Thomas M. 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.
GPA: 96.4%
Advisors: Dr. Chris Bauch, Dr. Madhur Anand

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

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

PROFESSIONAL APPOINTMENTS

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

FELLOWSHIPS

2021 – 2022 CAMBAM postdoctoral fellowship, Centre for Applied Mathematics in Bioscience and Medicine, McGill University ($10,000)

2020 – 2021 CAMBAM postdoctoral fellowship, Centre for Applied Mathematics in Bioscience and Medicine, McGill University ($7,000)

AWARDS & HONORS

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

2019 Combined travel grants, Waterloo Institute for Complexity and Innovation ($2500)

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

2017 Second place at Fields Thesis Competition, Fields Institute, Toronto ($300)

2017 Finalist at 3-Minute Thesis competition, University of Waterloo ($100)
- Recording: youtube.com/watch?v=UQ1nW9PNil8

PUBLICATIONS

PAPERS

2021

T. M. 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*. doi:10.1073/pnas.2106140118.

- Code: ThomasMBury/deep-early-warnings-pnas

J. Menard, **T. M. 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*. doi:10.1098/rspb.2021.1357.

- Code: HerdOfBears/Sociodynamics

2020

T. M. 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*. doi:10.1063/5.0023987.

T. M. Bury, C. T. Bauch, M. Anand. Detecting and distinguishing tipping points using spectral early warning signals. *Journal of the Royal Society Interface*. doi:10.1098/rsif.2020.0482.

- Code: ThomasMBury/ewstools

2019

T. M. Bury, C. T. Bauch, M. Anand. Charting pathways to climate change mitigation in a coupled socio-climate model. *PLoS computational biology*. doi:10.1371/journal.pcbi.1007000.

- Code: ThomasMBury/socio_climate_model

D. A. Pananos, **T. M. 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* doi:10.1073/pnas.1704093114.

OPEN-SOURCE SOFTWARE

2019 – present

ewstools

A Python package for computing early warning signals for bifurcations in time series data. doi:10.5281/zenodo.3497512

- Role: Creator, core developer
- Code: ThomasMBury/ewstools

PRESENTATIONS

2021

T. M. Bury, R. Sujith, I. Pavithran, M. Scheffer, T. Lenton, M. Anand, and C. Bauch. Deep learning for early warning signals of bifurcations. *Dynamics Days Europe*, Virtual.

- Slides: doi.org/10.6084/m9.figshare.16892431.v1

T. M. Bury, C. Lerma, G. Bub, Z. Laksman, M. W. Deyell, L. Glass. Long ECGs reveal rich and robust dynamical regimes in patients with frequent PVCs. *Society for Mathematical Biology Annual Meeting*, Virtual.

- Slides: doi.org/10.6084/m9.figshare.16892593.v1

T. M. Bury, C. Lerma, G. Bub, Z. Laksman, M. W. Deyell, L. Glass. Patterns of premature ventricular complexes in the human heart. *Department of Physiology Seminar Series, McGill University*, Virtual.
- **Invited talk**

2020 **T. M. Bury**, C. T. Bauch, M. Anand. Detecting and distinguishing bifurcations from noisy time series data. *Applied Mathematics Seminar, Centre de Recherches Mathématiques*, Virtual.
- **Invited talk**
- Recording: youtube.com/watch?v=QGs2knhnXDM
- Slides: doi.org/10.6084/m9.figshare.16892632.v1

T. M. Bury. Bifurcations in the era of big data: Applications to cardiology and ecology. *Applied Mathematics Seminar Series, University of Ottawa*, Virtual.
- **Invited talk**

T. M. Bury. Bifurcations in the era of big data: Applications to cardiology and ecology. *Seminar Series in Quantitative Life Sciences and Medicine, University of McGill*, Virtual.
- **Invited talk**

T. M. Bury, M. Anand, C. T. Bauch. Fold or Flip? Distinguishing bifurcations in advance with spectral early warning signals. *Workshop on Critical Transitions in Complex Systems, Shanghai Institutes for Biological Sciences*, Virtual.
- **Invited talk**
- Recording: drive.google.com/file/d/1kp2G6q-Eu-H13JpVgUCcbezF_rZzKjJ3
- Slides: doi.org/10.6084/m9.figshare.16892644.v1

2019 **T. M. Bury**, C. T. Bauch, M. Anand. Spectral early warning signals improve tipping point detection and description. *Society for Mathematical Biology Annual Meeting*, Montréal, Canada.
- Poster: doi.org/10.6084/m9.figshare.16892395.v2

T. M. Bury, C. T. Bauch, M. Anand. Spectral early warning signals improve tipping point detection and description. *Canadian Society of Applied and Industrial Mathematics, Annual Meeting 2019*, Whistler, Canada.
- Slides: doi.org/10.6084/m9.figshare.16892662.v1

2018 **T. M. Bury**, M. Anand, C. T. Bauch. Early warning indicators of ecological tipping points. Do they predict critical transitions, or something else? *Ecological Society of America, Annual Meeting*, New Orleans, U.S.
- **Invited talk**

T. M. Bury, M. Anand, C. T. Bauch. Characterizing impending transitions in complex systems. *Dynamics Days US 2018*, Denver, U.S.

2017 **T. M. Bury**. The mathematics of tipping points. *TEDx, University of Toronto*, Toronto, Canada.
- **Invited talk**
- Recording: youtube.com/watch?v=pfm7OqBVA6I

T. M. Bury, M. Anand, C. T. Bauch. Anticipating Critical Transitions in Socio-Ecological Systems *Applied Mathematics, Modeling and Computational Science, International Conference*, Waterloo, Canada.

T. M. Bury, M. Anand, C. T. Bauch. Regime Shifts in Socio-Ecological Systems *Mathematical Models in Ecology and Evolution, Conference*, London, UK.

T. M. Bury, M. Anand, C. T. Bauch. Regime Shifts in Socio-Ecological Systems *Waterloo Institute for Complexity and Innovation, Interdisciplinary Conference on Resilience in Complex Natural and Human Systems*, Waterloo, Canada.

MEDIA COVERAGE (SELECTED)

My research has been broadcast by over 40 different national and international news outlets.

2021 The Independent
- independent.co.uk/climate-change/news/

2021 The Daily Mail
- dailymail.co.uk/sciencetech/

2019 Canadian Broadcasting Corporation
- cbc.ca/news/canada/

2019 The Indian Express
- indianexpress.com/article/

TEACHING

GRADUATE

2021 **Instructor**, *McGill University*
Foundations of Quantitative Life Sciences, (Fall 2021)

2017 – 2018 **Teaching Assistant and Guest Lecturer**, *University of Waterloo*
Stochastic Processes in the Physical Sciences, (Winter 2017, Winter 2018)

2017 **Teaching Assistant**, *University of Waterloo*
Mathematical Modeling with Differential Equations, (Fall 2017)

UNDERGRADUATE

2018 **Instructor**, *University of Waterloo*
Calculus I for the Sciences, (Fall 2018)

2018 **Teaching Assistant**, *University of Waterloo*
Partial Differential Equations I (Winter 2018)

2016 **Teaching Assistant**, *University of Waterloo*
Introduction to Differential Equations, (Winter 2016)

2015 – 2016 **Teaching Assistant**, *University of Waterloo*
Various calculus courses for math and engineering students
(Fall 2015, Summer 2016, Fall 2016)

CREDENTIALS

2017 – 2019 Certificate of University Teaching, *University of Waterloo*
An in-depth, selective, 2-year teaching course for PhD students. Includes multiple teaching observations, guided self-reflection and improvement, workshops and a pedagogical research project.

2015 – 2016 Fundamentals of University Teaching, *University of Waterloo*
Includes weekly workshops on teaching fundamentals including active learning, equitable teaching, and effective delivery.

STUDENT SUPERVISION

PhD

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

UNDERGRADUATE

2020 – 2021 Alix Vanpoperinghe (advisor)
McGill University
Project: Simulation of cardiac monolayers under optogenetic control
- Code: alixvanpo/opto-project

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

ACADEMIC SERVICE

COMMITTEES

2021 CGSM evaluation committee member, *McGill University*
Served as an evaluator for the 2021-2022 Canada Graduate Scholarship-Master's competition.

2017 – 2018 Senate Graduate and Research Council, *University of Waterloo*
Served as the math grad student representative for matters of academic quality and research activity within the university.

SUMMER SCHOOLS AND WORKSHOPS

2021 Summer School in Nonlinear Dynamics for the Life Sciences (online)
CAMBAM and NSERC-CREATE, McGill University
Technical lead for 2-week, international summer school with 50 participants and 24 instructors.

2020 Interactive Data Visualisation in Python (online)
CAMBAM-CRM, McGill University
Designed and implemented 5-hour workshop with 60 participants including students and faculty.
- Code: ThomasMBury/workshop_datavis_python

2018 A Hands-on Introduction to Mathematical Modelling
Waterloo Institute for Complexity and Innovation: Leveraging systems approaches to improve human and planetary health
Co-designed and implemented 4-hour workshop.

OUTREACH

2021 Interviews with newspapers and magazines including *The Scientific American*, *The Waterloo Region Record*, *The McGill Tribune* and *The Charlatan*.

2016 – 2018 Workshop facilitator at primary school visits. *Let's Talk Science*, Waterloo, Canada.

2017 TEDx speaker. *University of Toronto*, Toronto, Canada.

GRADTalks speaker and panelist *University of Waterloo*, Waterloo, 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

- Physics Review X
- Ecology Letters
- Proceedings of the Royal Society A
- Proceedings of the Royal Society B
- Journal of the Royal Society Interface
- Chaos
- Ecological Economics
- Climatic Change
- PLOS One

LANGUAGES

English Native

French TEFaQ Level C1 (proficiency) obtained in 2020.