

# Thomas M. Bury

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Department of Physiology  
Faculty of Medicine  
McGill University  
Montréal, QC  
H3A 0G4 Canada

Last updated: February, 2022  
ORCID: [0000-0003-1595-9444](https://orcid.org/0000-0003-1595-9444)  
Email: [thomas.bury@mcgill.ca](mailto:thomas.bury@mcgill.ca)  
Website: [thomas-bury.research.mcgill.ca](http://thomas-bury.research.mcgill.ca)  
Google Scholar: [scholar.google.ca](https://scholar.google.ca)

## 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    **BA, 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](https://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](https://doi.org/10.1073/pnas.2106140118).  
 • Code:  [ThomasMBury/deep-early-warnings-pnas](https://github.com/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](https://doi.org/10.1098/rspb.2021.1357).  
 • Code:  [HerdOfBears/Sociodynamics](https://github.com/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](https://doi.org/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](https://doi.org/10.1098/rsif.2020.0482).  
 • Code:  [ThomasMBury/ewstools](https://github.com/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](https://doi.org/10.1371/journal.pcbi.1007000).  
 • Code:  [ThomasMBury/socio\\_climate\\_model](https://github.com/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](https://doi.org/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](https://doi.org/10.5281/zenodo.3497512)  
 • Role: Creator, core developer  
 • Code:  [ThomasMBury/ewstools](https://github.com/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](https://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](https://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](https://youtube.com/watch?v=QGs2knhnXDM)

- Slides:  [doi.org/10.6084/m9.figshare.16892632.v1](https://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](https://drive.google.com/file/d/1kp2G6q-Eu-H13JpVgUCcbezF_rZzKjJ3)

- Slides:  [doi.org/10.6084/m9.figshare.16892644.v1](https://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](https://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](https://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](https://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.

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| 2021 | The Independent <ul style="list-style-type: none"> <li>•  <a href="https://independent.co.uk/climate-change/news/">independent.co.uk/climate-change/news/</a></li> </ul> |
| 2021 | The Daily Mail <ul style="list-style-type: none"> <li>•  <a href="https://dailymail.co.uk/sciencetech/">dailymail.co.uk/sciencetech/</a></li> </ul>                      |
| 2019 | Canadian Broadcasting Corporation <ul style="list-style-type: none"> <li>•  <a href="https://cbc.ca/news/canada/">cbc.ca/news/canada/</a></li> </ul>                     |
| 2019 | The Indian Express <ul style="list-style-type: none"> <li>•  <a href="https://indianexpress.com/article/">indianexpress.com/article/</a></li> </ul>                      |

## TEACHING

### GRADUATE

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|-------------|---|
| 2021        | <b>Instructor</b> , <i>McGill University</i><br>Foundations of Quantitative Life Sciences, (Fall 2021)  |
| 2017 – 2018 | <b>Teaching Assistant and Guest Lecturer</b> , <i>University of Waterloo</i><br>Stochastic Processes in the Physical Sciences, (Winter 2017, Winter 2018) |
| 2017        | <b>Teaching Assistant</b> , <i>University of Waterloo</i><br>Mathematical Modeling with Differential Equations, (Fall 2017)                               |

### UNDERGRADUATE

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|-------------|--|
| 2018        | <b>Instructor</b> , <i>University of Waterloo</i><br>Calculus I for the Sciences, (Fall 2018)  |
| 2018        | <b>Teaching Assistant</b> , <i>University of Waterloo</i><br>Partial Differential Equations I (Winter 2018)  |
| 2016        | <b>Teaching Assistant</b> , <i>University of Waterloo</i><br>Introduction to Differential Equations, (Winter 2016)   |
| 2015 – 2016 | <b>Teaching Assistant</b> , <i>University of Waterloo</i><br>Various calculus courses for math and engineering students<br>(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](https://github.com/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 – 2022      CGSM evaluation committee member, *McGill University*  
Served as an evaluator for the 2021 and 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](https://github.com/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

- 2020 – present 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.