Jaskaran Singh

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Education

October 2021 - Present

Ph.D. in Biology, Institut national de la recherche scientifique, Quebec, Canada
1. Dissecting the mechanistic link between cerebellar pathology and the loss of c9orf72 function in a zebrafish ALS model.
2. Investigating the role of Toll-like receptor "X" in neuromuscular disorders.

Note: Initially started remotely in May 2021 due to COVID-19 restrictions.

2015 – 2020

Integrated BS-MS (Biology Majors), Indian Institute of Science Education and Research, Mohali

Scholarships

2025 **FRQS-Doctoral Scholarship**
Awarded by prestigious Fonds de recherche du Québec (CAD 25000)

2024- 2025 **Olivier Goy Rising Star Trainee Award in ALS Research**
Awarded by Brain Canada Foundation (CAD 10000)

Doctoral Scholarship
Awarded by Fondation Armand-Frappier (CAD 10000)

2024 **Doctoral Scholarship**
Awarded by CERMO-FC (CAD 4500)

2023- 2024 **Pierre Auger Morissette Capacity Building Award in ALS Research**
Awarded by Brain Canada Foundation (CAD 7500)

2015 – 2020 **Innovation in Science Pursuit for Inspired Research (INSPIRE) Scholarship**
Awarded to top one percentile students pursuing higher education in science in India by the Department of Science and Technology (DST), India

Awards

2024 **Travel grant to attend International Zebrafish Conference (*Kyoto,Japan*)**
Awarded by International Brain Research Organisation (CAD 2200)

Travel grant to attend International Zebrafish Conference (*Kyoto,Japan*)
Awarded by Fondation Armand-Frappier (CAD 500)

Research Experience

October 2021 — Present

Doctoral Thesis Projects:
1. X gene is a critical mediator of DNA damage and subsequent cerebellar neuronal loss in C9orf72 ALS: Uncovered a novel link between C9orf72 loss-of-function and DNA-damage driven cerebellar neurodegeneration. Leveraged CRISPR and miRNA-induced zebrafish ALS models, patient iPSC motor neurons, neuromuscular assays, and single-cell transcriptomics to show that Gene X regulates DNA damage and repair, and restoring its expression eliminates DNA lesions and rescues cerebellar degeneration.

Research Experience (continued)

Doctoral Thesis Projects:

2. TLR"X" regulates chromatin landscape around genes central to ALS: Established the role of TLR"X" in neuromuscular disorders, specifically ALS, using pharmacological and genetic zebrafish models and iPSC-MNs derived from sporadic ALS patients. Performed multi-omics analysis (ATAC-seq and Hi-C) to reveal the novel role of TLR"X" as a gatekeeper of chromatin architecture around genes central to ALS and endogenous retroviral elements.

3. NMJ Analyser: a novel method to quantify neuromuscular junction morphology in zebrafish: Developed an ImageJ macro to automatically quantify the neuromuscular junction morphology in zebrafish and other models. It enables high-throughput NMJ phenotypic screens in the drug-discovery process for neuromuscular disorders.

Guide: *Dr. Kessen Patten (Professor, Institut national de la recherche scientifique, Quebec, Canada)*

August 2019 — July 2020

Master's thesis project in "Understanding molecular mechanisms underlying zebrafish brain regeneration"

Guide: *Dr. Rajesh Ramachandran (Associate Professor, Dept. of Biological Sciences, IISER Mohali)*

May 2019 — July 2019

Summer project in "Neuronal regeneration in zebrafish brain"

Guide: *Dr. Rajesh Ramachandran (Associate Professor, Dept. of Biological Sciences, IISER Mohali)*

May 2018 — July 2018

Summer project in "Regeneration of various tissues in zebrafish"

Guide: *Dr. Rajesh Ramachandran (Associate Professor, Dept. of Biological Sciences, IISER Mohali)*

May 2017 — July 2017

Summer project in:

1. Designed an experiment and wrote a MATLAB program to find X, Y and Z coordinates of a moving body using a Kinect sensor
2. Learned EEG recording technique and became familiar with the instrumentation

Guide: *Prof. Aditya Murthy (Chair, Centre for Neuroscience, Indian Institute of Science, Bangalore)*

May 2016 — July 2016

Summer project on "*Drosophila melanogaster* — Methods, Protocols and Genetics"

Guide: *Dr. Lolitika Mandal (Associate Professor, Dept. of Biological Sciences, IISER Mohali)*

Research Publications

1. **Singh, Jaskaran**, L. Lescouzères, C. Zaouter, M. Chaineau, G. Haghi, T. M. Durcan, and S. A. Patten., "X gene is a critical mediator of DNA damage and subsequent cerebellar neuronal loss in c9orf72 ALS," (*In Review*), 2025.
2. **Singh, Jaskaran**, L. Lescouzères, M. Lal, M. Chaineau, G. Haghi, T. M. Durcan, K. S. Sandhu, and S. A. Patten., "TLR"X" maintains the neuromuscular system and chromatin landscape around genes central to ALS," (*In Process*), 2025.
3. **Singh, Jaskaran**, Y. E. Pan, and S. A. Patten, "Nmj analyser: A novel method to quantify neuromuscular junction morphology in zebrafish," *Bioinformatics*, vol. 39, no. 12, btad720, 2023. DOI: 10.1093/bioinformatics/btad720.

4. **Singh, Jaskaran** and S. A. Patten, "Modeling neuromuscular diseases in zebrafish," *Frontiers in Molecular Neuroscience*, vol. 15, p. 1 054 573, 2022. DOI: 10.3389/fnmol.2022.1054573.

5. S. Ghosh*, N. S. Damseh*, **Singh, Jaskaran**, M. Severino, L. Faivre, J. Heitz, A.-S. Denommé-Pichon, A. E. Golding, R. D. Pace, M. Jarnik, B. Abu-Libdeh, H. Lochmuller, H. M. Shaked, J. E. Neil, G. Mochida, S. Edvardson, O. Elpeleg, S. A. Patten, and J. S. Bonifacino., "Homozygous missense variants in eipr1 cause a neurodevelopmental disorder linked to defective endosomal recycling," *In Revision (Brain, Oxford Academic)*, 2025.

6. M. Breuer, G. Fortier, **Singh, Jaskaran**, B. Kassa, P. Jamadagni, C. Zaouter, and S. A. Patten., "Chd7 regulates lipid metabolism and swim bladder inflation in zebrafish," *(In Review)*, 2025.

7. M. Breuer, M. Rummler, **Singh,Jaskaran**, S. Maher, P. Jamadagni, C. Zaouter, N. Pilon, B. M. Willie, and S. A. Patten, "Chd7 regulates craniofacial cartilage development via controlling htr2b expression," *Journal of Bone and Mineral Research*, 2024. DOI: 10.1093/jbmr/zjae024.

Conference Abstracts

1. **Singh, Jaskaran**, L. Lescouzeres, and K. Patten, "Investigating link between cerebellar pathology and loss of c9orf72 in zebrafish ALS model," in *35th International Symposium on ALS/MND*, Montreal,Canada, 2024.

2. **Singh, Jaskaran**, L. Lescouzeres, and K. Patten, "Investigating link between cerebellar pathology and loss of c9orf72 in zebrafish ALS model," in *Symposium-Center of Excellence in Research on Orphan Diseases - Fondation Courtois*, Montreal,Canada, 2024.

3. **Singh, Jaskaran**, L. Lescouzeres, and K. Patten, "Investigating link between cerebellar pathology and loss of c9orf72 in zebrafish ALS model," in *International Zebrafish Conference*, Kyoto,Japan, 2024.

4. **Singh, Jaskaran**, L. Lescouzeres, and K. Patten, "Investigating link between cerebellar pathology and loss of c9orf72 in zebrafish ALS model," in *Canadian Zebrafish Research Community*, Montreal, Canada, 2024.

5. **Singh, Jaskaran** and K. Patten, "Nmj analyser: A novel method to quantify neuromuscular junction morphology in zebrafish," in *Regroupement interdisciplinaire de formation d'applications utilisant des lasers intenses (RIFALI)*, Montreal,Canada, 2024.

6. **Singh, Jaskaran**, L. Lescouzeres, and K. Patten, "Investigating link between cerebellar pathology and loss of c9orf72 in zebrafish als model," in *2024 ALS Canada Research Forum*, Toronto, Canada, 2024.

7. **Singh, Jaskaran**, L. Lescouzeres, and K. Patten, "Investigating link between cerebellar pathology and loss of c9orf72 in zebrafish als model," in *16th Zebrafish Disease Model Conference*, Durham, USA, 2023.

8. **Singh, Jaskaran** and K. Patten, "Elucidating the role of toll-like receptor "x" in motor neuron disorders," in *16th Zebrafish Disease Model Conference*, Durham, USA, 2023.

9. **Singh, Jaskaran**, Y. E. Pan, J. Li, and K. Patten, "C9orf72 knockdown zebrafish als model exhibits cerebellar pathology and motor defects," in *Symposium-Center of Excellence in Research on Orphan Diseases - Fondation Courtois*, Montreal, Canada, 2022.

10. **Singh, Jaskaran**, Y. E. Pan, J. Li, and K. Patten, "Link between cerebellar pathology and loss of c9orf72 in zebrafish als model," in *17th International Zebrafish Conference*, Montreal, Canada, 2022.

11. M. Breuer, M. Rummler, P. Jamadagni, **Singh, J.**, C. Zaouter, B. Willie, and K. Patten, "Craniofacial dysmorphism mediated by serotonin receptor htr2b in a zebrafish model of charge syndrome," in *17th International Zebrafish Conference*, Montreal, Canada, 2022.

Skills

Languages — Strong reading, writing and speaking competencies in English, Punjabi and Hindi.

Skills (continued)

Coding / Data Analysis	Python (NumPy, Matplotlib, Pandas, Cooler), R (tidyverse, edgeR, DiffBind, ChIPseeker, clusterProfiler), MATLAB, HTML/CSS, Excel Macros; command-line tools (Cutadapt, MultiQC, Bowtie2, Picard, SAMtools/BCFtools, deepTools, BEDTools, MACS2, MEME-ChIP); statistics & graphics software (GraphPad Prism, Fiji/ImageJ). *Built custom Python workflow integrating differential ATAC-seq and Hi-C data with multi-track visualisation* *Developed MATLAB scripts for Kinect-based 3-D object tracking and Image J macro for zebrafish swim-angle quantification* *Generated and deployed personal research website: jaskaranneuro.github.io*
Cell and Molecular Techniques	CRISPR/Cas9 F0 knockout (gRNA design, RNP microinjection, HRM genotyping, Sanger sequencing); RT-qPCR; Western blot; molecular cloning; RNA/DNA isolation; agarose-gel electrophoresis; immunohistochemistry / immunocytochemistry; α-bungarotoxin, SV2 and acetyl-tubulin whole-mount staining; Alcian-blue cartilage staining.
Animal Techniques	One-cell stage microinjection in zebrafish eggs (mRNA, CRISPR RNP); motor-behaviour assays (DanioVision / EthoVision XT); touch-escape and swim-performance testing; stab-, nostril- and heart-injury models; electroporation; cryosectioning; brain, heart and retina dissections.
Microscopy and Image Analysis	Confocal, epifluorescence and bright-field microscopy; Leica stereomicroscopy; Z-stack acquisition and rendering.
Computational Genomics	NGS QC, alignment, peak-calling and differential analysis for ATAC-seq and RNA-seq; Hi-C contact-map generation, loop calling and multi-omic integration; motif, gene-ontology and disease-ontology enrichment analyses.

Accomplishments

2024 **Selected to attend NMD4C's Basic Research Summer School**
Organised by Neuromuscular Disease Network for Canada (May 27th-28th, 2024)

2023 **Scientific Image Competition**
Won Congrès Armand-Frappier 2023 scientific image competition (3rd Prize)

2020 **National Eligibility Test (NET)**
Secured All India Rank: 62 for assistant professorship (Council of Scientific and Industrial Research, India)

2016 **MOOC on "Ecosystems Approach and Systems Thinking"**
Scored 92% in MOOC organized by UNEP-Concordia University

Participated in Young Scientist's Conclave organized as a part of India International Science Festival

2015 **Qualified a highly competitive All India Pre-Medical Test (AIPMT) national level medical entrance exam**

Qualified a highly competitive Punjab Medical Entrance Test (PMET) state-level medical entrance exam

2013 **Science Fair**
Potential of energy usage from methane reserves in Antarctic icecaps
Won first prize in district level and participated in state level, January 2014

Accomplishments (continued)

2012 **English Debate Competition, 2012**
Won 3rd prize in state-level debate competition conducted in memory of Sardar Mehma Singh Grewal

Teaching Experience

2024 **Trained and supervised a summer intern-Daniel Hany (Bachelors, McGill, Montreal, Canada)**

2023 **Trained and supervised a summer intern-Raphael Vallee (Bachelors, UdeM, Montreal, Canada)**

2024 **Mentor, 'Apprentis chercheurs' Program, INRS**

- June 2024
- August 2024

2023 **Mentor, 'Apprentis chercheurs' Program, INRS**

- June 2023
- August 2023

2022 **Mentor, 'Apprentis chercheurs' Program, INRS**

- June 2022
- August 2022

2020 **Teaching assistant in biology lab at IISER Mohali**

Science Communication/Outreach

Volunteer Work

1. Volunteered at 17th International Zebrafish Conference, Montreal, Canada, 2022
2. Volunteered at Scientific Foundation Day, IISER Mohali, 2018

Scientific societies

1. Member of International Zebrafish Society
2. Member of Neuromuscular Disease Network for Canada (NMD4C)
3. Member of Indian Society of Cell Biology (2016)

Contributions to Society

2019–2016 Organized free food event (Langar) for underprivileged people in Mohali, India

2019 Wrote and acted in a short film exploring the sensitive issues of transgender inequality and caste discrimination in India

2018 Organized a public lecture at IISER Mohali on the day of Vaisakhi to educate people about the abandonment of caste and treating all people as equal

2017–2015 Organized blood donation campaigns at IISER Mohali

References

Dr. Kessen Patten, *Professor, INRS-AFSB, Laval, Canada*
Email: kessen.patten@inrs.ca

Dr. Rajesh Ramachandran, *Associate Professor, Department of Biological Sciences, IISER Mohali*
Email: rajeshra@iisermohali.ac.in