

Madeleine Bonsma-Fisher

Postdoctoral Fellow, University of Toronto Data Sciences Institute

CivMin & MIE
University of Toronto
Toronto, Canada
✉ m.bonsma@utoronto.ca

Education

- 2015–2022 **PhD, Physics**, *University of Toronto*, Toronto, Canada.
Thesis: *Population dynamics of CRISPR adaptive immunity in communities of bacteria and phages: A window into another world*
Supervisor: Sidhartha Goyal
- 2014–2015 **MSc, Physics**, *University of Toronto*, Toronto, Canada.
Thesis: *Analyzing prokaryote-phage interactions using the CRISPR locus*
Supervisor: Sidhartha Goyal
- 2009–2014 **BSc, Honours Co-operative Physics, Biology Minor**, *University of Waterloo*, Waterloo, Canada.
Thesis: *Analyzing oscillations in the rat ventral striatum*
Supervisor: Matthijs van der Meer

Research

Postdoctoral

- 2022–present **University of Toronto**, *Data Sciences Institute*.
Researching equitable prioritization of active transportation infrastructure in Canadian cities. Advisors: Shoshanna Saxe (Department of Civil & Mineral Engineering) and Timothy Chan (Department of Mechanical & Industrial Engineering)

Graduate

- 2014–2022 **University of Toronto**, *Biophysics Group, Department of Physics*.
Developing models of bacteria-phage interactions in natural communities to understand microbiome organization.
Advisor: Sidhartha Goyal
- 2015–2019 **Project Lead**, *phageParser Open Source Project*.
Planned and directed open source data analysis project through Mozilla Science Lab's 'Collaborate' interface. Participated in multiple Mozilla code sprints as project lead.

Undergraduate

- 2013–2014 **University of Waterloo**, *Computational Neuroscience Group, Department of Biology*.
Developed and implemented computational analysis methods for analyzing rat brain wave measurements. Advisor: Matthijs van der Meer
- Summer 2013 **Dalhousie University**, *DREAMS Undergraduate Visiting Research Assistant, Department of Physics & Atmospheric Science*, Halifax, Canada.
Synthesized new materials for gas respirators, performed and developed techniques for sample analysis, prepared presentations and a paper for publication. Advisor: Jeff Dahn
- Fall 2012 **Institute for Quantum Computing**, *Quantum Optics and Quantum Information Group*, Waterloo, Canada.
Built and performed experiments in quantum optics, analyzed experimental results, prepared, submitted, and published a paper on results in Physical Review A. Advisor: Kevin Resch

Industry

- Winter 2011 & Winter 2012 **Sensors & Software Inc.**, *Research and Development*, Mississauga, Canada.
Performed field and lab testing of ground penetrating radar, analyzed data and prepared reports, tested new software developments, completed independent analysis of radar speed in ice and presented findings to company executives. Supervisor: David Redman.
- Fall 2011 **Christie Digital Systems Inc.**, *Optical Engineering*, Kitchener, Canada.
Developed and performed experiments to measure birefringence in optical components, wrote technical briefs on experimental results and optics concepts. Supervisor: John Domm.

Publications

Refereed Publications

- 2023 M. Bonsma-Fisher, S. Goyal. *Dynamics of immune memory and learning in bacterial communities*, eLife 12:e81692.
- 2019 L. W. Johnston, M. Bonsma-Fisher, J. Ostblom, A. R. Hasan, J. S. Santangelo, L. Coome, L. Tran, E. Sales de Andrade, S. Mahallati. *A graduate student-led participatory live-coding quantitative methods course in R: Experiences on initiating, developing, and teaching*, The Journal of Open Source Education, 2(16), 49.
- 2018 M. Bonsma-Fisher, D. Soutière, S. Goyal. *How adaptive immunity constrains the composition and fate of large bacterial populations*, Proceedings of the National Academy of Sciences, **115**, 32 (2018).
- 2015 L. Vermeyden, X. Ma, J. Lavoie, M. Bonsma, U. Sinha, R. Laflamme, K. J. Resch. *Experimental test of environment-assisted invariance*, Physical Review A, **91**, 012120 (2015).
- 2013 L. Vermeyden*, M. Bonsma*, C. Noel, J.M. Donohue, E. Wolfe, K. J. Resch. *Experimental violation of three families of Bell inequalities*, Physical Review A, **87**, 032105 (2013). *These authors contributed equally to this work.

Other Publications

- 2022 M. Bonsma-Fisher, K. Hertweck, D. Irving, L. Johnston, J. Ostblom, I. Flores Siaca, C. Wickham, G. Wilson. **Research Software Engineering with R: Building software that makes research possible** [Book in progress].
- 2022 M. Bonsma-Fisher, D. Roberston. **Ottawa's Winter Cycling Network: An analysis of expansion opportunities using Strava Ridership Data**. Report circulated to Ottawa City Council.
- 2018 M. Bonsma-Fisher. **Do left-handed people really die young?** DataCamp coding tutorial.
- 2018 M. Bonsma-Fisher and A. Hasan. *Working with plant phenology data and fitting a nonlinear model using least squares in R*. NEON Faculty Mentoring Network, QUBES Educational Resources. doi:10.25334/Q4Q73D
- 2018 M. Bonsma-Fisher. *Working with spreadsheet-style data in Python with pandas and seaborn*. QUBES Educational Resources. doi:10.25334/Q4PF1D
- 2017 M. Bonsma-Fisher. *The Importance of Working Open*. Medium.

Presentations

Invited Talks and Panels

- 2022 **M. Bonsma-Fisher** B. Lin, S. Saxe, T. C. Y. Chan. *Optimizing bicycle infrastructure placement with Level of Traffic Stress*, CHATR lab research visit, Vancouver, Canada.
- 2019 **M. Bonsma-Fisher**. *Immune memory in the CRISPR arms race*, MicrobeTO Seminar Series, Toronto, Canada.
- 2019 **M. Bonsma-Fisher**, A. Hasan, J. S. Santangelo. *Let them learn R - and reproducible, collaborative, quantitative science*, GTA R User Group, Toronto, Canada.
- 2018 **M. Bonsma-Fisher** *Open CRISPR: leveraging open source for scientific discovery*, Free Software and Open Source Symposium 2018, Toronto, Canada. [Keynote]
- 2018 **M. Bonsma-Fisher**. *Source code management for students using Git and GitHub*, 2018 Association of Computer Studies Educators Conference, Toronto, Canada.
- 2017 **M. Bonsma**. *Are You Open?* Shaking it Up: Making Open Science Work For You, Toronto, Canada. [Panelist]
- 2017 **M. Bonsma**. *Using Personas and Pathways to Build Community*, Mozilla Science Lab Working Open Workshop, Montreal, Canada.
- 2016 A. Collins, **M. Bonsma**. *Sprints and Events*, Mozilla Science Lab Working Open Workshop, Berlin, Germany.

Contributed Talks and Workshops

- 2022 **M. Bonsma-Fisher** and S. Goyal. *Diversity-generating host-disease coevolution with CRISPR adaptive immunity*, 2022 Canadian Association of Physicists Congress, Hamilton, Canada. Received 1st place in Division of Physics in Medicine and Biology.
- 2021 **M. Bonsma-Fisher** and S. Goyal. *Who lives, who dies: Average immunity predicts population outcomes in host-disease coevolution*, Ontario Networking Event in Biophysics.
- 2019 **M. Bonsma-Fisher**. *Introduction to Bash and Git*, iSchool Bachelor of Information Workshop, Toronto, Canada. [Workshop]
- 2018 **M. Bonsma-Fisher**. *Working with data in Python*, iSchool Master of Information Programming Bootcamp, Toronto, Canada. [Workshop]
- 2018 **M. Bonsma-Fisher**, D. Soutière, S. Goyal. *Adaptive immunity constrains the composition and fate of large bacterial populations*, APS March Meeting 2018, Los Angeles, USA.
- 2017 **M. Bonsma-Fisher**, D. Soutière, S. Goyal. *The CRISPR-Cas system: a window into the microbial world*, Physics Summer Colloquium, Toronto, Canada.
- 2017 **M. Bonsma-Fisher**, D. Soutière, S. Goyal. *Modelling the effect of CRISPR on bacteria-virus interactions*, Ontario Networking Event in Biophysics, Mississauga, Canada.
- 2016 **M. Bonsma**. *Hacking CRISPR – Code Sprint*, Mozilla Festival, London, UK. [Workshop]
- 2016 **M. Bonsma**, L. Tran, L. Coome, L. Johnston. *Study Groups - Crossing the Boundaries of Discipline*, Mozilla Festival, London, UK. [Workshop]
- 2016 **M. Bonsma**. *Hands-On GitHub*, AIS Intro to Open Source Workshop, Toronto, Canada. [Workshop]
- 2016 **M. Bonsma-Fisher**, K. Bonsma-Fisher. *Careers in Science*, Smithville Christian High School Career Day, Smithville, ON.
- 2015 **M. Bonsma**, S. Goyal. *Building bacteria-phage interaction networks using the CRISPR locus*, Women in Physics Canada Conference, Toronto, Canada.
- 2014 **M. Bonsma**, E. Carmichael, M. van der Meer. *Ratty Brain Waves: Analyzing Oscillations in the Rat Ventral Striatum*, Biology Senior Honours Colloquium, Waterloo, Canada.
- 2013 L. Vermeyden, **M. Bonsma**, C. Noel, J. M. Donohue, E. Wolfe, K.J. Resch. *Locally-Biased Nonlocality: Experimental violation of three families of Bell inequalities*, Canadian Undergraduate Physics Conference, Hamilton, Canada. Received 3rd place in quantum condensed matter category.
- 2013 **M. Bonsma**, J. V. Romero, J. R. Dahn. *Synthesis of Copper and Manganese Compounds for Gas Adsorption*, DREAMS Research Day, Halifax, Canada.
- 2012 L. Vermeyden, **M. Bonsma**, C. Noel, J. M. Donohue, E. Wolfe, K.J. Resch. *Locally Biased Nonlocality*, IQC Colloquium, Waterloo, Canada.

Poster Sessions

- 2019 **M. Bonsma-Fisher**, S. Goyal. *Signatures of co-evolution in the CRISPR adaptive immune system*, CRISPR 2019, Québec, Canada.
- 2019 **M. Bonsma-Fisher**, S. Goyal. *Signatures of co-evolution in the CRISPR adaptive immune system*, Microbiology and Infectious Disease Research Days 2019, Toronto, Canada.
- 2018 **M. Bonsma-Fisher**, D. Soutière, S. Goyal. *How adaptive immunity constrains the composition and fate of large bacterial populations*, Canadian Society for Ecology and Evolution 2018 Meeting, Guelph, Canada.
- 2018 **M. Bonsma-Fisher** and S. Goyal. *Diversity and survival in the CRISPR adaptive immune system*, Ontario Networking Event in Biophysics, Mississauga, Canada.
- 2017 **M. Bonsma-Fisher**, D. Soutière, S. Goyal. *Modelling the effect of CRISPR on bacteria-virus interactions*, Beg Rohu Summer School, Saint Pierre Quiberon, France.
- 2015 **M. Bonsma**, S. Goyal. *Building bacteria-phage interaction networks using the CRISPR locus*, The Ninth q-bio Conference, Blacksburg, USA.
- 2013 **M. Bonsma**, J. V. Romero, J. R. Dahn. *Synthesis of Copper and Manganese Compounds for Gas Adsorption*, IRM Research Day, Halifax, Canada.

Awards

Highlights

- 2022 **Data Sciences Institute Postdoctoral Fellowship**, *University of Toronto*, Toronto, Canada.
- 2016–2020 **NSERC Vanier Canada Graduate Scholarship**, *University of Toronto*, Toronto, Canada.
- 2016–2017 **NSERC Gilles Brassard Doctoral Prize for Interdisciplinary Research**.
Awarded to an outstanding recipient of an NSERC Vanier Canada Graduate Scholarship who best exemplifies interdisciplinary research.
- 2016–2017 **NSERC Alexander Graham Bell Canada Graduate Scholarship – Doctoral**, *University of Toronto*, Toronto, Canada, [Declined].
- 2017 **Mozilla Network 50**, 50 People Who Made the Internet a Better Place in 2016.
Awarded to 50 Mozilla network members who have done outstanding Internet health work.
- 2015–2016 **Van Kranendonk Teaching Assistant Award**, *University of Toronto*, Toronto, Canada.
Awarded to four physics graduate students annually based on student nominations.

Other Awards

- 2021 **Walter C. Sumner Memorial Fellowship**.
- 2020–2021 **Queen Elizabeth II Graduate Scholarship in Science and Technology**, *University of Toronto*, Toronto, Canada.
- 2015–2016 **NSERC Alexander Graham Bell Canada Graduate Scholarship – Master's**, *University of Toronto*, Toronto, Canada.
- 2015–2016 **Mary H. Beatty Fellowship**, *University of Toronto*, Toronto, Canada.
- 2014–2015 **Ontario Graduate Scholarship**, *University of Toronto*, Toronto, Canada.
- 2014–2015 **University of Toronto Fellowship**, *University of Toronto*, Toronto, Canada.
- 2014–2015 **NSERC Alexander Graham Bell Canada Graduate Scholarship – Master's**, *University of Waterloo*, *University of Ottawa*, *McMaster University*, *Simon Fraser University*, [Declined].
- 2014–2015 **Ontario Graduate Scholarship**, *University of Guelph*, *University of Ottawa*, [Declined].
- 2009–2014 **Queen Elizabeth II Aiming for the Top Scholarship**.
- 2013–2014 **Mike Lazaridis Scholarship in Theoretical Physics**, *University of Waterloo*, Waterloo, Canada, [Declined].
- 2013 **Ian R. Dagg Memorial Scholarship**, *University of Waterloo*, Waterloo, Canada.
- 2013 **DREAMS Summer Research Award**, *Dalhousie University*, Halifax, Canada.
- 2012 **NSERC Undergraduate Student Research Award**, *University of Waterloo*, Waterloo, Canada.
- 2012 **President's Research Award**, *University of Waterloo*, Waterloo, Canada.
- 2009 **President's Scholarship of Distinction**, *University of Waterloo*, Waterloo, Canada.
- 2009 **A. Donald Maynes Entrance Scholarship**, *University of Waterloo*, Waterloo, Canada.
- 2009 **Miller Thomson Foundation Scholarship**.

Teaching & Outreach

- 2021–present **Data Working Group Volunteer**, *Bike Ottawa*.
Analyzed City of Ottawa bike counter data and Strava Metro cycling data for Bike Ottawa's 2020 annual report.
- 2019–2020 **Mentor**, *eLife Innovation Leaders*.
Mentored a community project creator to develop and grow an open science project.
- 2019 **Science Fair Judge**, *UofT Department of Physics Undergraduate Research Fair*, Toronto, Canada.
Evaluated three undergraduate research posters at the annual science fair.
- 2018 **Course Instructor**, *Quantitative Methods in R for Biology*, Department of Ecology and Evolutionary Biology, Toronto, Canada.
Co-designed and co-instructed a third-year course with 26 students, prepared and delivered 2 lectures on theoretical ecology, data analysis, and programming.

- 2018 **NEON Data Education Fellows Faculty Mentoring Network**, *National Ecological Observatory Network and the Quantitative Undergraduate Biology Education and Synthesis project*. Participant in semester-long faculty discussion group on bringing data into the classroom.
- 2018, 2020 **Girls in STEM Club Workshop Leader**. Co-designed an interactive 1.5 hour biophysics workshops for girls in grades 6-8. Delivered workshop to two groups of students per session at two sessions.
- 2018–present **Canada Learning Code Instructor**. Taught introductory Python at two Ladies Learning Code workshops in Toronto.
- 2018–2019 **Special Projects Coordinator**, *UofT Coders*, Toronto, Canada. Organized and facilitated coding workshops at the University of Toronto.
- 2016–present **Software Carpentry Instructor**. Licensed instructor for Software Carpentry. Organized multiple workshops in Toronto, taught Git to researchers at two workshops, taught Python at one workshop, and taught Bash at one workshop.
- 2014–2020 **Mentor**, *Department of Physics, University of Toronto*, Toronto, Canada. Met monthly with an undergraduate student to discuss career plans and graduate school.
- 2015–2018 **President**, *UofT Coders*, Toronto, Canada. Founded and organized cross-disciplinary study group to foster skill sharing, idea generation, and peer support among scientists who code. uoftcoders.github.io
- 2016–2018 **Mentor**, *Mozilla Open Leadership Training Series*. Mentored open science leaders to grow and improve their projects and communities.
- 2017 **Course Instructor**, *Theoretical Ecology and Reproducible Quantitative Methods in R*, Department of Ecology and Evolutionary Biology, Toronto, Canada. Co-designed and co-instructed a fourth-year course, prepared and delivered 5 lectures on theoretical ecology and programming.
- 2014–2017 **Teaching Assistant**, *Department of Physics, University of Toronto*, Toronto, Canada. Tutor for 'Topics in Biological Physics' fourth year course (3 hours/week), lab demonstrator for Girls in STEM workshop (3 hours), lab demonstrator and marker for first year engineering Classical Mechanics course (5.5 hours/week), practicals demonstrator for first year Physics course (3.5 hours/week), tutor for 'The Magic of Physics' first year course (7 hours/week).
- 2016 **Career Day Presenter**, *Smithville Christian High School*, Smithville, Canada. Spoke to groups of high school students about biophysics and life as a graduate student preparing for a career in science.

Service and Committee Membership

- 2023–present **Advisory Board Member**, *Movements and Mobility*.
- 2021–present **Member of the Board of Directors**, *Bike Ottawa*, Ottawa, Ontario.
- Summer 2018 **Physics Graduate Chair Search Committee Member**, Department of Physics, University of Toronto.
- Winter 2018 **Department of Physics Chair Search Committee Member**, Department of Physics, University of Toronto.

News and Interviews

- 2022 **Outspoken Cyclist**. *Interview by Diane Jenks*, Outspoken Cyclist Podcast.
- 2022 **City urged to get wheels in motion for its own bike-sharing program**. *Interview by Giacomo Panico*, CBC.
- 2022 **Bike Talk - Slow Jams**. *Interview by Nick Richert*, Bike Talk Podcast.
- 2022 **Riding an electric cargo bike year-round in Ottawa**. *Interview by Eugenie Waters*, Manor Park Chronicle, March-April 2022, page 17.
- 2019 **Women in STEM: Madeleine Bonsma-Fisher**. *Interview by Javiera Gutierrez Duran*, The Varsity.
- 2018 **Mind the gender gap: Women in STEM**. *Interview by Carmen Wong*, Emerge Magazine.
- 2017 **NSERC recognizes U of T research into self-driving cars and microbial ticking time bombs in our bodies**. *Interview by Sean Bettam*, UofT News.