Thomas Bury

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EDUCATION

2015 – 2019 **PhD, Applied Mathematics**, University of Waterloo, Canada
Thesis: Detecting and distinguishing transitions in ecological systems: model and data-driven approaches.
Advisors: Dr. Chris Bauch, Dr. Madhur Anand

2014 – 2015 **MMATH, Mathematics**, University of Cambridge, UK
Director of studies: Dr. Julia Gog, OBE

2011 – 2014 **BA, Mathematics**, University of Cambridge, UK

PROFESSIONAL APPOINTMENTS

2020 – present **Postdoctoral Researcher**
Department of Physiology
Faculty of Medicine
McGill University, Canada

GRANTS AND FELLOWSHIPS

2023 – 2026 (Collaborator) NWO Vidi grant - To tip, or not to tip, that is the question (800,000 euros)

2022 – 2025 FRQNT postdoctoral research scholarship ($135,000)

2020 – 2022 CAMBAM postdoctoral fellowship, Centre for Applied Mathematics in Bioscience and Medicine, McGill University ($17,000)

AWARDS & HONORS

2024 Post-Graduate Studnets' Society travel award, McGill University ($500)

2023 Centre de recherche en biologie structurale travel award, McGill University ($1,000)

2021 PNAS Cozzarelli Prize for scientific excellence and originality—finalist

2019 Doctoral thesis award, University of Waterloo ($5000)

Combined travel grants, Waterloo Institute for Complexity and Innovation ($2500)

2017 Research dissemination award, GRADTalks, University of Waterloo ($500)

Second place at Fields Thesis Competition, Fields Institute, Toronto ($300)

Finalist at 3-Minute Thesis competition, University of Waterloo ($100) (recording)

PUBLICATIONS

SUBMITTED

2024 A. Osakwe, N. Wightman, M. Deyell, Z. Laksman, A. Shrier, G. Bub, L. Glass and **T. Bury**. Dependence of premature ventricular complexes on heart rate—it's not that simple. *Journal of the American Medical Informatics Association.* (Undergoing peer review).

Z. Ma, C. Zheng, Y. Zhang and **T. Bury**. Learning from the past: predicting critical transitions with machine learning trained on surrogates of historical data. *Communications Physics.* (Undergoing peer review).

PUBLISHED

2024 M. Sadria and **T. Bury**. FateNet: an integration of dynamical systems and deep learning for cell fate prediction. *Bioinformatics*, 40(9), btae525. (manuscript) (code)

2023 **T. Bury**, K. Diagne, D. Olshan, L. Glass, A. Shrier, B. Lerman and G. Bub. The Inverse Problem for Cardiac Arrhythmias. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 33(12). (manuscript) (code)

T. Bury, D. Dylewsky, C. Bauch, M. Anand, L. Glass, A. Shrier and G. Bub. Predicting discrete-time bifurcations with deep learning. *Nature Communications*, 14(1), 6331. (**Editors' highlight**) (manuscript) (code)

T. Bury. ewstools: A Python package for early warning signals of bifurcations in time series data. *Journal of Open Source Software*, 8(82), 5038. (manuscript) (code)

K. Diagne, **T. Bury**, M. Deyell, Z. Laksman, A. Shrier, G. Bub and L. Glass. Rhythms from two competing periodic sources embedded in an excitable medium. *Physical Review Letters*, 130(2), 028401. (**Editors' suggestion**) (manuscript)
- Press: APS Physics, PNAS news, Physics Today

2022 F. Dablander and **T. Bury**. Deep learning for tipping points: Preprocessing matters. *Proceedings of the National Academy of Sciences*, 119(37), e2207720119. (manuscript)

D. Dylewsky, T. Lenton, M. Scheffer, **T. Bury**, C. Fletcher, M. Anand, and C. Bauch. Universal early warning signals of phase transitions in climate systems. *Journal of the Royal Society Interface*, 20(201), 20220562. (manuscript)

2021 **T. Bury**, R. Sujith, I. Pavithran, M. Scheffer, T. Lenton, M. Anand, and C. Bauch. Deep learning for early warning signals of tipping points. *Proceedings of the National Academy of Sciences*, 118(39), e2106140118. (**Cozzarelli finalist**) (manuscript) (code)
- Press: PNAS commentary, The Independent, The Daily Mail

J. Menard, **T. Bury**, C. T. Bauch, and M. Anand. When conflicts get heated, so does the planet: coupled social-climate dynamics under inequality. *Proceedings of the Royal Society B*, 288(1959), 20211357. (manuscript)

2020 **T. Bury**, C. Lerma, G. Bub, Z. Laksman, M. W. Deyell, L. Glass. Long ECGs reveal rich and robust dynamical regimes in patients with frequent ectopy. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 30(11). (manuscript)

T. Bury, C. T. Bauch, M. Anand. Detecting and distinguishing tipping points using spectral early warning signals. *Journal of the Royal Society Interface*, 17(170), 20200482. (manuscript)

2019 **T. Bury**, C. T. Bauch, M. Anand. Charting pathways to climate change mitigation in a coupled socio-climate model. *PLoS Computational Biology*, 15(6), e1007000. (manuscript) (code)
- Press: Globe and Mail, CityNews

D. A. Pananos, **T. Bury**, C. Wang, J. Schonfeld, S. P. Mohanty, B. Nyhan, M. Salathé, C. T. Bauch. Critical dynamics in population vaccinating behavior. *Proceedings of the National Academy of Sciences*, 114(52), 13762-13767. (manuscript)
- Press: CBC, Science Daily

OPEN-SOURCE SOFTWARE

2019 – present **ewstools**
A Python package for computing early warning signals for bifurcations in time series data
- Role: Creator, core developer
- GitHub: ThomasMBury/ewstools, 72 stars

INVITED SEMINARS

2024 Centre de Recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM), Elie Bou Assi lab, Montréal, QC, 6 June

Montreal Institute for Learning Algorithms (MILA), Montréal, QC, 31 May

IFMSA-Quebec Global Health Symposium, Montréal, QC, 24 May

Waterloo Institute for Complexity and Innovation (WICI), Waterloo, ON, 2 May (recording)

2023 Youreka Canada Symposium, Keynote speaker, Montréal, QC, 28 April

2020 Centre de Recherches Mathématiques (CRM), Université de Montréal, 11 May (recording)

Dept. of Applied Mathematics, University of Ottawa, 26 November

CONFERENCE PRESENTATIONS

2024 SIAM Conference on Mathematics of Data Science, Atlanta, GA, 21-25 October - upcoming (**mini-symposium organiser**)

SIAM Annual Meeting, Spokane, WA, 8-12 July (**invited, mini-symposium**)

2023 Workshop: Challenges of predicting critical transitions in natural systems, Exeter University, UK, 7-8 December (**invited plenary**)

SIAM Conference on Applications of Dynamical Systems, Portland OR, 14-18 May (**invited, mini-symposium**)

2021 Dynamics Days Europe, Virtual, 23-27 August

Society for Mathematical Biology Annual Meeting, Virtual, 13-17 June

2020 Workshop on Critical Transitions in Complex Systems, Shanghai Institute for Biological Sciences, Virtual, 29-31 July (**invited**)

2019 Society for Mathematical Biology Annual Meeting, Montréal, Canada, 22-26 July (poster)

Canadian Society of Applied and Industrial Mathematics Annual Meeting, Whistler, Canada, 9-13 June

2018 Ecological Society of America, Annual Meeting, New Orleans, U.S. 5-10 August

Dynamics Days US, Denver, U.S. 4-6 January

2017 TEDx UofT, Toronto, Canada, 13 September (recording)

Applied Mathematics, Modeling and Computational Science, International Conference, Waterloo, Canada, 20-25 August

Mathematical Models in Ecology and Evolution, Conference, London, UK, 10-12 July

WICI Interdisciplinary Conference on Resilience in Complex Natural and Human Systems, Waterloo, Canada, 16-17 May

DEPARTMENTAL TALKS

2024 Centre de Recherche en Biologie Structurale Seminar Series, McGill University, 22 March

2021 Department of Physiology Seminar Series, McGill University, 22 January

2020 Seminar Series in Quantitative Life Sciences and Medicine, McGill University, 22 September

TEACHING

GRADUATE

2021 – 2022 **Instructor**, *McGill University*
QLSC 600D1: Foundations of Quantitative Life Sciences. Module: Resetting and entraining of biological rhythms, 15-20 students (Fall 2021, Fall 2022)

2017 – 2018 **Teaching Assistant**, *University of Waterloo*
AMATH 777: Stochastic Processes in the Physical Sciences (Winter 2017, Winter 2018)
MATH 650: Mathematical Modeling with Differential Equations (Fall 2017)

UNDERGRADUATE

2024 **Guest Lecturer**, *McGill University*
BIOL 309: Mathematical Models in Biology, 80 students (Fall 2024)

2018 **Instructor**, *University of Waterloo*
MATH 127: Calculus I for the Sciences, 110 students (Fall 2018)

2015 – 2018 **Teaching Assistant**, *University of Waterloo*
AMATH 353: Partial Differential Equations (Winter 2018)
AMATH 350: Differential Equations for Business and Economics (Winter 2017)
AMATH 250: Introduction to Differential Equations (Winter 2016)
MATH 116: Calculus I (Fall 2015, Summer 2016, Fall 2016)

SUMMER SCHOOLS AND WORKSHOPS

2021 **Technical lead**, Summer School in Nonlinear Dynamics for the Life Sciences, McGill University (virtual), 31 May - 11 June

2020 **Workshop creator and facilitator**, Interactive Data Visualisation in Python, McGill University (virtual), 27 July (GitHub)

2018 **Workshop co-creator and co-facilitator**, A Hands-on Introduction to Mathematical Modelling, Waterloo Institute for Complexity and Innovation, 26 April

CREDENTIALS

2017 – 2019 Certificate of University Teaching, *University of Waterloo*

2015 – 2016 Fundamentals of University Teaching, *University of Waterloo*

STUDENT SUPERVISION

DOCTORATE

2019 – present Khady Diagne (co-supervisor)
McGill University
Project: Spatio-temporal dynamics of pure parasystole in cardiac tissue

UNDERGRADUATE

2020 – 2021 Alix Vanpoperinghe (supervisor)
McGill University
Project: Simulation of cardiac monolayers under optogenetic control

2020 – 2021 Glisant Plasa (co-supervisor)
McGill University
Project: Reinforcement learning for discovery of reentry mechanisms in cardiac tissue

ACADEMIC SERVICE

PROFESSIONAL

2024 EDIA Champions Merit Review Committee, *Digital Research Alliance of Canada*

	Organiser of mini-symposium "Early warning signals in medicine", *SIAM Conference on Mathematics of Data Science*
2021 – present	Evaluation committee member for the 2021, 2022 and 2023 Tri-Agency Canada Graduate Scholarship-Master's competition, *McGill University*
2017 – 2018	Math graduate student representative, Senate Graduate and Research Council, *University of Waterloo*

OUTREACH

Ongoing	Interviews with *The Scientific American*, *The Waterloo Region Record*, *The McGill Tribune* and *The Charlatan*
Ongoing	Technical author for Towards Data Science, Medium publication
2024	Career panelist at the McGill Quantitative Life Sciences Research Day
2023	Lecture to CEGEP students at Youreka Canada. "Data science: practice and principles". Montréal, Canada
	Poster judge for the Faculty of Medicine and Health Sciences Student Research Day. *McGill University*, Montréal, Canada
2022 – 2023	Poster judge for the Quantitative Life Sciences Research Day in 2022 and 2023. *McGill University*, Montréal, Canada
2022	Lecture to high school students at Kelly College. "Mathematics beyond school: university, careers and life". Devon, UK
2016 – 2018	Workshop facilitator at primary school visits. *Let's Talk Science*, Waterloo, Canada
2017	TEDx speaker. *University of Toronto*, Toronto, Canada
	Volunteer at Physics Lab Day for Grade 11-12. *University of Waterloo*, Waterloo, Canada
	Science fair judge for Grade 8 projects. *Centennial Public School*, Waterloo, Canada

REVIEWER

Nature, Nature Communications, Nature Climate Change, Proceedings of the National Academy of Sciences (PNAS), Physical Review X, Ecology Letters, Proceedings of the Royal Society A/B, Journal of the Royal Society Interface, Royal Society Open Science, npj Systems Biology and Applications, Wiley: Ecology and Evolution, Wiley: Methods in Ecology and Evolution, Chaos: An Interdisciplinary Journal of Nonlinear Science, Physica D: Nonlinear Phenomena, Ecological Economics, Climatic Change, PLOS One

LANGUAGES

English	Native
French	Proficient : TEFaQ Level C1 obtained in 2020