François Charih

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Research interests

Computational biology	Applied machine learning	Software development
Biomedical informatics	High performance computing	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 — 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 2018 - 2019
The Ottawa Hospital Rehabilitation Centre 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 2017 - 2018
Natural Resources Canada 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 2017 - present
Carleton University 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 2014 - 2016
Ottawa Institute of Systems Biology 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

[J13] 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 (2024). *Nature Communications*. (Submitted to Nature Communications)

[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. Standford, 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.*)

[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

[PW9] **Machine learning in Biomedical Informatics and Bioinformatics (Guest lecture)** — November 6th, 2024
ECOR1055 — Ottawa, ON

[PW8] **Machine learning in Biomedical Informatics and Bioinformatics** — November 1st, 2022
ECOR1055 — Ottawa, ON

[PW7] **Evolution-Inspired Peptide Drug Design** — April 2022
GRADflix Challenge [Link] — Ottawa, ON

[PW6] **AI in biology and biomedical engineering (guest lecture)** — December 2nd, 2019
ECOR1055 — Ottawa, ON

[PW5] **X-ray crystallography and computational biochemistry (guest lecture)** — November 22nd, 2019
BIOC3202 [Link] — Ottawa, ON

[PW4] **Introductory Data Analysis with Pandas** — October 16th, 2019
Lecture Series (IEEE EMBS Carleton) [Link] — Ottawa, ON

[PW3] **Building interactive visualizations in the browser with D3.js** — February 6th, 2019
Lecture Series (IEEE EMBS Carleton) [Link] — Ottawa, ON

[PW2] **Machine learning in Audiology (guest lecture)** — November 2018, 2019
HLTH2001 and HLTH4102 (Carleton University) [Link] — Ottawa, ON

[PW1] **MethylSight: A Computational Approach to the Elucidation of the Methyllysine Proteome** — November 9th, 2018
21st Chemistry and Biochemistry Graduate Research Conference [Link] — Montreal, QC

Selected posters

[P6] **In silico design of a novel SMYD3 inhibitor with Darwin** — May 2023
Life Science Day 6.0, Carleton University — Ottawa, ON

[P5] **Darwin: an evolution-inspired algorithm for target-specific peptide inhibitor engineering** — June 2022
American Peptide Society Symposium — Whistler, BC

[P4] **Machine Learning in Audiology: Applications and Implications** — October 2018
Ottawa-AI Alliance Workshop — Ottawa, ON

[P3] **Systematic Street View Sampling for Accurate Urban Population Estimation** — May 2018
Data Day 5.0 — Ottawa, ON

[P2] **Extending the SHOEBOX Audiometry mobile audiometer with an automated audiogram classification system** — May 2018
Life Science Day 2.0, Carleton University — Ottawa, ON

[P1] **Structural insights into the DNA Binding Activity of the Ferric Uptake Regulator in Campylobacter jejuni** — April, 2015
Honours Project Poster Day — Ottawa, ON

Awards and honours

Gabriel Warshaw Scholarship, Carleton University (1,700 CAD) — 2023
Merit-based award

Queen Elizabeth II Scholarship in Science and Technology, Government of Ontario (15,000 CAD) — 2022
Merit-based award

American Peptide Symposium Travel Award, American Peptide Society (600 USD) — 2022

Douglas Millar Scholarship, Dean of the FGPA (Carleton) (3,200 CAD) — 2020
Awarded yearly to an outstanding graduate student in engineering

Postgraduate Scholarship-Doctoral (PGS-D), NSERC (63,000 CAD) — 2019
Awarded to high potential researchers to pursue doctoral studies

Ontario Graduate Scholarship, Carleton University (15,000 CAD) — 2019
Declined in favour of NSERC PGS-D award

Carleton University Senate Medal, Carleton University — 2019
Awarded for outstanding academic achievement at the graduate level (1 medal/faculty awarded)

Ph.D. Entrance Scholaship, 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) — 2017
Co-authored the proposal for the grant awarded to Prof. James R. Green

M.A.Sc. Entrance Scholaship, 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

I have had the great pleasure to mentor the following students:

Abhinav Yalamanchili, M.Eng. Student — Summer 2020
Project: *Machine vision to digitize audiogram images (with WSIB Ontario)*

Ahmed Abdelrazik, Undergraduate Student — Summer 2020
Project: *Development of an ergonomic audiogram digitization tool (with WSIB Ontario)*

Siddharth Chadha, Undergraduate Student — Summer 2019
Project: *Digitization of audiograms with template matching*

Pratyush Singh, Undergraduate Student — Summer 2018
Project: *Machine vision to digitize audiogram images*

Ashlynn Steeves, Undergraduate Student — Winter 2018
Project: *Using kNN to impute values in incomplete audiograms*

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

Executive Member — 2023
Carleton University Biology Graduate Student Association

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

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

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, SQL