Tyler Cassidy

Lecturer in Mathematical Biology
University of Leeds.

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Interests: Mathematical physiology/immunology, treatment resistance, dynamical systems, delay differential equations, structured population models

Education

Ph.D. Mathematics and Statistics 2015-2019
McGill University, Montréal, Canada
B.Sc. (Honors) Applied Mathematics, First Class Honors 2011-2015
University of Alberta, Edmonton, Canada

Academic Positions

Lecturer (Assistant Professor) in Mathematical Biology 2022-Present
University of Leeds
Leeds, United Kingdom
Senior Scientist 2021-2022
Pfizer Inc: Oncology Research Unit
Boulder, Colorado, United States of America
Postdoctoral Research Associate 2019-2021
Theoretical Biology and Biophysics
Los Alamos National Laboratory, Los Alamos, New Mexico, United States of America
Junior Fellowship 2018
Institut Mittag-Leffler
Djursholm, Sweden

Publications

1. **Cassidy, T.**, Gillich*, P., Humphries, A.R., and van Dorp, C.H., Numerical methods and hypoexponential approximations for Gamma distributed delay differential equations, *To appear*,The IMA Journal of Applied Mathematics, arXiv: 2104.03873
2. Sanche, S., **Cassidy, T.**, Chu, P., Perelson, A.S., Ribeiro, R.M., and Ke, R., A simple model of COVID-19 explains disease severity and the effect of treatments, *Scientific Reports*, 12, 14210 (2022), DOI: 10.1038/s41598-022-18244-2
3. Stephenson, K.E., Julg, B., Tan, C.S., Zash, R., Walsh, S.R., Rolle, C-P., Monczor, A.N., Lupo, S., Gelderblom, H.C., Ansel, J.L., Kanhilal, D.G., Maxfield, L.F., Nkolola, J., Borducchi, E.N., Abbink, P., Liu, J., Peter, L., Chandrashekar, A., Nityanandam, R., Lin, Z., Setaro, A., Sapiente, J., Chen, Z., Sunner, L., **Cassidy, T.**, Bennett, C., Sato, A., Mayer, B., Perelson, A.S., deCamp, A., Priddy, F.H., Wagh, K., Giorgi, E.E., Yates, N.L., Arduino, R.C., DeJesus, E., Tomaras, G.D., Seaman, M.S., Korber, B., and Barouch, D.H., Safety, pharmacokinetics, and antiviral activity of PGT121, a broadly neutralizing monoclonal antibody against HIV-1: a randomized, placebo-controlled, phase 1 clinical trial, *Nature Medicine*, 27, 1718–1724 (2021), DOI: 10.1038/s41591-021-01509-0.
4. **Cassidy, T.**, Nichol, D., Robertson-Tessi, M., Craig, M., and Anderson, A.R.A., The role of memory in non-genetic inheritance and its impact on cancer treatment resistance, *PLOS Computational Biology*, 17(8), 2021, e1009348, DOI: 10.1371/journal.pcbi.1009348
5. Ismail, S.D., Riou, C., Joseph, S.B., Archin, N.M., Margolis, D.M., Perelson, A.S., **Cassidy, T.**, Abrahams, M-R., Moeser, M., Council, O.D., McKinnon, L.R., Osman, F., Karim, Q.A., Abdool Karim, S.S., Swanstrom, R., Williamson, C., Garrett, N.J., Burgers, W.A., Immunological correlates of the HIV-1 replication-competent reservoir size, *Clinical Infectious Diseases*, 73, 8 (2021), 1528–1531, https://doi.org/10.1093/cid/ciab587.
6. **Cassidy, T.**, Distributed Delay Differential Equation Representations of Cyclic Differential Equations, *SIAM Journal on Applied Mathematics*, 81(4), 1742–1766, DOI: doi.org/10.1137/20M1351606

7. Jenner, A.L., **Cassidy, T.**, Belaid*, K., Bourgeois-Daigneault, M.C., and Craig, M., In silico trials predict that combination strategies for enhancing vesicular stomatisis oncolytic virus are determined by tumour aggressivity, *Journal for ImmunoTherapy of Cancer* (2021), 9:e001387. doi: 10.1136/jitc-2020-001387
8. **Cassidy, T.**, Humphries, A.R., Craig, M., and Mackey, M.C., Characterizing chemotherapy-induced neutropenia and monocytopenia through mathematical modelling, *Bulletin of Mathematical Biology* 82, 104, (2020), DOI: 10.1007/s11538-020-00777-0
9. **Cassidy, T.** and Craig, M., Determinants of combination GM-CSF immunotherapy and oncolytic virotherapy success identified through in silico treatment personalization, *PLOS Computational Biology*, 15(11), 2020,: e1007495, DOI: 10.1371/journal.pcbi.1007495
10. **Cassidy, T.** and Humphries, A.R., A Mathematical Model Of Viral Oncology As An Immuno-Oncology Instigator, *Mathematical Medicine and Biology: A Journal of the IMA*, 37(1):117-151, (2020), DOI:10.1093/imammb/dqz008.
11. **Cassidy, T.**, Craig, M. and Humphries, A.R., Equivalences Between Age Structured Models and State Dependent Distributed Delay Differential Equations, *Mathematical Biosciences and Engineering*, (2019), 16(5): 5419-5450. DOI: 10.3934/mbe.2019270
12. De Souza, D.C, Craig, M., **Cassidy, T.**, Li, J., Nekka, F., Bélair, J. and Humphries, A.R., Transit and lifespan in neutrophil production: implications for drug intervention, *Journal of Pharmacokinetics and Pharmacodynamics*, (2018) 45: 59. DOI: 10.1007/s10928-017-9560-y
13. **Cassidy, T.**, Gaudreau, P. and Safouhi, H. On the Computation of Eigenvalues of the Anharmonic Coulombic Potential. *Journal of Mathematical Chemistry*, (2018) 56: 477. https://doi.org/10.1007/s10910-017-0801-5

In preparation: available upon request

A **Cassidy, T.**, Wagh, K., and Perelson, A.S., Competitive release drives development of resistance to the HIV-1 broadly neutralizing antibody PGT-121

Awards and Fellowships

NSERC Postdoctoral fellowship: ranked 3rd in Mathematical Sciences Committee — 2022-2024
Wolfson Center for Mathematical Biology, University of Oxford
Government of Canada, 90 000$
Deferred due to COVID-19 Pandemic

Institut Mittag-Leffler Junior Fellowship — 2018
Institut Mittag-Leffler

NSERC Postgraduate Scholarships: Doctoral Award — 2018-2021
Government of Canada, 63 000$

FRQNT Doctoral Scholarship: Declined — 2018-2022
Government of Quebec, 77 000$

Lorne Trottier Science Accelerator Fellowship — 2018- 2019
McGill University, 5000$

Murata Family Fellowship — 2018- 2019
McGill University, 3300$

Sir James Lougheed Award of Distinction — 2015, 2017
Government of Alberta, 15 000$ (M.Sc), 20 000$ (Ph.D)

Graduate Student Fellowship — 2016, 2017
Center for Applied Mathematics in Biology and Medicine, 12 500$

Applied Mathematics Fellowship — 2015, 2016
Centre de Recherches Mathématiques, 10 000$

Graduate Excellence Fellowship — 2015, 2016
McGill University, total 10 366$

NSERC Undergraduate Student Research Award — 2014, 2015
Government of Canada, total 9 000 $

*Undergraduate student

Best Poster Awards
Workshop on Mathematical Ecology: Modeling Structured Populations, Kingston, Ontario, (2019)
McGill Physiology Research Day, Montreal, Quebec, (2018)

Mathematics and Statistics Teaching Assistant Award 2017, 2018
McGill University

Teaching and Mentoring

Graduate Summer Research: Pfizer, Inc.
Rachel Sousa: Development of resistance in the MAPK pathway
Undergraduate Honours Research Project: Senior Thesis at McGill University
Jean Chillet: Characteristic Roots of Gamma Distributed Delay Differential Equations (Fall 2018-Winter 2019)
Peter Gillich: Numerical Methods for Gamma Distributed Delay Differential Equations (Fall 2019)

Undergraduate Summer Research
Peter Gillich: Numerical Methods for Gamma Distributed Delay Differential Equations (NSERC USRA 2019)
Katia Belaid: Optimizing Combination Oncolytic Virus Therapies

Teaching Assistant 2016-2018
McGill University
Montréal, Quebec, Canada
MATH 141: Calculus II (2017, 2018) [Departmental Teaching Assistant Award, 2017 and 2018]
MATH 122: Calculus for Management (2016)

Teaching Assistant 2013-2015
University of Alberta
Edmonton, Alberta, Canada
STATQ 151: Applied Statistics (2013)
MATHQ 100: Beginner Calculus I (2013)
MATHQ 101: Beginner Calculus II (2014, 2015)
MATHQ 102: Applied Linear Algebra (2013, 2014, 2015)
MATHQ 113: Introductory Calculus I (2013, 2014)

Invited Talks

Pfizer Excellence: Scientific Seminar Series April 2022
Oncology Research Department, Pfizer Inc., La Jolla, CA, USA
Quantitative systems pharmacology virtual population simulations to examine efficacy of SHP2i + lorlatinib inhibition for ALK+ NSCLC

Quantitative Biosciences and Engineering Seminar April 2022
Colorado School of Mines, Golden, Colorado, USA
Early warning signals to avoid chemotherapy induced neutropenia

Symposium Annuel en Mathématiques pour un Avenir en Recherche et en Industrie March 2022
Montréal, Quebec, Canada
Mathématiques en Médicine et Industrie

Mathematical Medicine Seminar January 2022
Creighton University, Omaha, Nebraska, USA
Understanding and avoiding resistance to anti-cancer therapies

Computational Modelling of Cancer Biology and Treatments July 2021
Centre de recherches mathématiques, Montréal, Quebec, Canada
Modelling intra- and inter- patient heterogeneity: Structured equations and virtual clinical trials

FURSCA Seminar June 2021
Albion College, Albion, Michigan, USA
Avoiding failure of targeted anti-cancer therapies

Early Clinical Development Seminar May 2021
Pfizer, Inc., Virtual
Quantitative approaches to treatment personalization and optimization

SIAM/CAIMS Joint Annual Meeting July 2020
Toronto, Ontario, Canada
Session: Delay equations for structured dynamics: theory, numerics and applications
Insights from phenotype and age structured equations to avoid chemotherapeutic drug resistance

Laboratory of Industrial and Applied Mathematics Seminar May 2020
York University, Toronto, Ontario, Canada
Using Structured Equations to Control Tumour Evolution and Avoid Chemotherapeutic Resistance

Université de Montréal Student Seminar October 2019
Montréal, Quebec, Canada
Structured Equations and Cancer Therapies

Society for Mathematical Biology July 2019
Montréal, Quebec, Canada
Session: Quantitative approaches to unravel immune function and immunity
Innate Immune System Regulation in Health and Disease

Canadian Applied and Industrial Mathematics Society June 2019
Whistler, British Colombia, Canada
Session: Quantitative Systems Pharmacology
The Linear Chain Trick in Modelling Drug Effects on Neutrophil Response
ISM Travel Award

Systems Immunology Seminar March 2019
Helmholtz Center for Infection Research, Braunschweig, Germany
Modelling and Optimizing Immune Support of Cancer Virotherapy

Quantitative Systems Pharmacology in Early Clinical Development Seminar February 2019
Pfizer Inc., Boston, Massachusetts, USA
Understanding and Exploiting Immune Support of Cancer Virotherapy

Integrated Mathematical Oncology Seminar February 2019
Moffitt Cancer Center, Tampa, Florida, USA
Understanding and Optimizing Cancer Virotherapy

Séminaire de biologie quantitative et computationnelle January 2019
Université de Montréal, Montreal, Quebec, Canada
Understanding and Optimizing Cancer Virotherapy

Centre for Mathematical Medicine and Biology Seminar November 2018
University of Nottingham, Nottingham, United Kingdom
Modelling Viral Therapy and Immune Recruitment

Center for Applied Mathematics in Biology and Medicine Seminar January 2017
McGill University, Montreal, Quebec, Canada
Mathematical Modelling of Cyclic Neutropenia

Society of Industrial and Applied Mathematics Life Sciences Meeting July 2016
Boston, Massachusetts, USA
Session: Better Medicine Through Mathematics
Treating and Avoiding Hematological Disease: Better Medicine Through Mathematics?

Contributed Talks

Theoretical Biology and Biophysics Seminar June 2021
Los Alamos National Laboratory, Los Alamos, New Mexico, USA
Numerical methods and hypoexponential approximations for gamma distributed delay differential equations

Theoretical Biology and Biophysics Seminar September 2020
Los Alamos National Laboratory, Los Alamos, New Mexico, USA
Transit compartmental representations of functional differential equations

Theoretical Biology and Biophysics Seminar February 2020
Los Alamos National Laboratory, Los Alamos, New Mexico, USA
Insights from phenotype and age structured equations to avoid chemotherapeutic drug resistance

Canadian Applied and Industrial Mathematics Society June 2019
Whistler, British Colombia, Canada

Session: Ecology and Evolution
Bet-hedging and the Development of Resistance

Society of Industrial and Applied Mathematics Dynamical Systems Meeting May 2019
Snowbird, Utah, USA
Session: Delay Differential Equations
A Recipe for State Dependent Distributed Delay Differential Equations
SIAM Travel Award

10th Swedish Meeting on Mathematics in Biology November 2018
Stockholm, Sweden
A Mathematical Model of Viral Oncology

Society of Industrial and Applied Mathematics Life Sciences Meeting August 2018
Minneapolis, Minnesota, USA
Session: Immunotherapy
A Mathematical Model of Viruses as Instigators of Cancer Immunotherapy
SIAM Travel Award

6th G. J. Butler Memorial Conference July 2018
Edmonton, Alberta, Canada
Session: Mathematical Biology
A Mathematical Model of Viral Oncology

Canadian Applied and Industrial Mathematics Society June 2018
Toronto, Ontario, Canada
Session: Mathematics of Disease and Ecology
A Mathematical Model of Oncolytic Viruses

Biomath 2018 May 2018
University of Ottawa, Ottawa, Ontario, Canada
Can Viruses Fight Cancer for Us?

Graduate Student Seminar January 2018
McGill University, Montreal, Quebec, Canada
To Infinity and Back-Delays in Mathematics

Pacific Institute of Mathematics and Statistics Young Researchers Conference June 2016
Edmonton, Alberta, Canada
Mathematical Modelling of Cyclical Neutropenia

Pacific Institute of Mathematics and Statistics Young Researchers Conference May 2015
Calgary, Alberta, Canada
The Use of the DECSM to Produce Numerical Solutions of the Schrödinger equation

Poster Presentations

Cancer Adaptive Therapy Models December 2020
Virtual meeting
Applying population dynamics perspectives to avoid phenotypic drug resistance

Workshop on Mathematical Ecology: Modeling Structured Populations June 2019
Kingston, Ontario, Canada
Does Heterogeneity in Infection Duration Matter?
Fields Institute Travel Award
Winner of Student Poster Award

McGill Physiology Research Day May 2018
Montréal, Quebec, Canada
Can Viruses Fight Cancer for Us?
Winner of Student Poster Award

Montreal Immunology Meeting November 2017
Montréal, Quebec, Canada
Quantitative Systems Biology Model of Myelopoiesis

Society of Industrial and Applied Mathematics Life Sciences Meeting July 2016
Boston, Massachusetts, USA
Mathematical Modelling Based Hypothesis for the Origins of Cyclical Neutropenia

McGill Physiology Research Day May 2016
Montréal, Quebec, Canada
Mathematical Modelling of Cyclical Neutropenia

Professional Service

Workshop Organizer
Problems and solutions in lifting individual behaviour to population level dynamics
CRM-CAMBAM Workshop in Mathematical Biology 2020

Session Organizer
2. *Numerical methods for population models in biology*
SCICADE 2022

1. *Quantitative approaches to unravel immune function and immunity*
Society for Mathematical Biology Annual Meeting 2019

Reviewer
PLOS Computational Biology, Mathematical Medicine and Biology, ImmunoInformatics, Journal of Biological Dynamics, Physical Review E, Frontiers in Oncology, Applied Mathematics and Computation, PLOS One, Computers and Mathematics with Applications, Mathematical Biosciences and Engineering, Chaos: An Interdisciplinary Journal of Nonlinear Science, Journal of Mathematical Biology, Progress in Biophysics and Molecular Biology, International Journal for Numerical Methods in Biomedical Engineering

CAMBAM Student Seminar 2016-2018
Organizer of a Montréal wide weekly mathematical biology student seminar
Montréal, Quebec, Canada