

# François Charih

Carleton University Biomedical Informatics Collaboratory (cuBIC)

Institute of Biochemistry, Carleton University

NuvoBio

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## Research interests

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Computational biology

Biomedical informatics

Applied machine learning

High performance computing

Software development

Protein/peptide engineering

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## Education

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### 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

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## Relevant employment experience

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### Research Scientist

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

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## Publications

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### 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.

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## Presentations and workshops

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

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## Selected posters

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

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

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

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## Peer reviews

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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)

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## Other relevant roles

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<b>Executive Member</b>	2023
Carleton University Biology Graduate Student Association	

<b>Judge</b>	2019, 2021, 2023, 2024
Ottawa Regional Science Fair	

<b>Communications Officer</b>	2018-2020
Carleton University Engineering in Medicine and Biology Society	

<b>Judge</b>	2018, 2021, 2024
Canada Wide Science Fair	

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## Languages

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

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