

# Curriculum Vitae

Jay Newby

Associate Professor  
Faculty of Science  
Mathematical & Statistical Sciences  
University of Alberta  
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## EDUCATION

- ▶ PhD in Mathematics · University of Utah · 2010 (Advisor: Paul Bressloff)
- ▶ BS in Mathematics · University of Utah · 2006

## CURRENT POSITION

Assistant Professor (Tenure Track) · University of Alberta · July 2018 - present

## PREVIOUS POSITIONS

- ▶ Research Assistant Professor · University of North Carolina at Chapel Hill · September 2017 - July 2018
- ▶ Postdoctoral Fellow · University of North Carolina at Chapel Hill · September 2015 - August 2017 (Advisor: Greg Forest)
- ▶ Postdoctoral Fellow · Ohio State University · September 2012 - August 2015 (Advisor: None)
- ▶ Postdoctoral Fellow · University of Oxford · October 2010 - August 2012 (Advisor: Paul Bressloff)

## MENTORSHIP

### *Undergraduate Students:*

- ▶ Alex Harrison (UAlberta) · summer student 2022
- ▶ Max Hirsch (Carnegie Mellon) · 2019 - 2022
- ▶ Nat Kendal-Freedman (UAlberta) · summer USRA student - 2021 (currently a graduate student at Waterloo)
- ▶ Rebekah Hall (UAlberta) · Math 499 student - 2021 (currently a graduate student at SFU)

- ▶ Dasha Ivanova (UAlberta) · summer USRA student - 2020 (graduating soon)
- ▶ Keshav Bhavesh (UNC) · 2017-2018 (currently a graduate student at U. of Utah)
- ▶ Shengtan Mao (UNC) · 2017-2019 (currently a graduate student at Columbia)
- ▶ Ian Seim (UNC) · 2015-2017 (recently graduated (PhD), UNC Biology)

*Graduate Students:*

- ▶ Liane Solomon (UAlberta) · Primary advisor 2019 - present
- ▶ Grace McLaughlin (UNC, Biology) · Co-advisor 2017 - present
- ▶ Karl Deusher (UAlberta) · Co-advisor 2018-2022 (graduated MSc spring 2022)

*Postdoctoral Researchers:*

- ▶ Ilhem Bouderbala (UAlberta) · Primary advisor 2022 - present
- ▶ Yonatan Ashenafi (UAlberta) · Primary advisor 2021 - present
- ▶ Carlos Contreras (UAlberta) · Co-advisor 2020 - 2022 (currently employed at ATB Financial)
- ▶ Kelsey Gasior (UNC, Florida State) · Co-advisor 2016 - 2020 (currently holds tenure track position at U. Ottawa)
- ▶ Feifei Xu (UNC) · Co-advisor 2015 - 2017 (currently employed at Google)

## HONORS AND AWARDS

- ▶ UAlberta Outstanding Mentorship in Undergraduate Research · 2022
- ▶ NSERC Discovery Accelerator Supplement · 2019 - 2025
- ▶ Isaac Newton Institute Visiting Fellow · 2016
- ▶ MBI-NSF Postdoctoral Fellowship · 2012-2015
- ▶ Oxford (OCCAM) Postdoctoral Fellowship · 2010-2012
- ▶ Oxford (OCCAM) Visiting Studentship · 2009
- ▶ IGERT-NSF Graduate Fellowship · 2006-2009

## SERVICE

- ▶ Associate Editor · SIAM Journal on Applied Mathematics · 2022 - present

## SIGNIFICANT CONTRIBUTIONS TO TEACHING

- ▶ Designed a new graduate course on data science and computational statistics. UAlberta MATH 509 · Fall 2021

## ENTREPRENEURSHIP

Co-founder of AI-Tracking Solutions · 2017  
High performance, machine learning based particle tracking in the cloud  
[aitracker.net](http://aitracker.net)

## PATENTS

1. Methods, systems, and computer readable media for using synthetically trained deep neural networks for automated tracking of particles in diverse video microscopy data sets JM Newby, MG Forest, and SKB Lai · US Patent Number 10664978, 2020
2. Optimized Crosslinkers for Trapping a Target on a Substrate S Lai, G Forest, C Henry, T Wessler, A Chen, J Schiller, and JM Newby · US Patent App. 15/977,432, 2018

## MANUSCRIPTS IN PREPARATION

1. L. Solomon and J.M. Newby. *Quantifying heterogeneity of Salmonella motion using model-embedding and expectation maximization on particle tracking data*. In Preparation. 2022
2. Y. Ashenafi, and G. J. Jedd, J.M. Newby *Multiscale modeling and Bayesian object tracking analysis of raphid diatom motion*. In Preparation. 2022
3. J.M Newby and J. Maclauren. *Asymptotic analysis of rare event first passage times for many random walkers*. In preparation 2022

## PEER-REVIEWED PUBLICATIONS

1. C. Contreras, J.M. Newby, T. Hillen. *Personalize virus load curves for acute viral infections*. *Viruses*. 13 (9), 2021
2. H. Yu, S. Lu, K. Gasior, D. Singh, O. Tapia, S. Vazquez-Sanchez, D. Toprani, M. Beccari, J. Yates, S. Da Cruz, J. Newby, M. Larfaga, A. Gladfelter, E. Villa, and D. Cleveland. *HSP70 chaperones RNA-free TDP-43 into anisotropic intranuclear liquid spherical shells*. (Preprint) *Science* 371 (6529), 2021
3. Y. Ling, M. Lysy, I. Seim, J. Newby, D. Hill, J. Cribb, and M.G. Forest. *Measurement Error Correction in Particle Tracking Microrheology*. [preprint](#) *Ann. Appl. Stat.* (in press), 2020
4. K. Gasior, M.G. Forest, A. Gladfelter, and J. Newby. *Modeling the Mechanisms by Which Coexisting Biomolecular RNA-Protein Condensates Form*. *Bull. Math. Biol.* 82 (12), 2020

5. G. McLaughlin, E. Langdon, J. Crutchley, L. Holt, M.G. Forest, J. Newby, and A. Gladfelter. *Spatial heterogeneity of the cytosol revealed by machine learning-based 3D particle tracking*. *Mol. Biol. Cell* 31 (14), 1437-1549, 2020
6. H. Schroeder, J. Newby, A. Schaefer, B. Subramani, A. Tubbs, M.G. Forest, E. Miao, and S.K. Lai. *LPS-binding IgG arrests actively motile Salmonella Typhimurium in gastrointestinal mucus*. *Mucosal Immunol.*, 1-10, 2020
7. Feifei Xu, Jay M Newby, Jennifer L Schiller, Holly A Schroeder, Timothy Wessler, Alex Chen, M Gregory Forest, and Samuel K Lai. *Modeling barrier properties of intestinal mucus reinforced with IgG and secretory IgA against motile bacteria*. *ACS Infect. Dis.* 5 (9), 1570-1580, 2020
8. K. Patel, S. Mao, M.G. Forest, S.K. Lai, and J. Newby. *Limited processivity of single motors improves overall transport flux of self-assembled motor-cargo complexes*. *Phys. Rev. E* 100 (2): 022408, 2019
9. K. Liu, B. Chu, J. Newby, E. Read, J. Lowengrub, and J. Allard. *Hydrodynamics of transient cell-cell contact: The role of membrane permeability and active protrusion length*. *PLoS Comput. Biol.* 15 (4), e1006352, 2019
10. J.T. Huckaby, C. Parker, T. Jacobs, A. Schaefer, D. Wadsworth, A. Nguyen, A. Wang, J. Newby, and S.K. Lai. *Engineering polymer-binding bispecific antibodies for enhanced pretargeted delivery of nanoparticles to mucus-covered epithelium*. *Angew.* 131 (17), 5660-5664, 2019
11. K. Gasiior, J. Zhao, G. McLaughlin, M.G. Forest, A. Gladfelter, J. Newby. *Partial demixing of RNA-protein complexes leads to intra-droplet patterning in phase-separated biological condensates*. *Phys. Rev. E*, 99 (1): 012411, 2019
12. J. Newby, A. Schaefer, P. Lee, M. G. Forest, and S. Lai. *Convolutional neural networks automate detection for tracking of submicron scale particles in 2D and 3D*. *PNAS*, 115:36, 2018
13. A. Khan, J. Newby, and A. Gladfelter. *Control of septin filament flexibility and bundling by subunit composition and nucleotide interactions*. *Mol. Biol. Cell*, 29:6, 2018
14. J. Newby, I. Seim, M. Lysy, Y. Ling, J. Huckaby, S. K Lai, and M. G. Forest. *Technological strategies to estimate and control diffusive passage times through the mucus barrier in mucosal drug delivery*. *Adv. Drug Deliv. Rev.* 124, 64-81, 2018
15. J. Newby, J. Schiller, T. Wessler, M. G. Forest, and S. Lai. *A blueprint for fast dynamic crosslinking of mobile species in biogels with weak molecular anchors*. *Nat. Commun.*, 8:833, 2017
16. L. Miao, J. Newby, M. Lin, Z. Lu, F. Xu, W. Kim, M. G. Forest, S. Lai, M. Milowsky, S. Wobker, and L. Huang. *The Binding Site Barrier Elicited by Tumor Associated Fibroblasts Interferes Disposition of Nanoparticles in Stroma-Vessel Type Tumors*. *ACS Nano.*, 10 (10), pp 9243-9258, 2016
17. J. Newby and J. Allard. *First-passage time to clear the way for receptor-ligand binding in a crowded environment*. *Phys. Rev. Lett.*, 116:128101, 2016

18. S. Isaacson, A. Mauro, and J. Newby. *Uniform asymptotic approximation of diffusion to a small target: generalized reaction models*. [Phys. Rev. E](#), 2016
19. M. Schwemmer and J. Newby. *Metastable switching in a planar limit cycle system with additive noise*. [Physica D](#), 317, pp 15-27, 2016
20. J. Newby. *Bistable switching asymptotics for the self regulating gene*. [J. Phys. A](#), 2015
21. J. Newby. *Spontaneous excitability in the Morris–Lecar model with ion channel noise*. [SIAM J. Appl. Dyn. Syst.](#), 13:4, pp 1756-1791, 2014
22. J. Newby and M. Schwemmer. *Effects of moderate noise on a limit cycle oscillator: Counterrotation and bistability*. [Phys. Rev. Lett.](#), 112:114101, 2014
23. J. Newby, P. C. Bressloff, and J. P. Keener. *Breakdown of fast-slow analysis in an excitable system with channel noise*. [Phys. Rev. Lett.](#), 111:128121, 2013
24. J. Newby and J. Chapman. *Metastable behavior in Markov processes with internal states*. [J. Math. Biol.](#), 2013
25. S. Isaacson and J. Newby. *Uniform asymptotic approximation of the first passage time density for diffusion to a small spherical trap within a bounded domain*. [Phys. Rev. E](#), 88:012820, 2013
26. P. C. Bressloff and J. Newby. *Stochastic models of intracellular transport*. [Rev. Mod. Phys.](#), 85:135-196, 2013
27. P. C. Bressloff and J. Newby. *Metastability in a stochastic neural network modeled as a velocity jump Markov process*. [SIAM J. Appl. Dyn. Syst.](#), 12:1394-1435, 2013
28. P. C. Bressloff and J. Newby. *Stochastic hybrid model of spontaneous dendritic NMDA spikes*. [Physical Biol.](#), 11:-16006, 2013
29. J. Newby. *Isolating intrinsic noise sources in a stochastic genetic switch*. [Physical Biol.](#), 9:026002, 2012
30. P. C. Bressloff and J. Newby. *Filling of a Poisson trap by a population of random intermittent searchers*. [Phys. Rev. E](#), 85:031909, 2012
31. L. Y. Ming, J. Newby, and P. C. Bressloff. *Effects of demographic noise on the synchronization of a metapopulation in a fluctuating environment*. [Phys. Rev. Lett.](#), 107:118102, 2011
32. J. P. Keener and J. Newby. *Perturbation analysis of spontaneous action potential initiation by stochastic ion channels*. [Phys. Rev. E](#), 84:011918, 2011
33. J. Newby and J. P. Keener. *An asymptotic analysis of the spatially-inhomogeneous velocity-jump process*. [Multiscale Model. Simul.](#), 9:735-765, 2011
34. P. C. Bressloff and J. Newby. *Quasi-steady state analysis of two-dimensional random intermittent search processes*. [Phys. Rev. E](#), 83:061139, 2011
35. J. Newby and P. C. Bressloff. *Local synaptic signalling enhances the stochastic transport of motor-driven cargo in neurons*. [Phys. Biol.](#), 7:036004, 2010

36. J. Newby and P. C. Bressloff. *Random intermittent search and the Tug-of-war model of motor-driven transport.* *J. Stat. Mech.*, 4:04014, 2010
37. J. Newby and P. C. Bressloff. *Quasi-steady state reduction of molecular motor-based models of directed intermittent search.* *Bull. Math. Biol.*, 72:1840-1866, 2010
38. J. Newby and P. C. Bressloff. *Directed intermittent search for a hidden target on a dendritic tree.* *Phys. Rev. E*, 80(2):021913, 2009

#### INVITED TALKS (PAST 5 YEARS)

- |                                                                                                                             |                   |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------|
| ▶ <i>Fields Institute: Workshop on Advances in Mathematical Ecology</i><br>Toronto, Canada                                  | 6 December 2022   |
| ▶ <i>2022 Clifford Lectures Conference</i><br>New Orleans, USA                                                              | 17 November 2022  |
| ▶ <i>SIAM: Life Sciences (minisymposium talk)</i><br>Pittsburgh, USA                                                        | 11 July 2022      |
| ▶ <i>Western Canada Math Biology Workshop</i><br>Kelowna, Canada                                                            | 15 May 2022       |
| ▶ <i>Arizona State stochastic modeling seminar</i><br>Online due to COVID-19                                                | 3 March 2022      |
| ▶ <i>UC Riverside math biology seminar</i><br>Online due to COVID-19                                                        | 8 February 2022   |
| ▶ <i>University of Alberta Math &amp; Stats dept. colloquium</i><br>Online due to COVID-19                                  | 13 January 2022   |
| ▶ <i>Banff International Research Station Workshop: Mathematics of the Cell</i><br>Banff, Canada                            | 17 October 2021   |
| ▶ <i>Penn. State Math Biology Seminar</i><br>Online due to COVID-19                                                         | 29 September 2021 |
| ▶ <i>Statistical Society of Canada Probability Workshop</i><br>Online due to COVID-19                                       | 13 June 2021      |
| ▶ <i>SIAM: Dynamical Systems (minisymposium talk)</i><br>Online due to COVID-19                                             | 23 May 2021       |
| ▶ <i>PIMS Workshop on Localized Patterns:<br/>in Celebration of Michael Ward's 60(+) Birthday</i><br>Online due to COVID-19 | 10 May 2021       |
| ▶ <i>U. of Ottawa Applied Math Seminar</i><br>Online due to COVID-19                                                        | 17 September 2020 |

- ▶ *The Society for Industrial and Applied Mathematics and The Canadian Applied and Industrial Mathematics Society Joint Annual Meeting (minisymposium talk)* 13 July 2020  
Online due to COVID-19
- ▶ *Mathematical Biosciences Institute Workshop: Mathematical and Computational Methods in Biology* 5 May 2020  
Online due to COVID-19
- ▶ *Southeast Center for Mathematics and Biology Workshop: Particle Tracking Techniques and Live Cell Imaging* 7 February 2020  
New Orleans, USA
- ▶ *Banff International Research Station Workshop: Advances in Theoretical and Experimental Methods for Analyzing Complex Regulatory Networks* 16 February 2020  
Banff, Canada
- ▶ *Seventh International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems* 12 Oct 2019  
Tempe, USA
- ▶ *Society for Math Biology Annual Conference (minisymposium talk)* 25 July 2019  
Montreal, Canada
- ▶ *The International Congress on Industrial and Applied Mathematics (minisymposium talk)* 17 July 2019  
Valencia, Spain
- ▶ *Society for Industrial and Applied Mathematics (SIAM) Dynamical Systems (minisymposium talk)* 21 May 2019  
Salt Lake City, USA
- ▶ *14th International Conference on Mathematical and Numerical Aspects of Wave Propagation (minisymposium talk)* 17 April 2019  
Athens, USA
- ▶ *The Southeast Center for Mathematics and Biology Workshop: Quantitative Methods in Understanding Cellular Transport* 8 February 2019  
New Orleans, USA
- ▶ *McGill Physiology Seminar* 12 October 2018  
Montreal, Canada
- ▶ *Yale Statistics & Data Science Colloquium* 12 February 2018  
New Haven, USA
- ▶ *U. of Alberta Mathematics Colloquium* 5 February 2018  
Edmonton, Canada

- ▶ *U. of British Columbia Mathematics Colloquium*  
Vancouver, Canada
1 February 2018
- ▶ *Stochastic Perturbations of Dynamical Systems:  
A conference in honor of Alexander Wentzell and his work*  
New Orleans, USA
5 October 2017
- ▶ *Harvard Widely Applied Math Seminar*  
Cambridge, USA
21 September 2017
- ▶ *Arizona State Statistics Seminar*  
Phoenix, USA
10 February 2017

## EVENT ORGANIZATION

- ▶ *Banff International Research Station Workshop: Mathematics of the Cell:  
Integrating Signaling, Transport and Mechanics*  
**Co-organizer**  
Banff, Canada
17 October, 2021
- ▶ *Statistical Society of Canada Probability Workshop 2021*  
**Speaker-organizer**
13 June, 2021
- ▶ *Mathematical Biosciences Institute Workshop  
Axonal transport and neuronal mechanics*  
**Co-organizer**  
Columbus, USA
3 November 2014
- ▶ *Mathematical Biosciences Institute Workshop for young  
researchers in mathematical biology*  
**Co-organizer**  
Columbus, USA
25 August 2014

## CURRENT GRANT AWARDS

### 1. *Dissecting animal morphogenesis as active liquid crystals*

**Primary Investigator:** Kenji Sugioka (UBC) and Jay Newby (University of Alberta)  
**Co-Investigators:** Eric Cytrynbaum (UBC)  
**Collaborator:** James Feng (UBC)  
**Project Location:** University of Alberta and University of British Columbia  
**Source of Support:** New Frontiers in Research Fund (CIHR, NSERC, and SSHRC)  
**Total Award Amount:** \$250,000  
**Total Award Period:** 24 months  
**Start Date:** 2020

2. *Automated particle tracking and stochastic modeling of molecular motion in submicron living systems*

**Primary Investigator:** Jay Newby  
**Project Location:** University of Alberta  
**Source of Support:** NSERC  
**Supplemental Awards:** Discovery Accelerator Supplement and Discovery Launch Supplement  
**Total Award Amount:** \$337,500  
**Total Award Period:** 5 years  
**Start Date:** 2019

## PAST FUNDING

1. *Collaborative Research: Computational Modeling of How Living Cells Utilize Liquid-Liquid Phase Separation to Organize Chemical Compartments*

**Primary Investigator:** Greg Forest  
**Co-Investigators:** Jay Newby and Kelsey Gaisor  
**Project Location:** University of North Carolina at Chapel Hill  
**Source of Support:** NSF-DMS  
**Total Award Amount:** \$555,886  
**Total Award Period:** 36 months  
**Start Date:** 2018

2. *Collaborative Research: Spatial stochastic rare events by asymptotics and weighted ensemble sampling to understand how cells make space*

**Primary Investigator:** Jay Newby (UNC) and Elizabeth Read (UCI)  
**Co-Investigators:** Jun Allard  
**Project Location:** University of North Carolina at Chapel Hill  
University of California-Irvine  
**Source of Support:** NSF-DMS  
**Total Award Amount:** \$369,293  
**Total Award Period:** 36 months  
**Start Date:** 2017

3. *An integrated neural network analysis and video microscopy platform for fully automated particle tracking*

**Primary Investigator:** Sam Lai  
**Co-Investigators:** Richard Superfine and Jay Newby  
**Project Location:** University of North Carolina at Chapel Hill  
**Source of Support:** NIH: STTR  
**Total Award Amount:** \$224,894  
**Total Award Period:** 12 months  
**Start Date:** 2018

4. *Artificial neural networks for high performance, fully automated particle tracking analysis even at low signal-to-noise regimes*

**Primary Investigator:** Sam Lai  
**Co-Investigators:** Greg Forest and Jay Newby  
**Project Location:** University of North Carolina at Chapel Hill  
**Source of Support:** NIH: STTR  
**Total Award Amount:** \$210,278  
**Total Award Period:** 12 months  
**Start Date:** 2017