

# Dayag Sheykhkarimli, Ph.D.

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## RESEARCH SUMMARY

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Molecular and computational biology focused on measuring relationships between proteins and cells. Doctoral research developed and applied sequencing-based assays for proteome-scale interaction mapping across five organisms, including co-first authorship of a reference map of SARS-CoV-2-human contacts. Current work explores molecular recording and how cellular context and history change what a measurement can reveal. Experimental design is paired with reproducible R and Python analysis for high-throughput and single-cell sequencing. A recurring question is how the representation of an experiment shapes what can be learned from its output.

## EDUCATION

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**Ph.D., Molecular Genetics** — University of Toronto 2022

*Thesis: "Sequencing protein interaction dynamics at proteome scale."* Advisor: Dr. Frederick P. Roth.

**B.Sc., Honours with Distinction** — University of Toronto 2014

Double major in Molecular Genetics and Human Biology; Minor in Cinema Studies.

## RESEARCH EXPERIENCE

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**Postdoctoral Fellow** (NRC & NSERC Fellow) — SBME, University of British Columbia 2024 – present

Principal Investigator: Dr. Nozomu Yachie

- Developing sequencing-based approaches to measure molecular interactions in cellular context.
- Investigating molecular recording as a way to preserve cellular histories alongside their molecular parts.
- Combining experimental design with reproducible analysis of high-throughput and single-cell data.

**Visiting Scientist** (MITACS/JSPS Fellow) — Osaka University, Japan May – Aug 2024

Engineered mouse primary neurons and performed *in vitro* fertilization related surgeries in collaboration with Dr. Y. Lu

**Postdoctoral Fellow** — Donnelly Centre, University of Toronto 2022 – 2024

Principal Investigator: Dr. Frederick P. Roth

**Ph.D. student** — Department of Molecular Genetics, University of Toronto 2016 – 2022

Principal Investigator: Dr. Frederick P. Roth

- Developed and benchmarked fluorescence and messenger BFG-Y2H assays for pooled proteome-scale protein-interaction mapping and minute-scale measurement of interaction dynamics across perturbations.
- Co-first author of the SARS-CoV-2-human contactome; designed high-throughput screening workflows and integrated the virus-host interaction map with tissue-expression and COVID-19 host-genetic data.
- Managed large barcoded ORF collections, automated quality-control workflows, and sequencing analyses across human, yeast, fly, and pathogen interactome projects; coordinated external collaborators and supervised trainees.

**Research Assistant** — Donnelly Centre, University of Toronto 2013 – 2015

Drosophila genetic screen for regulators of sperm development (Dr. Julie Brill); early development of sequencing-based protein-interaction assays (Dr. Frederick P. Roth).

**Undergraduate Summer Research Student** — University of Toronto, University of Szeged 2012

Quantum *ab initio* simulations to characterize molecular aging of proteins (Dr. Imre G. Csizmadia, Dr. Bela Fiser).

## SELECTED PUBLICATIONS

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\* denotes first or co-first author. A complete, up-to-date list is available on [Google Scholar](#).

### PEER-REVIEWED ARTICLES

Strauss S-K, ..., **Sheykhkarimli D**, ..., Pilpel Y. Quantitative genetics of natural *S. cerevisiae* strains upon mating reveal heritable determinants of fitness and differential mating affinities. *Cell Reports* 45(2), 116972 (2026).

Mount H-O, ..., **Sheykhkarimli D**, ..., Ensminger AW. A comprehensive two-hybrid analysis to explore the *Legionella pneumophila* effector–effector interactome. *mSystems* 9(12), e01004-24 (2024).

Kim D-K\*, ..., **Sheykhkarimli D\***, ..., Falter-Braun P. A proteome-scale map of the SARS-CoV-2–human contactome. *Nature Biotechnology* 41(1), 140–149 (2023).

Tang H-W, ..., **Sheykhkarimli D**, ..., Mohr SE. Next-generation large-scale binary protein interaction network for *Drosophila*. *Nature Communications* 14, 2162 (2023).

van Loggerenberg W, ..., **Sheykhkarimli D**, ..., Roth FP. Systematically testing human HMBS missense variants to reveal mechanism and pathogenic variation. *The American Journal of Human Genetics* 110(10), 1769–1786 (2023).

Luck K, ..., **Sheykhkarimli D**, ..., Vidal M. A reference map of the human binary protein interactome. *Nature* 580(7803), 402–408 (2020).

Kim D-K, ..., **Sheykhkarimli D**, ..., Roth FP. A comprehensive, flexible collection of SARS-CoV-2 coding regions. *G3: Genes, Genomes, Genetics* 10(9), 3399–3402 (2020).

Yachie N, ..., **Sheykhkarimli D**, ..., Roth FP. Pooled-matrix protein interaction screens using Barcode Fusion Genetics. *Molecular Systems Biology* 12(4), 863 (2016).

**Sheykhkarimli D\***, ..., Fiser B. Molecular ageing: free radical-initiated epimerization of thymopentin — a case study. *The Journal of Chemical Physics* 140(20), 205102 (2014).

### MANUSCRIPTS IN PREPARATION

**Sheykhkarimli D\***, ..., Roth, F.P. Environmental protein interaction dynamics at proteome scale. *In preparation* (2026).

### GRANTS, FELLOWSHIPS & AWARDS

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|---------------------------------------------------------------------------------|-------------|
| <b>NRC H.L. Holmes Award for Postdoctoral Studies, UBC</b> · CA\$200,000        | 2025 – 2027 |
| Awarded biennially to a single postdoctoral fellow <a href="#">nationally</a> . |             |

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| <b>NSERC Postdoctoral Fellowship, UBC</b> · CA\$140,000 | 2024 – 2026 |
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| <b>Sony Research Award (with N. Yachie)</b> · US\$150,000                      | 2024 – 2025 |
| DNA “tapes” for recording the developmental plasticity of the mammalian brain. |             |

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| <b>MITACS Globalink / JSPS Research Fellowship</b> · CA\$12,000 | 2024 |
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| <b>NIH R21 Exploratory/Developmental Grant (with F. Roth; top 5th percentile)</b> · US\$300,000 | 2021 – 2023 |
| High-temporal-resolution protein-interaction mapping at proteome scale.                         |             |

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| <b>Best Talk / Poster Awards (cumulative)</b>                                                | 2016 – 2024 |
| EMBO; GSA Yeast Genetics (×2); CSHL; Donnelly Centre (×3); Dept. of Molecular Genetics (×2). |             |

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| <b>Faculty of Medicine Merit Scholarship, University of Toronto</b> · CA\$2,000 | 2015 |
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| <b>State Program for Study of Distinguished Azerbaijani Youth Abroad</b> · US\$180,000 | 2010 – 2014 |
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## TECHNICAL EXPERTISE

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**Experimental:** Molecular and protein-interaction assay development; genome-wide screens; barcoded lentiviral and pooled phenotypic assays; CRISPR and combinatorial overexpression screens; mammalian cell engineering; human iPSC and primary mouse neuronal culture; molecular cloning; flow cytometry; immunostaining; confocal microscopy; mouse injection and dissection; Illumina and Oxford Nanopore library preparation and sequencing; 10x Genomics/Drop-seq.

**Computational:** R, Python, bash, Nextflow, Git/version control, Linux/HPC; large-scale sequencing-data analysis; network biology; biostatistics; Cytoscape, GraphPad, and FlowJo.

**Languages:** English (fluent); Azerbaijani (native); Russian (intermediate); Turkish (intermediate).

## SELECTED CONFERENCE PRESENTATIONS

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**EMBO Workshop on Protein-Protein Interactions** — Trieste, Italy 2022

Oral presentation: "Proteome-scale mapping of protein-interaction dynamics across environments."

**Cold Spring Harbor Laboratory** — Systems Biology / Network Biology 2022, 2023

Poster (2022) and talk (2023): systematic interrogation of protein-interaction networks under stress.

**GSA Yeast Genetics Meeting** 2019, 2021

Poster awards (x2): "Barcode fusion genetics for massively parallel interaction screening."

**Donnelly Centre Research Day** — University of Toronto 2018, 2020, 2022

Talk / poster awards (x3): high-throughput barcode fusion genetics and interactome dynamics.

**Dept. of Molecular Genetics Retreat** — University of Toronto 2016 – 2021

Best-talk awards (x2): protein-interaction dynamics under environmental perturbation.

## TEACHING & MENTORSHIP

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**Primary Lab Instructor** — BMEG 245, "The Fundamental Units of Life," University of British Columbia 2024 – present

Designed and taught labs for ~100 students: mammalian cell culture, nuclear/F-actin staining, and hands-on bioinformatics.

**Sessional Lecturer** — Dept. of Molecular Genetics, University of Toronto 2019 – 2021

MGY360 (Undergraduate, Whole-Genome Sequencing & Analysis) and MMG3006 (Graduate, Medical Genomics), including remote delivery during COVID-19.

**Teaching Assistant** — Dept. of Molecular Genetics, University of Toronto 2018 – 2021

MGY360, MMG3006 and MMG1001 (Foundational Genetic Approaches): designed and marked exam questions, supervised tutorials, literature discussions, and laboratories.

**Mentorship:** Supervised 14+ trainees (8 undergraduate, 2 MSc, 2 PhD, 2 research staff); currently supervising and co-supervising 3 trainees at UBC.

## ENTREPRENEURSHIP & KNOWLEDGE TRANSLATION

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**Co-Founder** — Zenbu Tx 2024 – 2025

Yachie-Lab spin-off exploring targeted drug delivery. Patent filed: PCT/CA2023/050239. Finalist, e@UBC Venture Founder Program; 2nd place, Amgen Pitch Competition. Experience in IP strategy, stakeholder engagement, and bench-to-bedside commercialization planning.

### Selected Media

["Landscape of molecular contacts: How SARS-CoV-2 communicates with human cells"](#) *Phys.org*, 2022.

["H.L. Holmes Award supports tissue-mapping research for targeted drug delivery"](#) National Research Council Canada, 2025.