

François Charih

Carleton University Biomedical Informatics Collaboratory (cuBIC)

Institute of Biochemistry, Carleton University

NuvoBio

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Research interests

Computational biology
Biomedical informatics

Applied machine learning
High performance computing

Software development
Protein/peptide engineering

Education

Ph.D. in Electrical and Computer Engineering (Computational Biology)

2019 - 2025 (expected)

Carleton University

📍 Ottawa, ON

Thesis: Uncovering and modulating the lysine methylome: a computational approach

Thesis advisor(s): [James R. Green](#) and [Kyle K. Biggar](#)

M.A.Sc. in Electrical and Computer Engineering (Data Science)

2016 - 2018

Carleton University

📍 Ottawa, ON

Thesis: Machine Learning in Audiology: Applications and Implications

Thesis advisor(s): [James R. Green](#)

B.Sc.(Hons.) in Biochemistry

2010 - 2016

University of Ottawa

📍 Ottawa, ON

Thesis: Structural Insights into the DNA-Binding Activity of Metalloregulator Fur in C.
jejuni

Thesis advisor(s): [Jean-François Couture](#)

B.A.Sc. in Chemical Engineering

2010 - 2016

University of Ottawa

📍 Ottawa, ON

Thesis: Design, Simulation and Optimization of a High Production Volume Toluene
Plant

Relevant employment experience

Research Scientist & Co-Founder

2022 - present

NuvoBio

📍 Ottawa, ON

- Leading the development of Darwin, a inhibitory peptide engineering algorithm
- Responsible for the implementation, deployment and distribution of Darwin
- Managing multiple high performance computing platforms (mid-size computer clusters)

Lead Researcher (Contractual position)

Summer 2020

Carleton University

📍 Ottawa, ON

- Collaboration initiated by the WSIB of Ontario upon reading my master's thesis
- Managed a team composed of myself, one M.Eng. student, and one undergraduate student

- Responsible for developing a semi-automated audiogram digitization/interpretation solution using machine learning and computer vision to support the claim adjudication process at WSIB

Contract Researcher

The Ottawa Hospital Rehabilitation Centre

2018 - 2019

📍 Ottawa, ON

- Responsible for the implementation of a tablet-based software for the annotation of stress levels of PTSD/TBI patients undergoing VR therapy (collaboration with Rehabilitation Virtual Reality Lab at The Ottawa Hospital).

Contract Researcher

Natural Resources Canada

2017 - 2018

📍 Ottawa, ON

- Co-authored a technical report detailing how deep learning strategies can be deployed for passive monitoring of critical electrical infrastructure
- Responsible for the annotation of thousands of images for the development of deep learning-based segmentation models

Teaching Assistant

Carleton University

2017 - present

📍 Ottawa, ON

- SYSC4001 - Operating Systems (Fall 2023)
- SYSC2100 - Data Structures and Algorithms (Spring 2023)
- SYSC4415 - Introduction to Machine Learning (Winter 2023)
- SYSC2002 - Data Structures and Algorithms (Spring 2020)
- SYSC2006 - Foundations of Imperative Programming (Fall 2017, Winter 2019)

Undergraduate Research Assistant

Ottawa Institute of Systems Biology

2014 - 2016

📍 Ottawa, ON

- Successfully crystallized and contributed to the resolution of the crystal structure of the protein under study
- Performed and optimized a variety of biochemistry techniques, including protein overexpression, mutational studies, structural characterization and protein-DNA interaction studies
- Used tools including high-throughput crystallization robots, x-ray diffractometer, FPLC/HPLC, protein modelling software, isothermal titration calorimetry on a regular basis in addition to applying other common techniques

Publications

Peer-reviewed journal articles

- [J12] A. Shukri, A. C. Carroll, R. Collins, **F. Charih**, A. Wong, K. K. Biggar. Systematic in vitro optimization of antimicrobial peptides against *Escherichia coli* (2024). *JAC-Antimicrobial Resistance*, 6(4). [\[Link\]](#)
- [J11] A. H. Shukri, V. Lukinović, **F. Charih**, K. K. Biggar. Unraveling the Battle for Lysine: A Review of the Competition among Post-Translational Modifications (2023). *Biochimica et Biophysica Acta (BBA) - Gene Regulatory Mechanisms*, 1866(4). [\[Link\]](#)
- [J10] **F. Charih** and J.R. Green. Audiogram Digitization Tool for Audiological Reports (2022). *IEEE Access*, 10. [\[Link\]](#)
- [J9] K. Dick, J. B. Tanner, **F. Charih**, J.R. Green. GasBotty: Multi-Metric Extraction in the Wild (2022). *IEEE Access*, 10. [\[Link\]](#)
- [J8] **F. Charih**, K. Biggar, J.R. Green. Assessing sequence-based protein-protein interaction predictors for use in therapeutic peptide engineering (2022). *Scientific Reports*, 12(9610). [\[Link\]](#)

- [J7] G.M. Rurak, S. Simard, M. Freitas-Andrade, B. Lacoste, **F. Charih**, A. Van Geel, J. Stead, B. Woodside, J.R. Green, G. Coppola, N. Salmaso. Translatomic database of cortical astroglia across male and female mouse development reveals two distinct developmental phenotypes (2022). *Cell Reports*, 38(5). [\[Link\]](#)
- [J6] **F. Charih**, J. R. Green, K. K. Biggar. Machine Learning-Driven Identification of Novel Lysine Methylation Sites with MethylSight (2020). *Star Protocols* [\[Link\]](#)
- [J5] K. K. Biggar*, **F. Charih***, H. Liu, Y. B. Ruiz-Blanco, L. Stalker, A. Chopra, J. Connolly, K. Frensemier, M. Galka, Q. Fang, C. Wynder, W. L. Stanford, J. R. Green, and S. S-C. Li. Proteome-wide Prediction of Lysine Methylation Reveals Novel Histone Marks and Outlines the Methyllysine Proteome (2020). *Cell Reports*, 32(107896). (*Co-first authors) [\[Link\]](#)
- [J4] **F. Charih**, M. Bromwich, A. E. Mark, R. Lefrançois, and J. R. Green. Data-Driven Audiogram Classification for Mobile Audiometry (2020). *Scientific Reports*, 10(3962). [\[Link\]](#)
- [J3] S. Sarvan, A. Yeung, **F. Charih**, A. Stintzi, and J.-F. Couture. Purification and characterization of Campylobacter jejuni ferric uptake regulator (2018). *BioMetals*, 32(3). [\[Link\]](#)
- [J2] S. Sarvan, **F. Charih**, J. Butcher, J. S. Brunzelle, A. Stintzi, and J.-F. Couture. Crystal structure of Campylobacter jejuni peroxide regulator (2018). *FEBS Letters*, 592(13). [\[Link\]](#)
- [J1] S. Sarvan, **F. Charih**, M. Askoura, J. Butcher, J. S. Brunzelle, A. Stintzi, and J.-F. Couture. Functional insights into the interplay between DNA interaction and metal coordination in ferric uptake regulators (2018). *Scientific Reports*, 8(1). [\[Link\]](#)

Conference proceedings

- [C5] K. Dick, **F. Charih**, J. Woo, J. R. Green. Gas Prices of America: The Machine-Augmented Crowd-Sourcing Era. *17th Conference on Computer and Robot Vision*, Ottawa, Canada, May 2020. [\[Link\]](#)
- [C4] R. Selzler, A. Smith, **F. Charih**, A. Boyle, J. Holly, C. Bridgewater, M. Besemann, D. Curran, A. D. C. Chan, and J. R. Green. Exploratory Analysis of Ultra-Short-Term Heart Rate Variability Features in Virtual Rehabilitation Sessions. *2020 IEEE International Symposium on Medical Measurements and Applications (MeMeA)*, Bari, Italy, June 2020. [\[Link\]](#)
- [C3] **F. Charih**, A. Steeves, M. Bromwich, A. E. Mark, R. Lefrançois, and J. R. Green. Applications of Machine Learning Methods in Retrospective Studies on Hearing. *Proceedings of the 2018 IEEE Life Sciences Conference*, Montréal, Canada, October 2018. [\[Link\]](#)
- [C2] **F. Charih**, M. Bromwich, R. Lefrançois, A. E. Mark, and J. R. Green. Mining Audiograms to Improve the Interpretability of Automated Audiometry Measurements. *Proceedings of the 2018 IEEE International Symposium on Medical Measurements and Applications (MeMeA)*, Rome, Italy, June 2018. [\[Link\]](#)
- [C1] K. Dick, **F. Charih**, Y. Souley Dosso, L. Russell, and J. R. Green. Systematic Street View Sampling: High Quality Annotation of Power Infrastructure in Rural Ontario. *Proceedings of the 2018 15th Conference on Computer and Robot Vision (CRV)*, Toronto, Canada, May 2018. [\[Link\]](#)

Other manuscripts (e.g. pre-prints, theses, etc.)

- [O3] K. K. Biggar, N. Ridgeway, A. Chopra, V. Lukinović, **F. Charih**, D. Levy, J. R. Green. Machine learning-based exploration of enzyme-substrate networks: SET8-mediated methyllysine and its changing impact within cancer proteomes. *preprint*, Nature Communications (under review), 2024. [\[Link\]](#)
- [O2] **F. Charih**. Machine Learning in Audiology: Applications and Implications. *Master's thesis*, Carleton University, Ottawa, ON, December 2018. (Defended without revisions, and was awarded the Carleton University Senate medal) [\[Link\]](#)
- [O1] K. Dick, **F. Charih**, Y. Souley Dosso, L. Russell, and J. R. Green. Towards Energy Infrastructure Image Segmentation Using Deep Learning. *Technical Report prepared for Natural Resources Canada*, Carleton University, Ottawa, ON, April 2018.

Presentations and workshops

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| [PW9] Machine learning in Biomedical Informatics and Bioinformatics (Guest lecture) ECOR1055 | November 6th, 2024 📍 Ottawa, ON |
| [PW8] Machine learning in Biomedical Informatics and Bioinformatics ECOR1055 | November 1st, 2022 📍 Ottawa, ON |
| [PW7] Evolution-Inspired Peptide Drug Design GRADflix Challenge [Link] | April 2022 📍 Ottawa, ON |
| [PW6] AI in biology and biomedical engineering (guest lecture) ECOR1055 | December 2nd, 2019 📍 Ottawa, ON |
| [PW5] X-ray crystallography and computational biochemistry (guest lecture) BIOC3202 [Link] | November 22nd, 2019 📍 Ottawa, ON |
| [PW4] Introductory Data Analysis with Pandas Lecture Series (IEEE EMBS Carleton) [Link] | October 16th, 2019 📍 Ottawa, ON |
| [PW3] Building interactive visualizations in the browser with D3.js Lecture Series (IEEE EMBS Carleton) [Link] | February 6th, 2019 📍 Ottawa, ON |
| [PW2] Machine learning in Audiology (guest lecture) HLTH2001 and HLTH4102 (Carleton University) [Link] | November 2018, 2019 📍 Ottawa, ON |
| [PW1] MethylSight: A Computational Approach to the Elucidation of the Methyllysine Proteome 21st Chemistry and Biochemistry Graduate Research Conference [Link] | November 9th, 2018 📍 Montreal, QC |

Selected posters

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| [P6] In silico design of a novel SMYD3 inhibitor with Darwin Life Science Day 6.0, Carleton University | May 2023 📍 Ottawa, ON |
| [P5] Darwin: an evolution-inspired algorithm for target-specific peptide inhibitor engineering American Peptide Society Symposium | June 2022 📍 Whistler, BC |
| [P4] Machine Learning in Audiology: Applications and Implications Ottawa-AI Alliance Workshop | October 2018 📍 Ottawa, ON |
| [P3] Systematic Street View Sampling for Accurate Urban Population Estimation Data Day 5.0 | May 2018 📍 Ottawa, ON |
| [P2] Extending the SHOEBOX Audiometry mobile audiometer with an automated audiogram classification system Life Science Day 2.0, Carleton University | May 2018 📍 Ottawa, ON |
| [P1] Structural insights into the DNA Binding Activity of the Ferric Uptake Regulator in <i>Campylobacter jejuni</i> Honours Project Poster Day | April, 2015 📍 Ottawa, ON |

| Awards and honours | |
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| Gabriel Warshaw Scholarship , Carleton University (1,700 CAD) Merit-based award | 2023 |
| Queen Elizabeth II Scholarship in Science and Technology , Government of Ontario (15,000 CAD) Merit-based award | 2022 |
| American Peptide Symposium Travel Award , American Peptide Society (600 USD) | 2022 |
| Douglas Millar Scholarship , Dean of the FGPA (Carleton) (3,200 CAD) Awarded yearly to an outstanding graduate student in engineering | 2020 |
| Postgraduate Scholarship-Doctoral (PGS-D) , NSERC (63,000 CAD) Awarded to high potential researchers to pursue doctoral studies | 2019 |
| Ontario Graduate Scholarship , Carleton University (15,000 CAD) Declined in favour of NSERC PGS-D award | 2019 |
| Carleton University Senate Medal , Carleton University Awarded for outstanding academic achievement at the graduate level (1 medal/faculty awarded) | 2019 |
| Ph.D. Entrance Scholarship , Carleton University (2,000 CAD) | 2018 |
| CREATE-BEST Scholarship , NSERC (5,000 CAD) | 2017 |
| Engage/VIP-I Grant , NSERC, OCE and Clearwater Clinical Ltd. (50,000 CAD) Co-authored the proposal for the grant awarded to Prof. James R. Green | 2017 |
| M.A.Sc. Entrance Scholarship , Carleton University (2,000 CAD) | 2017 |
| Protein Modeling Contest , University of Ottawa (100 CAD) | 2014 |
| B.Sc. Entrance Scholarship , University of Ottawa (2,000 CAD) | 2011 |

| Research mentoring | |
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| I have had the great pleasure to mentor the following students: | |
| Abhinav Yalamanchili , M.Eng. Student Project: <i>Machine vision to digitize audiogram images (with WSIB Ontario)</i> | Summer 2020 |
| Ahmed Abdelrazik , Undergraduate Student Project: <i>Development of an ergonomic audiogram digitization tool (with WSIB Ontario)</i> | Summer 2020 |
| Siddharth Chadha , Undergraduate Student Project: <i>Digitization of audiograms with template matching</i> | Summer 2019 |
| Pratyush Singh , Undergraduate Student Project: <i>Machine vision to digitize audiogram images</i> | Summer 2018 |
| Ashlynn Steeves , Undergraduate Student Project: <i>Using kNN to impute values in incomplete audiograms</i> | Winter 2018 |

Peer reviews

I have reviewed submissions for the following peer-reviewed journals or conferences:

- Scientific Reports (5 reviews)
- Oxford Bioinformatics (1 review)
- PLoS One (1 review)
- Cell Star Protocols (1 review)
- IEEE International Symposium on Medical Measurements and Applications (1 review)

Other relevant roles

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| Executive Member | 2023 |
| Carleton University Biology Graduate Student Association | |

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| Judge | 2019, 2021, 2023, 2024 |
| Ottawa Regional Science Fair | |

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| Communications Officer | 2018-2020 |
| Carleton University Engineering in Medicine and Biology Society | |

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| Judge | 2018, 2021, 2024 |
| Canada Wide Science Fair | |

Languages

Natural languages: French (native), English (full professional proficiency), Moroccan Arabic (elementary proficiency)

Programming languages: Python, Rust, C/C++, JavaScript, Java, HTML/CSS