François Charih

Carleton University Biomedical Informatics Collaboratory (cuBIC)
Institute of Biochemistry, Carleton University
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Research interests

Computational biology	Applied machine learning	Cloud computing
Biomedical informatics	High performance computing	Peptide therapeutic design

Education

Ph.D. in Electrical and Computer Engineering (Computational Biology) 2019 - 2025 (expected)
Carleton University Ottawa, ON
Thesis: Sequence-based peptide binder design to modulate the lysine methylome and beyond
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 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

[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.*)

[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 Seg-mentation 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
- Drug Discovery Today
- Oxford Bioinformatics
- PLoS One
- Cell Star Protocols
- IEEE International Symposium on Medical Measurements and Applications

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