

# François Charih

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## Research Interests

Computational biochemistry	High performance computing	Motor neuron diseases
Applied machine learning	Protein biochemistry	Cancer

## Education

<b>Ph.D. Electrical and Computer Engineering (Computational Biochemistry)</b> Carleton University Advisors: <a href="#">James R. Green (Engineering)</a> and <a href="#">Kyle K. Biggar (Biochemistry)</a> Thesis: <i>Computational methods to uncover and modulate the methyllysine proteome</i>	2019 - 📍 Ottawa, ON
<b>M.A.Sc. Electrical and Computer Engineering (Data Science)</b> Carleton University Advisor: <a href="#">James R. Green</a> Thesis: <i>Machine Learning in Audiology: Applications and Implications</i>	2016 - 2018 📍 Ottawa, ON
<b>B.Sc.(Hons.) Biochemistry</b> University of Ottawa Advisor: <a href="#">Jean-François Couture</a> Thesis: <i>Structural Insights into the DNA-Binding Activity of Metalloregulator Fur in C. jejuni</i>	2010 - 2016 📍 Ottawa, ON
<b>B.A.Sc. Chemical Engineering</b> University of Ottawa Thesis: <i>Design, Simulation and Optimization of a High Production Volume Toluene Plant</i>	2010 - 2016 📍 Ottawa, ON

## Recent Employment

<b>Lead Researcher (Contractual position)</b> Carleton University	Summer 2020 📍 Ottawa, ON
<ul style="list-style-type: none"><li>• Collaboration initiated by the WSIB of Ontario upon reading my master's thesis</li><li>• Managed a team composed of myself, one M.Eng. student, and one undergraduate student</li><li>• Responsible for developing a semi-automated audiogram digitization/interpretation solution using machine learning and computer vision to support the claim adjudication process at WSIB</li></ul>	
<b>Contract Researcher</b> The Ottawa Hospital Rehabilitation Centre	2018 - 2019 📍 Ottawa, ON
<ul style="list-style-type: none"><li>• 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).</li></ul>	

**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 -

📍 Ottawa, ON

- 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*

[J7] G.M. Rurak, S. Simard, **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 (2020). *Cell Reports*. (Submitted)

[J6] **F. Charih**, J. R. Green, K. K. Biggar. [Machine Learning-Driven Identification of Novel Lysine Methylation Sites with MethylSight](#) (2020). *Star Protocols*.

[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)

[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).

[J3] S. Sarvan, A. Yeung, **F. Charih**, A. Stintzi, and J.-F. Couture. [Crystal structure of Campylobacter jejuni peroxide regulator](#) (2018). *BioMetals* 32(3) 491-500.

[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) 2351-2360.

[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) 1-14.

#### *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.

[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.

[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.

[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.

[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.

#### *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, (170 pages). (Defended without revisions, and was awarded the Carleton University Senate medal)

[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, (88 pages).

### **Presentations and Workshops**

[PW6] <b>AI in biology and biomedical engineering (guest lecture)</b>	December 2nd, 2019
ECOR1055	📍 Ottawa, ON

[PW5] <b>X-ray crystallography and computational biochemistry (guest lecture)</b>	November 22nd, 2019
BIOC3202	📍 Ottawa, ON

[PW4] <b>Introductory Data Analysis with Pandas</b>	October 16th, 2019
Lecture Series (IEEE EMBS Carleton)	📍 Ottawa, ON

[PW3] <b>Building interactive visualizations in the browser with D3.js</b> Lecture Series (IEEE EMBS Carleton)	February 6th, 2019 📍 Ottawa, ON
[PW2] <b>Machine learning in Audiology (guest lecture)</b> HLTH2001 and HLTH4102 (Carleton University)	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	November 9th, 2018 📍 Montreal, QC

### Selected Posters

[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 SHOEBBOX 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>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 act as a mentor to the following students:

<b>Abhinav Yalamanchili</b> , M.Eng. Student <i>Machine vision to digitize audiogram images (with WSIB Ontario)</i>	Summer 2020
<b>Ahmed Abdelrazik</b> , Undergraduate Student <i>Development of an ergonomic audiogram digitization tool (with WSIB Ontario)</i>	Summer 2020
<b>Pratyush Singh</b> , Undergraduate Student <i>Machine vision to digitize audiogram images</i>	Summer 2018
<b>Ashlynn Steeves</b> , Undergraduate Student <i>Using kNN to impute values in incomplete audiograms</i>	Winter 2018

### Other

<b>Judge</b> , Ottawa Regional Science Fair	2019
<b>Communications Officer</b> , Carleton University Engineering in Medicine and Biology Society	2018-2019
<b>Judge</b> , Canada Wide Science Fair	2018

### Languages

- French (native)
- English (fluent)
- Arabic (elementary conversational skills)

### Relevant skills

#### High-performance computing

- Development of concurrent software for scientific applications using low level languages (Rust, C, Java) and high level languages (Python)
- Multithreading (OpenMP)
- Distributed computing (MPI)

- General-purpose GPU programming (GPGPU)

#### **Statistical data analysis/visualization:**

- Frequentist and bayesian modelling
- Data processing and exploration
- Interactive data visualization with D3.js
- Machine learning (supervised and unsupervised)
- Deep learning

#### **Bioinformatics:**

- Application of machine learning techniques to biological datasets
- Sequence alignment
- Protein modelling and analysis
- Protein-ligand docking

#### **Web development:**

- Development and maintenance of web infrastructures (web servers, REST APIs, databases, websites) in the cloud (AWS/Google Cloud)
- Creation of clean, maintainable web applications using modern web technologies (React.js, Express.js, Flask, Postgresql, Docker).