctoral Researcher *Sep 2018 – Aug 2020*

Toronto Metropolitan University

- Developed **mechanistic models of cancer cachexia** capturing interactions between tumor cells, muscle cells, and satellite cells, to characterize tumor–host dynamics.

- Modeled chemotherapy-induced muscle wasting and **nonlinear dose–response relationships** for 5-fluorouracil treatment, to evaluate treatment-induced toxicity and optimize dosing strategies.

Education

Ph.D. in Physics (Evolutionary Graph Theory) *Sep 2014– Jun 2018*
University of Zanjan, Zanjan, Iran
Thesis: **Evolutionary Dynamics on Complex Networks**
Defense Date: June 19, 2018
Summary: Investigated evolutionary dynamics in structured populations under spatial and temporal heterogeneity using evolutionary graph theory. Modelled populations as networks of interacting individuals (e.g., cells), applying Moran processes (birth–death and death–birth) to study mutation fixation under natural selection and drift. Introduced fitness variability to quantify how randomness and network topology influence fixation probabilities and timing. Findings revealed distinct evolutionary effects of spatial vs. temporal heterogeneity, providing insight into mutation spread in complex systems such as tumour microenvironments and laying the groundwork for future modeling of heterogeneity in cancer, immunology, and pharmacology.
Supervisors: Dr. Amir Hossein Darooneh (University of Zanjan); Dr. Mohammad Kohandel (University of Waterloo)
Mentor/Collaborator: Dr. Natalia L. Komarova (University of California San Diego)
Visiting Ph.D. Researcher (Exchange Semesters), Department of Applied Mathematics, University of Waterloo, Canada, Fall–Winter 2017–2018
Conducted part of Ph.D. research under the supervision of Dr. Mohammad Kohandel.

M.Sc. in Physics (High-Energy Particle Physics) *Sep 2009– Jan 2012*
Azarbaijan Shahid Madani University, Tabriz, Iran
Thesis: **Nambu Structures on Four-Dimensional Real Lie Groups**
Defense Date: January 23, 2012
Summary: Investigated Nambu–Poisson structures and their role in integrable systems. Classified triple and quadruple Nambu tensors on Lie groups and proposed novel Nambu–sigma models on non-semisimple manifolds.
Supervisor: Dr. Adel Rezaei-Aghdam

B.Sc. in Physics *2005–2008*
University of Tabriz, Tabriz, Iran

Technical Skills

Statistical Genetics / Genetic Epidemiology: GWAS, MTAG, fine-mapping, colocalization, polygenic risk score (PRS) analysis, TWAS (including joint/conditional TWAS), causal inference analyses using instrumental variable (IV) frameworks, including two-sample Mendelian randomization (MR) and eQTL-MR

Single-Cell Analysis & Functional Annotation: UMAP, SCENT-based single-cell regulatory analysis, FUMA, FIVEx, LocusZoom (web and R), Manhattan plots, Miami plots, QQ plots, Venn diagrams

Pharmacokinetics (PK): Phoenix NLME (nonlinear mixed-effects modeling, compartmental analysis), Phoenix WinNonlin (noncompartmental analysis, NCA)

Mechanistic Modeling: Ordinary differential equations (ODEs), delay differential equations (DDEs), stochastic processes

Machine Learning: Supervised learning, classification and regression models, feature selection

Programming: Python (NumPy, pandas, SciPy, scikit-learn, TensorFlow, matplotlib), Julia (DifferentialEquations.jl, Plots.jl, DataFrames.jl, GLM.jl, LsqFit.jl), R, C++

Other Tools: MATLAB, Mathematica, LaTeX, Microsoft Office, CorelDRAW

Selected Publications

- **Farhang-Sardroodi, S.**, Chang, C., Pouget, J.G., Tyndale, R.F., and Chenoweth, M.J. (2025). Genome-wide multi-trait genomic and transcriptomic analyses of smoking behaviours and schizophrenia reveal new biological insights and opportunities for drug repurposing. *European Neuropsychopharmacology*, 99, 245. DOI: 10.1016/j.euroneuro.2025.08.431
- Sandhu, S., Merritt, P., **Farhang-Sardroodi, S.**, Tyndale, R.F., and Chenoweth, M.J. (2025). M5. Spotlighting women's health: Exploring the biological liability to migraine and anxiety in women. *European Neuropsychopharmacology*, 99(Suppl. 1), 109–110. DOI: 10.1016/j.euroneuro.2025.08.201
- **Farhang-Sardroodi, S.**, Ghaemi, M.S., Craig, M., Ooi, H.K., and Heffernan, J.M. (2022). A machine learning approach to differentiate between COVID-19 and influenza infection. *Mathematical Biosciences and Engineering*. DOI: 10.3934/mbe.2022272
- **Farhang-Sardroodi, S.**, La Croix, M.A., and Wilkie, K.P. (2022). Chemotherapy-induced cachexia and model-informed dosing to preserve lean mass in cancer treatment. *PLoS Computational Biology*. DOI: 10.1371/journal.pcbi.1009505
- Korosec, C.S., **Farhang-Sardroodi, S.**, Dick, D.W., Gholami, S., Ghaemi, M.S., Moyles, I.R., Craig, M., Ooi, H.K., and Heffernan, J.M. (2022). Long-term durability of immune responses to the BNT162b2 and mRNA-1273 vaccines based on dosage, age and sex. *Scientific Reports*. DOI: 10.1038/s41598-022-25134-0
- Gholami, S., Korosec, C.S., **Farhang-Sardroodi, S.**, Dick, D.W., Craig, M., Ghaemi, M.S., Ooi, H.K., and Heffernan, J.M. (2023). A mathematical model of protein subunits COVID-19 vaccines. *Mathematical Biosciences*. DOI: 10.1016/j.mbs.2023.108970
- **Farhang-Sardroodi, S.**, Korosec, C.S., Gholami, S., Craig, M., Moyles, I.R., Ghaemi, M.S., Ooi, H.K., and Heffernan, J.M. (2021). Analysis of host immunological response of adenovirus-based COVID-19 vaccines. *Vaccines*. DOI: 10.3390/vaccines9080861
- Molla, J., **Farhang-Sardroodi, S.**, Moyles, I.R., and Heffernan, J.M. (2023). Pharmaceutical and non-pharmaceutical interventions for controlling the COVID-19 pandemic. *Royal Society Open Science*. DOI: 10.1098/rsos.230621
- **Farhang-Sardroodi, S.** and Wilkie, K.P. (2020). Mathematical model of muscle wasting in cancer cachexia. *Journal of Clinical Medicine*. DOI: 10.3390/jcm9072029
- **Farhang-Sardroodi, S.**, Komarova, N.L., Michelen, M., and Pemantle, R. (2021). Success probability for selectively neutral invading species in the line model with a random fitness landscape. *Studies in Applied Mathematics*. DOI: 10.1111/sapm.12373
- **Farhang-Sardroodi, S.**, Darooneh, A.H., Kohandel, M., and Komarova, N.L. (2019). Environmental spatial and temporal variability and its role in non-favoured mutant dynamics. *Journal of the Royal Society Interface*. DOI: 10.1098/rsif.2018.0781
- **Farhang-Sardroodi, S.**, Darooneh, A.H., Nikbakht, M., Komarova, N.L., and Kohandel, M. (2017). The effect of spatial randomness on the average fixation time of mutants. *PLoS*

Computational Biology. DOI: 10.1371/journal.pcbi.1005864

- **Farhang-Sardroodi, S.**, Rezaei-Aghdam, A., and Sedghi-Ghadim, L. (2015). Nambu structures on four-dimensional real Lie groups and related superintegrable systems. *Theoretical and Mathematical Physics*. DOI: 10.1007/s11232-015-0288-9

Teaching Experience

- **York University, Department of Mathematics and Statistics** (link), Toronto, ON, Canada
  Instructor, **Calculus I**, Summer terms (May–August), 2020–2021
- **Toronto Metropolitan University, Biomathematics and Fluids Group** (link), Toronto, ON, Canada
  Instructor (selected sessions), **Calculus I, Calculus III, Mathematical Biology**, 2018–2019
- **University of Zanjan, Department of Physics, Faculty of Science** (link), Zanjan, Iran
  Instructor, **English Language (Applied Science and Technology, Jahad Daneshgahi)**, Nov 2014–Jun 2017
  Instructor, **Elementary Physics**, Fall 2016
  Co-Instructor, **Advanced Mathematical Physics**, Fall 2015
- **Azerbaijan Shahid Madani University, Department of Physics, Faculty of Science**, Tabriz, Iran
  Teaching Assistant, **Statistical Mechanics**, 2013–2015

Awards

- **GSK Pharmaceutical Industry Fellowship**, 2024–2026
- HQP Travel Support Award, Canadian Applied and Industrial Mathematics Society (CAIMS), 2024
- **Landahl Travel Grant**, Society of Mathematical Biology (SMB) Annual Meeting, 2023
- **Travel Award**, IMO Workshop: Cancer Communities, Moffitt Cancer Center, 2022
- **FOS Dean's Research Fund Travel Award**, Toronto Metropolitan University, 2019

Selected Conference Presentations

- Invited In-Person Talk, *Integrative Genomic Analysis of Smoking Behaviours and Schizophrenia Identifies Novel Risk Loci and Potential Biomarkers*, Einstein Lab (link), Apr 30, 2026, University of Toronto, Toronto, ON, Canada
- Virtual Talk, *Population Pharmacokinetic Modelling of Nicotine in the African Green Monkey*, CAMH Addiction Research Rounds, Feb 12, 2026, Centre for Addiction and Mental Health (CAMH), Toronto, ON, Canada
- Poster Presentation, *Genome-Wide Multi-Trait Genomic and Transcriptomic Analyses of Smoking Behaviours and Schizophrenia*, World Congress of Psychiatric Genetics (WCPG), Oct 19–23, 2025, Cancún, Mexico
- Poster Presentation, *Neurosciences and Clinical Translation*, Department of Psychiatry, University of Toronto, June 19, 2025, Chelsea Hotel, Toronto
- Poster Presentation, *Genome-Wide Multi-Trait Analysis of Smoking Behaviours and Schizophrenia: New Insights and Drug Repurposing Opportunities*, Society of Biological Psychiatry (SOBP 2025), Apr 24–26, 2025, Sheraton Toronto

- Virtual Talk, *Genome-Wide Multi-Trait Analysis of Smoking Behaviours and Schizophrenia Identifies Novel Loci and Therapeutic Targets*, CAMH Addiction Research Rounds, Apr 17, 2025
- Virtual Seminar, *Center for Computational Oncology*, University of Texas at Austin, Feb 26, 2025
- Virtual Seminar, *Department of Biology, Faculty of Science*, Memorial University of Newfoundland, Nov 22, 2024
- *Workshop Mathematical oncology: at the crossroads of computational fluids, mechanics, and biology*, Fields Institute, Toronto, Ontario, Canada, Nov 18–19, 2024
- Poster Presentation, *Multi-Trait Genome-Wide Association Analysis of Psychiatric Traits Identified New Loci*, American Society of Human Genetics (ASHG) Annual Meeting, Denver, CO, Nov 5–9, 2024
- Poster Presentation, *Genetic Risk Factors for Concurrent Tobacco Use and Schizophrenia*, Pharmacogenomics Global Research Network (PGRN) Scientific Meeting, The Ohio State University, Sep 23–25, 2024
- *Frontiers in Computational and Mathematical Medicine: Insights into B cell and antibody kinetics against SARS-CoV-2 variants using mathematical modelling*, Fields Institute, Toronto, Ontario, Canada, Sep 23–24, 2024
- Leveraging AI for Enhanced Disease Diagnosis: From Viral Infections to Cancer Cachexia, CAIMS 2024 Annual Meeting, Queen's University, Kingston, Ontario, Canada, June 26, 2023
- Talk, *Mechanistic Modeling: From Oncology to Anti-SARS-CoV-2 Immunity*, Department of Pharmacology & Toxicology, University of Toronto, Nov 10, 2023
- Virtual Presentation, Physics Colloquium, *Modeling humoral immune response to SARS-CoV-2 and machine learning for discriminating COVID-19 and influenza infection*, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran, Sep 4, 2023, link
- The VI AMMCS International Conference, *Mathematical modelling of the adaptive immune response: B-lymphocytes and SARS-CoV-2 neutralizing antibodies*, Waterloo, Ontario, Canada, Aug 14–18, 2023
- Online Video Flash Talk, SMB Annual Meeting, *Mathematical modelling of the humoral and B cell response to SARS-CoV-2*, hosted by Ohio State University, July 17, 2023
- Virtual Presentation, OMNI-RÉUNIS Super-Spreader Seminar Series, *Mathematical Modelling to Identify Optimal Dosing Schedules: From Chemotherapy to COVID-19 vaccines*, Apr 20, 2023
- Virtual Presentation, Centre for Mathematical Medicine Seminar, Fields Institute, Apr 10, 2023
- Virtual Presentation, Symposium on Machine Learning and Data Modelling in the Biomedical Sciences (MLDMBioMed-2022), York University, Sep 27–28, 2022
- Virtual Poster Presentation, European Conference on Mathematical Biology (ECMTB), 2022
- Online Video Flash Talk, The Royal Society, *Mathematical Modeling of SARS-CoV-2 Immune Escape*, London, UK, June 13, 2022
- Virtual Poster Presentation, DLSPH Biostatistics Research Day, University of Toronto, May 12, 2022
- Virtual Poster Presentation, ISoP QSP Virtual Student Symposium, May 11, 2022
- Virtual Poster Presentation, 5th Workshop on Virus Dynamics, Fred Hutchinson Cancer Center, Oct 4–6, 2021
- SMB Annual Meeting, *Immunological Response of Adenovirus-Based COVID-19 Vaccines*, link, 2021
- Seminar, University of Waterloo Math Oncology Seminar, March 6, 2020
- Seminar, Ontario Tech University, *Mathematical Model of Muscle Wasting in Cancer Cachexia*, Jan 14, 2020, link
- CMS Winter Meeting, *Mathematical Model of Muscle Wasting in Cancer Cachexia*, Toronto, Canada, 2019

- Seminar, Ryerson University, 2019
- SMB Annual Meeting, *Mathematical Model of Muscle Wasting in Cancer Cachexia*, Université de Montréal, 2019

Conference Organization

- Organizer, Mini-symposium: *Advancing Health and Medicine through Scientific Computing: Mechanistic Modelling, Machine Learning, and Quantitative Systems Pharmacology*, CAIMS Annual Meeting, 2024
- Organizer, Mini-symposium: *AI for Enhancing Public Health and Healthcare in Canada*, CAIMS Annual Meeting, 2024
- Organizer, Mini-symposium: *Mathematical and Computational Approaches to Modelling Immunology*, CMPD6 Workshop, 2023

Professional Service

- Poster Judge, World Congress of Psychiatric Genetics (WCPG), 2025
- Poster Judge, Visions in Pharmacology (VIP) Research Day, University of Toronto, 2025

Professional Service & Memberships

- Peer reviewer for Frontiers in Immunology, Frontiers in Molecular Neuroscience, PLOS Computational Biology, Mathematical Biosciences, and npj Systems Biology and Applications; editorial contributions available via Frontiers Loop profile.
- Steering Committee Member, Centre for Mathematical Medicine, Fields Institute (2025–2028).
- Affiliate Member, Acceleration Consortium, University of Toronto.
- Member, T-CAIREM (Temerty Centre for AI Research and Education in Medicine).
- Member, OMNI-RÉUNIS HQP Organizing Committee (2023–2024).

Additional

Languages: English, Turkish, Persian