

University of Toronto,
Department of Biochemistry //
Molecular Structure and
Function
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CHRISTOPHER EDWARD ING

Education

Ph.D., Biochemistry. University of Toronto. 2012 – 2017.

Thesis: Molecular basis of permeation and selectivity in voltage-gated sodium channels using microsecond-scale molecular dynamics (with Dr. Régis Pomès)

Courses: Protein Folding, Machine Learning, Computational Methods in Medicine

M.Sc., Physics. University of Waterloo. 2009 – 2011.

Thesis: Path integral Langevin dynamics of complex molecular systems: from low-temperature quantum clusters to biomolecules (with Dr. Pierre-Nicholas Roy and Dr. Wing-Ki Liu)

Courses: Biophysics, Quantum Physics, Stochastic Processes

Hon.B.Sc., Computational Physics. Co-Op. University of Waterloo. 2004 – 2009.

Thesis: Mathematical Analysis of the Adhesion of Cylindrical Colloids in the Helfrich Model. (with Jeffrey X.Y. Chen)

Contributions

Journal Articles (h-index 6, manuscripts in preparation not listed, *equal contributors)

1. N. Fleming, B. Kinsella, **C. Ing**, "Predicting Protein Thermostability Upon Mutation Using Molecular Dynamics Timeseries Data", Bioarxiv (2016).
2. **C. Ing***, S. Wang*, S. Emami*, Y. Jiang, H. Liang, R. Pomès, L. S. Brown, V. Ladizhansky. "Structure and Dynamics of Extracellular Loops in Human Aquaporin-1 from Solid-State NMR and Restrained Molecular Dynamics", 120, 37 (2016).
3. **C. Ing**, R. Pomès. "Computational Studies of Ion Permeation and Selectivity in Voltage-Gated Sodium Channels". Current Topics in Membranes. 78, (2016).
4. S. W. S. Chan*, J. Yau*, **C. Ing**, ..., L. E. Kay, C. M. Yip, R. Pomès, S. Sharpe, W. A. Houry, "Mechanism of Amyloidogenesis of a Bacterial AAA+ Chaperone". Structure 24, 7 (2016)
5. C. Calmettes, **C. Ing**, C. M. Buckwalter, M. El Bakkouri, C. Chieh-Lin Lai, A. Pogoutse, S. D. Gray-Owen, R. Pomès, T. F. Moraes. "The molecular mechanism of Zinc acquisition by the neisserial outer-membrane transporter ZnuD", Nature Communications. 6, 7966, (2015).
6. J. Little, G. Li, **C. Ing**, B. R. DiFrancesco, N. C. Bamford, H. Robinson, M. Nitz, R. Pomès, P. L. Howell, "Modification and periplasmic translocation of the biofilm exopolysaccharide poly- β -1,6-N-acetyl-D-glucosamine" Proc. Natl. Acad. Sci., 111, 30 (2014).
7. M. Schmidt, S. Constable, **C. Ing**, P.-N. Roy, "Inclusion of trial functions in the Langevin equation Path Integral Ground State method: application to parahydrogen clusters and their isotopologues", J. Chem. Phys., 140, 234101 (2014)
8. N. Chakrabarti, **C. Ing**, J. Payandeh, N. Zheng, W.A. Catterall, R. Pomès, "Catalysis of Na⁺ Permeation in Bacterial Sodium Channel NavAb" Proc. Natl. Acad. Sci., 110, 28 (2013).
9. S. Constable, M. Schmidt, **C. Ing**, T. Zeng, P.-N. Roy, "Langevin Equation Path Integral Ground State", J. Phys. Chem. A, 117, 32 (2013).
10. **C. Ing**, K. Hinsen, J. Yang, T. Zeng, H. Li, P.-N. Roy, "A path-integral Langevin equation treatment of low-temperature doped helium clusters", J. Chem. Phys., 136, 224309 (2012).
11. S. Mkrtychyan, **C. Ing**, and J.Z.Y. Chen, "Adhesion of cylindrical colloids on the surface of a membrane", Phys. Rev. E, 81, 1 (2010).

Supervision

2016 – Machine Learning Class Project (two graduate students)

Designed a novel approach for the prediction of protein thermostability upon mutation, utilizing massive-scale molecular dynamics and recurrent neural networks, executed by two graduate students.

2015 - Sanofi Biogenius Regional Competitors (two highschool students)

Directed research on the molecular simulation of intrinsically disordered peptides using supercomputers, in accordance with a published protocol.

2015 – Biochemistry Undergraduate Research Project (undergraduate student)

Supervised research on the voltage-sensing domain of voltage-gated sodium channel using MDAnalysis on multi-terabyte molecular dynamics datasets.

2014 – SickKids Summer Volunteers (two undergraduate students)

Utilized agile project management (PivotalTracker) to direct the tutorials, readings, research summaries, software development, and scientific analysis using entirely iPython Notebooks. Original contribution was prepared for Wikipedia.

Posters/Presentations

2016 – Simulation Studies of Ion Conduction and Selectivity in NaV Channels Depend Strongly on Force Field. 60th Annual Meeting – Biophysical Society, Los Angeles, CA, USA. (poster).

2015 – Hacking structural biology with Python and pandas. PyCon Canada 2015. Toronto, ON, Canada. (oral) (<https://www.youtube.com/watch?v=sBdRkj7x1aY>).

2015 – Nanometer-scale Pandas: A Data Science Approach to Structural Biology. PyCon 2015. Montréal, QC, Canada. (poster),

2015 – Coupling of Channel Fluctuations in Ion Permeation and Selectivity in Bacterial Sodium Channel NavAb. 59th Annual Meeting - Biophysical Society. Baltimore, MD, USA. (poster),

2014 – Catalysis and Selectivity of Na⁺ Permeation in the Bacterial Sodium Channel NavAb. 58th Annual Meeting - Biophysical Society. San Francisco, CA, USA. (poster),

2013 – Molecular Dynamics Simulations of Calcium Release Activated Channel Orai1. Biochemistry Research Day, Toronto, ON, Canada (poster).

2012 – Ionic Diffusion in the Selectivity Filter of a NaV Channel. SickKids Research Institute Retreat, Toronto, ON, Canada (poster).

2012 – Internal Hydration and Conformational Gating in Cytochrome c Oxidase. 56th Annual Meeting - Biophysical Society. San Diego, CA, USA. (poster), 11th Chemical Biophysics Symposium. Toronto, ON, Canada (poster).

2011 – Efficient Sampling of Quantum Systems Using Path Integral Molecular Dynamics: Applications to Weakly Bound Systems and Biomolecules. 66th International Symposium on Molecular Spectroscopy. Columbus, OH, USA (oral), 11th CERMM Symposium. Montreal, QC, Canada. (oral). 27th Annual Symposium on Chemical Physics. Waterloo, ON, Canada. (poster).

2011 – Applications of Ring-Polymer Molecular Dynamics and Path Integral Ground State Methods to He-CO₂ and Biomolecules. 94th Canadian Chemistry Conference. Montreal, QC, Canada (oral). Matrix 2011, Vancouver, BC, Canada (oral).

2011 – Sampling of Quantum Systems with Path Integral Langevin Dynamics: Applications to Weakly Bound Clusters and Biomolecules. 10th Chemical Biophysics Symposium. Toronto, ON, Canada. (oral), 17th Canadian Symposium on Theoretical Chemistry. Edmonton, AB, Canada. (poster).

2010 – Path Integral Implementation in MMTK. Sharcnet Research Day 2010, Toronto, ON, Canada. 10th CERMM Symposium. Montreal, QC, Canada. (oral).

Awards

2016 – SickKids Research Training Centre Trainee Travel Award, Biophysical Society 2016

2013 – University of Toronto Travel Scholarship, to deliver presentation at Biophysical Society 2014

2011 – MITACS Travel Scholarship, to deliver oral presentation at Matrix 2011

2010 – French Consulate Scholarship, to write Python software with Dr. Hinsen at Synchrotron Soleil

Work Experience

Action Potential Lab, Toronto, Canada

2014-Present – Lecturer, Course Content Creator, Demonstrator

Developed original art and science courses/workshops for children to adults on topics like “Cow Eyeball Dissection”, “Sew-Your-Own-Cells”, and the “Science of Sound”. Acted as instructor for multiple events, filmed for segment on YTV during Toronto Mini-Maker Faire 2014 during “Oobleck on Speaker” demonstration, and prepared original scientific art to help lessons.

General Electric / SmallGirlsPR, New York, USA

2014 – Fashion Reporter

Photographed runway shoots and wrote technical scientific content at New York Fashion Week on the General Electric Tumblr blog. All 16 articles received 3.5M+ impressions with 20,000 likes.

Department of Biochemistry, University of Toronto, Canada

2013/2014 – Exam Invigilator

Proctored final examinations of undergraduate Biochemistry courses.

Department of Physics and Astronomy, University of Waterloo, Canada

2011 – Teaching Assistant and Laboratory Instructor.

Lead weekly tutorials for first year Calculus students (>50 students). Acted as a lab demonstrator for general physics and teaching assistant for first-year scientific computing. Marked assignments upper-level undergraduate and graduate physics courses.

Synchrotron Soleil, Saint-Aubin, France

2010 – Scientific Programmer. Supervisor: Dr. Konrad Hinsen.

Implemented normal mode path integral molecular dynamics in MMTK, an open-source molecular dynamics package. Benchmark study submitted as a peer-reviewed manuscript. Utilized Cython.

KDE / Google, Online

2009 – Google Summer of Code Developer. Supervisor: Vladimir Kuznetsov.

Implemented a real-time smoothed particle hydrodynamics algorithm in Step, an open-source physics sandbox in the KDE education packages. Written in C++/Qt.

Radiation Laboratory, University of Notre Dame, U.S.A.

2008 – Computational Chemist. Supervisor: Dr. Daniel Chipman, Dr. Paulo R.C Couto.

Analyzed the many-body effects of hydroxyl-water clusters using a many-body decomposition scheme with Gaussian/Fortran workflow. Compared many-body effects of pure water clusters to those containing hydroxyl radicals.

Cardiac Imaging Group, Sunnybrook Hospital, Canada

2007 – Medical Imaging Developer. Supervisor Dr. Bonny Biswas, Dr. Graham Wright.

Contributed to C++ project for real-time MR imaging by adding new catheter tracking functionality.

Bioinformatics Group, Microarray Centre, Canada

2007 – Research Intern. Supervisor: Carl Virtanen.

Developed a statistical research tool in C# for visualizing gene ontology in expression data sets. Wrote Perl scripts for sequence alignment, annotation of genes, and MySQL database integration.

Volunteering

2015 – Mozilla Science Lab, project lead for open-source web application development

2011/2013/2014 – TEDxWaterloo, TEDxToronto, social media representative and floor volunteer

2012/2013 – PyCon Canada, speaker liaison and introducer

2012 – Inaugural Hacking Health Event, reception DJ using Ableton Live

2011 – Graduate Student Research Conference, chemistry session chair

2010/2013 – Science Rendezvous, oobleck, interactive molecular dynamics demonstrator.

2009-2016 – Fresh Photons, image blogger (185,000 followers, <http://www.freshphotons.com>)