Cole Zmurchok

Physics and Astronomy Department
Vanderbilt University
PMB 401807
2301 Vanderbilt Place
Nashville, TN 37235

cole.zmurchok@vanderbilt.edu
https://zmurchok.github.io
+1 (615) 668-6629

Employment

2018 NSERC Postdoctoral Research Fellow, Department of Physics and Astronomy, Vanderbilt University

Education

2018 Ph.D. Mathematics, The University of British Columbia (UBC)

2014 M.Sc. Applied Mathematics, University of Alberta (U of A)

2012 B.Sc. Honors Mathematics, University of Alberta

Publications

Refereed Journal Articles (*indicates equal contributing or co-corresponding authors)

7. T. L. Stepien*, C. Zmurchok*, J. B. Hengenius, R. M. C. Rivera, M. R. D'Orsogna, and A. E. Lindsay. Moth mating: modeling female pheromone calling and male navigational strategies to optimize reproductive success. *Applied Sciences*, 10(18):6543, 2020. https://doi.org/10.3390/app10186543

6. C. Zmurchok*, J. Collette*, V. Rajagopal, and W. R. Holmes. Membrane tension can enhance adaptation to maintain polarity of migrating cells. *Biophysical Journal*, 2020. https://doi.org/10.1016/j.bpj.2020.08.035

5. C. Zmurchok and W. R. Holmes. Simple Rho GTPase dynamics generate a complex regulatory landscape associated with cell shape. *Biophysical Journal*, 118(6):1438–1454, 2020. https://doi.org/10.1016/j.bpj.2020.01.035

4. C. Zmurchok and G. de Vries. Direction-dependent interaction rules enrich pattern formation in an individual-based model of collective behavior. *PLOS ONE*, 13(6):e0198550, 2018. https://doi.org/10.1371/journal.pone.0198550

3. C. Zmurchok, D. Bhaskar, and L. Edelstein-Keshet. Coupling mechanical tension and GTPase signaling to generate cell and tissue dynamics. *Physical Biology*, 15(4):046004, 2018. https://doi.org/10.1088/1478-3975/aab1c0

2. C. Zmurchok, T. Small, M. J. Ward, and L. Edelstein-Keshet. Application of quasi-steady-state methods to nonlinear models of intracellular transport by molecular motors. *Bulletin of*

Mathematical Biology, 79(9):1923–1978, 2017. https://doi.org/10.1007/s11538-017-0314-1

1. H. Knutsdottir, C. Zmurchok, D. Bhaskar, E. Palsson, D. Dalle Nogare, A. B. Chitnis, and L. Edelstein-Keshet. Polarization and migration in the zebrafish posterior lateral line system. *PLOS Computational Biology*, 13(4):e1005451, 2017. https://doi.org/10.1371/journal.pcbi.1005451

Awards

2017 Killam Graduate Teaching Assistant Award, UBC

2017 Graduate Research Award, Applied Mathematics, Department of Mathematics, UBC

2016 Best Poster Prize, European Conference for Mathematical and Theoretical Biology/Society for Mathematical Biology Joint Conference

2013 Leonard E. Gads Teaching Assistant Award, U of A

Grants and Fellowships

2020 AMS-Simons Travel Grant, American Mathematical Society and Simons Foundation

2019 Landahl Travel Grant, Society for Mathematical Biology

2018 NSERC (Natural Sciences and Engineering Research Council of Canada) Postdoctoral Fellowship Award held at Vanderbilt University, 2018–2020

Invited Talks

2019 Colloquium, Department of Mathematics, University of Tennessee Knoxville, "Mathematical modeling of cellular organization: regulatory signaling, cell mechanics, and collective cell behavior," November 8

2018 SIAM Conference on the Life Sciences, "Modelling the interplay between cell signalling and cell mechanics," August 6–9

2018 PIMS-UBC Math Distinguished Colloquium, "Graduate Research Award: Multi-Scale Modelling in Cellular Systems," March 16

2017 SIAM Pacific Northwest Regional Conference, "Application of quasi-steady-state methods to nonlinear models of intracellular transport by molecular motors," October 27–29

2017 Annual Meeting of the Canadian Society of Applied and Industrial Mathematics, "Application of quasi-steady-state methods to nonlinear models of intracellular transport by molecular motors," July 17–21

2017 SIAM Conference on Applications of Dynamical Systems, "Modelling the interplay between cell signalling and cell mechanics," May 21–25

2016 BIRS Workshop: Modeling and Quantifying Cell Function: 25 years of Cell Mechanobiology, "Modelling the interplay between cell signalling and cell mechanics," October 9–14

Conference Activity

Contributed Talks

2020 Society for Mathematical Biology Annual Meeting (online), "Mechanosensing can enhance adaptation to maintain polarity of migrating cells," August 17

2019 Society for Mathematical Biology Annual Meeting at the Université de Montréal, "Modeling cell shape diversity arising from complex Rho GTPase dynamics," July 21–26

2014 PIMS Young Researchers Conference at UBC, "Direction-dependent communication in an individual-based model of collective behaviour," June 2–4

2014 Alberta Mathematics Dialouge, "Direction-dependent communication in an individual-based model of collective behaviour," May 1–2

2013 PIMS Young Researchers Conference at U of A, "Direction-dependent communication in an individual-based model of collective behaviour," May 21–24

Poster Presentations

2017 Frontiers in Biophysics, "A model for Rho GTPase dynamics in epithelial monolayers" jointly presented with Dhananjay Bhaskar, June 16

2016 European Conference for Mathematical and Theoretical Biology/Society for Mathematical Biology Joint Conference, "Modelling the polarization, migration, and neuromast deposition in the zebrafish posterior lateral line system," July 11–15

2016 Seminaire de Mathematiques Superieures: Dynamics of Biological Systems Summer School Poster Session, "Modelling the polarization, migration, and neuromast deposition in the zebrafish posterior lateral line system," May 30–June 11

Workshops Attended

2020 Systems Modelling in the Pharmaceutical Industry (online), Fields Institute, July 16.

2019 Intersectional Perspectives in STEM, Vanderbilt University, Aug 30

2019 Computational Approaches to Study Cancer Heterogeneity Workshop, Vanderbilt University, August 21–22

2018 BIRS Workshop: Mathematics of the Cell: Mechanical and Chemical Signaling Across Scales, August 12–17

2018 AMS Mathematics Research Communities: Agent-based Modeling in Biological and Social Systems, June 17–23

2017 PIMS Changing the Culture, SFU-Vancouver at Harbour Centre, May 19

2013 PIMS IGTC Mathematical Biology Summer School, The Mathematics Behind Biological Invasions, U of A, May 27–June 14

2012 PIMS IGTC Mathematical Biology Annual Summit, October 12–14

Institutional and Departmental Talks

2019 Vanderbilt University Quantitative Systems Biology Center-Mathematics Seminar, "The interplay between cell signalling and cell mechanics," February 1

2017 UBC Math Biology Seminar, Various Presentations, 5 presentations between 2014–2017

Teaching

Instructor

Differential Calculus with Physical Applications, 90 students, UBC, September–December 2017

Integral Calculus with Applications to the Physical Sciences, 27 students (Team-teaching model: I taught two small active-learning-based classes and a faculty member taught one large lecture-based class per week), UBC, January–April 2017

Differential Calculus with Applications to the Life Sciences, 128 students, UBC, September–December 2016

Integral Calculus with Applications to the Life Sciences, 75 students, UBC, January–April 2015

Facilitator

Graduate Student Instructor Support Group (term-long community of practice, weekly meetings), Mathematics Department, UBC, September–December 2017

3-day Instructional Skills Workshop, Centre for Teaching, Learning, and Technology (3 workshops) and Mathematics Department (2 workshops), 2017–2018

Teaching Assistant Training (for new graduate students), Mathematics Department, UBC, September 2016 and 2017

Teaching Assistant

Mathematics Tutor (weekly drop-in sessions and additional sessions as needed), Indigenous Student Initiative, UBC, Sep 2017–Apr 2018

Mathematics Department, UBC, 2014–2018

Department of Mathematics and Statistical Sciences, U of A, 2012–2014

Teaching Accreditation

Peer Review of Teaching Workshop, Centre for Teaching, Learning, and Technology, UBC, 2017

Teaching Assistant Accreditation Program, Mathematics Department, UBC, 2017

Facilitator Development Workshop, Centre for Teaching, Learning, and Technology, UBC, 2017

Instructional Skills Workshop, UBC, 2015

Math 599: Mathematics Teaching Techniques Course, UBC, 2014

Graduate Teaching and Learning Program, Level 1, U of A, 2012

Research Supervision

Undergraduate Student Supervision

Justin Cruz, Ryan Konno, and Zachary Pellegrin (group project), "Using the cellular Potts model to simulate cell behaviours," UBC Undergraduate Research Opportunities, 2017

Jim Shaw, "Bifurcation analysis of a mechanochemical model to generate cell dynamics," UBC Engineering Physics, 2017

Rachel Chan, "Pattern formation in the zebrafish lateral line primoridum," UBC Engineering Physics, 2017

MoHan Zhang, "Simulating mechanical tension and GTPase signaling in vertex-based models of cells," UBC Computing Science, 2017

Tim Small, "Application of quasi-steady-state methods to nonlinear models of intracellular transport by molecular motors," UBC Engineering Physics, publication in 2017, 2015–2016

Service

Outreach

Future Science Leaders Fellow (science, mathematics, and Python programming outreach), Science World, Vancouver, British Columbia, 2015–2017

Outreach Volunteer (various events: GAME in the Schools, Math Fair & Unfair, summer camp with the Ermineskin Cree Nation), U of A, 2012–2014

Content Developer for Web-based Instructional Modules for the Teaching and Learning of Modern Applications of Mathematics (with Gerda de Vries), http://www.math.ualberta.ca/~devries/crystal/, U of A, 2009–2011

Departmental and University Service

Postdoctoral Representative, Interim Chancellor's Diversity Council, Vanderbilt University, 2019–2020

Senior Co-Chair, Vanderbilt Postdoctoral Association Executive Committee, Vanderbilt University, 2019–2020

Adjudication Committee Member, Faculty of Science Killam Graduate Teaching Assistant Awards, UBC, 2018

Student Committee Member, Institute of Applied Mathematics, UBC, 2014–2017

Secretary and Webmaster, Graduates at Alberta Mathematics Etc. (GAME) Student Committee, Mathematics Department, U of A, 2013–2014

Service to Community

Co-organizer, Vanderbilt Postdoctoral Association Symposium, Vanderbilt University, April 23, 2020 (cancelled)

Special Session Co-organizer, AMS Special Session on Agent-based Modeling in Biological and Social Systems (a Mathematics Research Communities Session), Joint Mathematics Meetings, January 16–19, 2019

Co-organizer, Frontiers in Biophysics Conference at UBC, June 16, 2017

Co-organizer, PIMS Young Researchers Conference at U of A, May 21–24, 2013

Reviewer for: Biophysical Journal, PLOS Computational Biology, Journal of Theoretical Biology, Bulletin of Mathematical Biology, Physical Biology, Molecular Biology of the Cell, Molecular Informatics, Applied Mathematics and Computation, Heliyon, Cells, Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences

Professional Memberships/Affiations

Society for Mathematical Biology

Society for Industrial and Applied Mathematics

National Postdoctoral Association