

Aidan I. Brown

Assistant Professor

Dept. of Physics, Toronto Metropolitan University (formerly Ryerson University)
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Research and Professional Experience

- 2020– **Assistant Professor**, *Dept. of Physics, Toronto Metropolitan University (formerly Ryerson University)*
- 2018–2020 **Postdoctoral Fellow**, *Dept. of Physics, University of California, San Diego*
Biological Physics and Nonequilibrium Statistical Mechanics of confined proteins with Prof. [Elena Koslover](#).
- 2015–2018 **Postdoctoral Fellow**, *Dept. of Physics, Simon Fraser University*
Biological Physics and Nonequilibrium Statistical Mechanics of molecular machines with Prof. [David Sivak](#).

Education

- 2012–2015 **Ph.D. in Physics**, *Dalhousie University*
Thesis: “Quantitative modelling of autophagy-related protein dynamics and clustering on peroxisome surfaces.” Advisor: Prof. [Andrew Rutenberg](#).
- 2010–2012 **M.Sc. in Physics**, *Dalhousie University*
Thesis: “Fixed nitrogen dynamics and heterocyst patterning in filamentous heterocystous cyanobacteria.” Advisor: Prof. [Andrew Rutenberg](#).
- 2006–2010 **B.Sc. Honours in Physics**, *University of Guelph*
Thesis: “Optical Conductivity of Graphene.” Advisor: Prof. [Elisabeth Nicol](#).
GPA: 94.5%. Governor General’s Silver Medalist.
Summer research: biophysics and statistical mechanics theory with Profs. [Rob Wickham](#) and [John Dutcher](#), condensed matter theory with Prof. [Stefan Kycia](#).

Awards and Fellowships

- 2012-2015 **Canada Graduate Scholarship, Ph.D**, *Natural Sciences and Engineering Research Council of Canada (NSERC)*
- 2012-2014 **Killam Predoctoral Scholarship, Ph.D**, *Dalhousie University*
- 2012-2014 **Walter C Sumner Memorial Fellowship**, *Dalhousie University*
- 2010-2012 **Killam Predoctoral Scholarship, M.Sc**, *Dalhousie University*
- 2010-2011 **Canada Graduate Scholarship, M.Sc**, *NSERC*
- 2010 **Governor General’s Silver Medal**, *University of Guelph*, awarded to the two graduating undergraduate students with highest GPAs across the university

Publications

peer-reviewed: 27 / first author: 16 / senior author: 4

- 28 DOI LT Kischuck and **AI Brown**. “Tube geometry controls protein cluster conformation and stability on the endoplasmic reticulum surface.” *Soft Matter*, **19**: 6771 - 6783 (2023)
- 27 DOI JA Leblanc, MG Sugiyama, CN Antonescu, and **AI Brown**. “Quantitative modeling of EGF receptor ligand discrimination via internalization proofreading.” *Phys. Biol.*, **20**: 056008 (2023)
- 26 DOI MG Sugiyama, **AI Brown**, J Vega-Lugo, AM Scott, K Jaqaman, GD Fairn, and CN Antonescu. “Confinement of unliganded EGFR by tetraspanin nanodomains gates EGFR ligand binding and signaling.” *Nat. Commun.*, **14**: 2681 (2023)
- 25 DOI XG Arceo, EF Koslover, BM Zid, and **AI Brown**. “Mitochondrial mRNA localization is governed by translation kinetics and spatial transport.” *PLoS Comput. Biol.*, **18** e1010413 (2022)
- 24 DOI ZC Scott, **AI Brown**, SS Mogre, LM Westrate, and EF Koslover. “Diffusive search and trajectories on spatial networks: a propagator approach.” *Eur. Phys. J. E*, **44**: 80 (2021)
- 23 DOI **AI Brown**, and EF Koslover. “Design principles for the glycoprotein quality control pathway.” *PLoS. Comput. Biol.* **17**: e1008654 (2021)
- 22 DOI SS Mogre, **AI Brown**, and EF Koslover. “Getting around the cell: physical transport in the intracellular world.” *Phys. Biol.* **17**: 061003 (2020)
- 21 DOI **AI Brown**, LM Westrate, and EF Koslover. “Impact of global structure on diffusive exploration of organelle networks.” *Sci. Rep.* **10**: 4984 (2020)
- 20 DOI MP Viana, **AI Brown**, IA Mueller, C Goul, EF Koslover, and SM Rafelski. “Mitochondrial Fission and fusion dynamics generate efficient, robust, and evenly distributed network topologies in budding yeast cells.” *Cell Syst.* **10**: 287-297 (2020)
- 19 DOI **AI Brown** and DA Sivak. “Theory of nonequilibrium free energy transduction by molecular machines.” *Chem. Rev.* **120**, 434-459 (2020)
- 18 DOI **AI Brown** and EF Koslover. “Drive, filter, and stick: A protein sorting conspiracy in photoreceptors.” *J. Cell Biol. (Spotlight article)* **218**, 3533-3534 (2019). ***Not peer reviewed***
- 17 DOI Z Chen, R Gabizon, **AI Brown**, A Lee, A Song, CD Celis, EF Koslover, T Yao, and C Bustamante. “High-resolution and high-accuracy topographic and transcriptional maps of the nucleosome barrier.” *eLife*. **8**, e48281 (2019). Featured in *eLife Insight*.
- 16 DOI A Zarrin, DA Sivak, and **AI Brown**. “Breaking time-reversal symmetry for ratchet models of molecular machines.” *Phys. Rev. E*, **99**, 062127 (2019).

- 15 DOI **AI Brown** and DA Sivak. “Pulling cargo increases the precision of molecular motor progress.” *Europhys. Lett.*, **126**, 40004 (2019)
- 14 DOI **AI Brown** and DA Sivak. “Allocating and splitting free energy to maximize molecular machine flux.” *J. Phys. Chem. B*, **122**, 1387-1393 (2018)
- 13 DOI **AI Brown** and DA Sivak. “Allocating dissipation across a molecular machine cycle to maximize flux.” *Proc. Natl. Acad. Sci. USA*, **114**, 11057-11062 (2017).
- 12 [arxiv](#) [PiC](#) **AI Brown** and DA Sivak. “Toward the design principles of molecular machines.” *Physics in Canada*, **73**, 61-66 (2017).
- 11 DOI **AI Brown** and AD Rutenberg. “A model of autophagy size selectivity by receptor clustering on peroxisomes.” *Front. Phys.*, **5**, 14 (2017).
- 10 DOI **AI Brown** and DA Sivak. “Effective dissipation: breaking time-reversal symmetry in driven microscopic energy transmission.” *Phys. Rev. E*, **94**, 032137 (2016).
- 9 DOI AD Rutenberg, **AI Brown**, and L Kreplak. “Uniform spatial distribution of collagen fibril radii within tendon implies local activation of pC-collagen at individual fibrils.” *Phys. Biol.*, **13**, 046008 (2016).
- 8 DOI SG Farrell, **AI Brown**, and AD Rutenberg. “Single file diffusion into a semi-infinite tube.” *Phys. Biol.*, **12**, 064001 (2015).
- 7 DOI **AI Brown** and AD Rutenberg. “Cluster coarsening on drops exhibits strong and sudden size-selectivity.” *Soft Matter*, **11**, 3786-3793 (2015).
- 6 DOI **AI Brown**, L Kreplak, and AD Rutenberg. “An equilibrium double-twist model for the radial structure of collagen fibrils.” *Soft Matter*, **10**, 8500-8511 (2014).
- 5 DOI CR Nayak, **AI Brown**, and AD Rutenberg. “Protein translocation without specific quality control in a computational model of the Tat system.” *Phys. Biol.*, **11**, 056005 (2014).
- 4 DOI **AI Brown**, PK Kim, and AD Rutenberg. “PEX5 and ubiquitin dynamics on mammalian peroxisome membranes.” *PLoS Comput. Biol.*, **10**, e1003426 (2014).
- 3 DOI **AI Brown** and AD Rutenberg. “A storage-based model of heterocyst commitment and patterning in cyanobacteria.” *Phys. Biol.*, **11**, 016001 (2014).
- 2 DOI **AI Brown** and AD Rutenberg. “Heterocyst placement strategies to maximize the growth of cyanobacterial filaments.” *Phys. Biol.*, **9**, 046002 (2012).
- 1 DOI **AI Brown** and AD Rutenberg. “Reconciling cyanobacterial fixed-nitrogen distribution and transport experiments with quantitative modelling.” *Phys. Biol.*, **9**, 016007 (2012).

Senior Supervision Experience

Postdoctoral fellows, Toronto Metropolitan University

2022 – Prabha Chuphal. “Impact of mitochondrial dynamics on the spatial organization of proteins.”

Graduate researchers, Toronto Metropolitan University

2021 – Liam Kischuck. “Geometric control of protein signaling cluster dynamics in the endoplasmic reticulum.”

2022 – Junyeong Kim. “Diffusive encounter kinetics within tubular geometries.”

2022 – Eshan Merali. “Stochastic mechanisms for mitochondrial DNA quality control in the female germline.”

Undergraduate researchers, Toronto Metropolitan University

2023 – Nicholas Duong. Summer student. “Modeling EGF receptor signaling dynamics on the cell membrane.”

2022 – 2023 Miriam Quintanilla. 4th-year thesis student. “Modeling EGF receptor signaling dynamics on the cell membrane.”

2022 – 2023 Maysum Khalfan. 4th-year thesis student. “Impact of cristae on diffusive search in mitochondria.”

2022 Jaleesa Leblanc. Summer student. “Modeling EGF receptor activation and confinement on the cell membrane.”

2021 – 2022 Junyeong Kim. 4th-year thesis student. “Diffusive encounter kinetics within tubular geometries.”

2021 – 2022 Rutvik Patel. Summer and 4th-year thesis student. “Modeling protein concentration fluctuations in mitochondrial networks.”

2020 – 2021 Jamal Faraaj. 4th-year thesis student. “Control of protein transport in mitochondria by fission and fusion of mitochondrial structures.”

2020 – 2021 Robert Kalisky. 4th-year thesis student. “Kinetics of protein folding quality control in the endoplasmic reticulum.”

Advising, Mentoring, and Co-Supervision Experience

Graduate researchers, University of California, San Diego

2019 – 2020 Ximena Garcia-Arceo. “Quantitative modeling of mRNA translation and localization to mitochondria.”

Undergraduate researchers, University of California, San Diego

2020 Rae Therese Fariolen. “Diffusive transport in organelles.”

Undergraduate researchers, Simon Fraser University

2016 – 2018 Arshia Zarrin. “Dissipation and irreversibility in model molecular motors.”

Undergraduate researchers, Dalhousie University

- 2014 – 2015 Spencer Farrell. “Single file diffusion into semi-infinite tubes”
- 2014 Will Musgrave. “Photobleaching fluctuations with rotational dynamics”
- 2012 Elias Zoghaib. “Fixed nitrogen storage models with filamentous cyanobacteria”

Teaching Experience

- FALL 2020 – 2023 **Course Instructor**, *Toronto Metropolitan University, PCS 107: The Natural Context*. Approx. 120 students.
- FALL 2021, 2022, 2023 **Course Instructor**, *Toronto Metropolitan University, PCS 622: Mathematical Methods in Medical Physics*. Approx. 25 students.
- WINTER 2023 **Course Instructor**, *Toronto Metropolitan University, BP 8117: Dynamical Systems* 6 students.
- WINTER 2022 **Course Instructor**, *Toronto Metropolitan University, PCS 125: Physics: Waves and Fields* 260 students.
- WINTER 2021 **Course Instructor**, *Toronto Metropolitan University, PCS 350: Computational Methods in Medical Physics*. 14 students.
- 2015, 2016, 2018 **Guest Lecturer**, *University of California, San Diego: Physics of the Cell. Simon Fraser University: Nonequilibrium Statistical Mechanics and Stochastic Processes; Thermodynamics; Soft Condensed Matter and Biological Physics*.
- 2018 **Research Facilitator**, *Marine Biological Laboratory, Physical Biology of the Cell course*. Supervised biology graduate students during research projects for intensive course on physical and computational modeling of cell biological processes.
- 2010 – 2012 **Teaching Assistant**, *Dalhousie University: Modern Physics, Electricity and Magnetism, Introduction to Numerical Programming, Statistical Mechanics*. Designed and ran tutorials, created solution keys, and graded problem sets.
- 2010 **Lab Instructor**, *Dalhousie University: Introduction to Physics*. Demonstrated experiments, assessed students orally, and supported students as they completed experiments.

Teaching Training

- 2016 **Instructional Skills Workshop**, *Simon Fraser University: Teaching and Learning Centre*. Three day intensive workshop focusing on lesson planning, participative and active learning techniques, and providing effective feedback.

Selected Talks

- AUG 2023 [Applied Mathematics, Modeling and Computational Science \(AMMCS\)](#) International conference. *Invited*.
- JULY 2023 Hurd group meeting at the University of Toronto. *Invited*.
- MAY 2023 Visit to Toronto of [De Leidsche Flesch](#) study association from Leiden University in the Netherlands. *Invited*.
- JUNE 2022 [Canadian Association of Physicists Congress](#). *Invited*.
- MAY 2022 [Biophysical Society of Canada Annual Meeting](#). *Selected for talk*.

APR 2022 Colloquium, Department of Physics and Astronomy, McMaster University. *Invited.*

JULY 2021 [Ontario Cell Biology Symposium](#), Virtual.

MAY 2021 [Biophysical Society of Canada Annual Meeting](#), Virtual.

MAR 2021 [Biophys TO seminar](#), Department of Physics, University of Toronto. *Invited.*

MAR 2021 American Physical Society March Meeting, Virtual.

FEB 2021 Colloquium, Department of Mathematics, Ryerson University. *Invited.*

JAN 2021 Quantitative Biology in Canada seminar, Virtual. *Invited.*

APR 2020 Colloquium, Department of Physics and Energy Science, University of Colorado Colorado Springs. *Invited.*

MAR 2020 Department Seminar, Department of Biology, York University. *Invited.*

MAR 2020 Colloquium, Department of Physics, Ryerson University. *Invited.*

MAR 2020 American Physical Society March Meeting, Virtual.

FEB 2020 Colloquium, School of Physics and Astronomy, Rochester Institute of Technology. *Invited.*

FEB 2020 Colloquium, Department of Physics, University of Texas at Dallas. *Invited.*

JAN 2020 Colloquium, Department of Physics and Astronomy, Trent University. *Invited.*

MAY 2019 [Biophysics and Systems Biology Seminar](#), University of California, Irvine. *Invited.*

JAN 2019 Colloquium, Department of Physics, University of Alberta. *Invited.*

JUNE 2017 [Frontiers in Biophysics](#), University of British Columbia.

JAN 2017 Mehta, Korolev, and Segrè Group Meeting, Boston University.

MAR 2016 [Postdoc Research Day](#), Simon Fraser University.

MAR 2016 American Physical Society March Meeting.

MAR 2015 American Physical Society March Meeting.

JAN 2015 Biophysics/Soft Matter Seminar, Simon Fraser University.

JUN 2014 Canadian Mathematical Society Summer Meeting. *Invited.*

APR 2014 Physics of Soft and Biological Matter Conference. *Selected for talk.*

DEC 2013 Waterloo Soft Matter Theory Conference.

JUN 2013 Canadian Mathematical Society Summer Meeting.

MAR 2013 American Physical Society March Meeting.

MAR 2011 American Physical Society March Meeting.

MAR 2010 American Physical Society March Meeting.

Selected Posters

FEB 2023 [Annual Meeting of the Biophysical Society.](#)

FEB 2020 [Annual Meeting of the Biophysical Society.](#)

JAN 2019 [Stochastic Physics in Biology Gordon Conference.](#)

DEC 2018 American Society for Cell Biology Meeting.

JAN 2017 [Berkeley Statistical Mechanics Meeting.](#)

JAN 2017 [Stochastic Physics in Biology Gordon Conference.](#)

- JUN 2016 [Engineering Approaches to Biomolecular Motors](#). *Poster Prize*.
- APR 2013 [Chemical Biophysics Symposium](#).
- APR 2012 [Chemical Biophysics Symposium](#).
- JUN 2011 7th International Conference on Biological Physics.

Peer Review

Journal Peer-review

Physical Review Letters ($\times 4$), Physical Review E ($\times 2$), Biophysical Journal ($\times 2$), iScience, Physical Review Research, Frontiers in Cell and Developmental Biology, Nature Communications, The European Physical Journal E, Nature Chemistry, Physical Review X, MDPI Life

Grant review

NSERC Discovery Grant program external reviewer (2022)

Service

- 2020– Current thesis committee member. PhD: Keanu Mason Rock, Nima Khalifehsoltani. MSc: Faheem Mosam, Krishtee Dyuti, Jordan Lanctot.
- 2020– Past thesis committee member. MSc: Joelle Easter and Mark Persic.
- 2020– Graduate thesis examination committee member. PhD: Christian Quirouette. MSc: Joelle Easter, Simran Pattar, Mark Persic.
- 2020 – Undergraduate Scholarships and Awards Committee, Dept. of Physics, Toronto Metropolitan University
- 2021– Undergraduate Curriculum Cmte., Faculty of Science, Toronto Metropolitan University
- 2021– Graduate Complex Systems Committee, Dept. of Physics, Toronto Metropolitan University
- 2022– Graduate Admissions Committee, Dept. of Physics, Toronto Metropolitan University
- 2021 – 2023 University Research Opportunity and University Interdisciplinary Research Opportunity Adjudication Committee, Faculty of Science, Toronto Metropolitan University
- 2021 – 2022 Graduate Program Membership Committee, Dept. of Physics, Toronto Metropolitan University
- 2021 President’s Entrance Scholarship and the Terence Grier Entrance Scholarship Adjudication Committee, Faculty of Science, Toronto Metropolitan University
- 2019 Physics outreach, Young Scientists Club at Carmel Creek Elementary in San Diego, outreach for students in grades one to three
- 2019 Physics outreach, [Tech Trek](#) summer camp at UC San Diego for middle school girls
- 2015 – 2018 Co-organizer, [Simon Fraser University Biophysics / Soft Matter seminar series](#)
- 2011 – 2013 President, Dalhousie Graduate Physics Society
- 2011 Physics outreach, Discovery Days, middle and high school students at Dalhousie University
- 2009 – 2010 Physics Representative to College Council, College of Physical and Engineering Science, University of Guelph
- 2009 – 2010 Executive Member, Physics Club, University of Guelph
- 2008 – 2010 Undergraduate Representative, Dept. of Physics Curriculum Committee, University of Guelph

