

Suzan Farhang-Sardroodi, PhD

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Summary

Computational scientist with a systems-level perspective, holding a Ph.D. in Physics with specialization in **evolutionary dynamics on complex networks and stochastic processes**.

Extensive experience in developing **mechanistic mathematical models** of complex biological systems, including immune dynamics, cancer cachexia, and pharmacological processes, combined with strong expertise in **data-driven modeling, statistical inference, and quantitative analysis**.

Currently focused on **integrating multi-omic and clinical data using computational approaches** to translate genomic associations into **biologically meaningful and clinically relevant therapeutic targets for neuropsychiatric disorders**.

Technical Skills

Statistical Genetics & Bioinformatics: GWAS, MTAG, fine-mapping, colocalization, PRS calculation, TWAS (including joint/conditional TWAS), integrative multi-omic annotation, single-cell genomic analysis, advanced computational workflows in psychiatric genetics

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

Pharmacokinetics (PK): Phoenix NLME 8.5.2.4 (nonlinear mixed-effects modeling, compartmental analysis), Phoenix WinNonlin 8.5.2.4 (noncompartmental analysis, NCA)

Mechanistic Modeling & Applied Mathematics: Ordinary differential equations (ODEs), stochastic processes, dynamical systems modeling, simulation-based modeling of biological systems

Machine Learning: predictive modeling in biomedical datasets, supervised learning, feature selection, classification models, simulation-based data generation, PCA and clustering; **familiarity with biology-informed neural networks (BINNs) for parameter estimation**

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, L^AT_EX, Microsoft Office, CorelDRAW

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**; and performed simulation studies to evaluate immune response dynamics and predict protection following reinfection or vaccination.

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

Summary: Studied evolutionary dynamics in structured populations using network-based models, with applications to biological systems such as tumour microenvironments.

Supervisors: [Dr. Amir Hossein Darooneh](#) (University of Zanjan); [Dr. Mohammad Kohandel](#) (University of Waterloo)

Collaborator: [Dr. Natalia L. Komarova](#) (UC San Diego)

Visiting Ph.D. Researcher (Exchange), University of Waterloo, Canada, 2017–2018

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

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](https://doi.org/10.1016/j.euroneuro.2025.08.431)
- **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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1007/s11232-015-0288-9)

Teaching Experience

- **University of Toronto, Department of Pharmacology and Toxicology** ([link](#)), Toronto, ON, Canada
Invited Guest Lecture (declined), PCL381H: Molecular Toxicology, 2026
- **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](#), [PLOS Computational Biology](#), and [Mathematical Biosciences](#).
- Steering Committee Member, [Centre for Mathematical Medicine, Fields Institute](#) (2025–2028).
- Affiliate Member, [Acceleration Consortium, University of Toronto](#).
- Member, [T-CAIREM \(Temerty Centre for AI Research and Education in Medicine\)](#).

Additional

Languages: English, Turkish, Persian