Curriculum Vitae

Jun Allard

CONTACT INFORMATION

Department of Mathematics
University of California, Irvine
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EMPLOYMENT

University of California, Irvine, Irvine, CA, United States

Department of Mathematics,
Department of Physics and Astronomy,
Center for Complex Biological Systems

Associate Professor (2017-present)
Assistant Professor (2013-2017)

University of California, Davis, Davis, CA, United States

Post-doctoral fellow (2011-2013)

- Research area: cytoskeletal dynamics, cell motility
- Advisor: Alex Mogilner (Mathematics, Neurobiology, Physiology and Behaviour)

EDUCATION

University of British Columbia, Vancouver, BC, Canada

Ph.D. Applied Mathematics (2011)
Institute of Applied Mathematics

- Thesis Title: Mathematics and biophysics of cortical microtubules in plants
- Advisors: Eric Cytrynbaum (Mathematics), Geoffrey Wasteneys (Botany), Leah Keshet (Mathematics)

Dalhousie University, Halifax, NS, Canada

M.Sc. Physics (2007)
Department of Physics and Atmospheric Science

- Thesis Title: Models of the actin-like MreB helix in prokaryotes
- Advisor: Andrew Rutenberg

Queen's University, Kingston, ON, Canada

B.Sc. Mathematical Physics (2005)
Department of Mathematics and Statistics and Department of Physics

- Thesis Title: Simulations of supernovae-driven outflows from stellar associations
- Advisor: Rob Thacker

FUNDING

- NSF DMS-2052668 Survival probability approaches and scalable algorithms to elucidate molecular-tether reactions in immunoreception and cell mechanics
- NSF CBET-1929565 Tailoring multivalent nanoparticle adhesion for efficient and superselective targeting of cells (PI: Jered Haun, Co-PI: Jun Allard)

- NSF DMS-1763272: Center for Multiscale Cell Fate Research (PI: Qing Nie, Co-PIs: Jun Allard, Xing Dai, Arthur Lander, John Lowengrub)
- NSF DMS-1715455: Spatial stochastic rare events by asymptotics and weighted ensemble sampling to understand how cells make space (PI: Elizabeth Read, Co-PI: Jun Allard, Co-PI: Jay Newby)
- NIH R01-GM123068: Control of cargo distributions by microtubule motor physical interactions with cargo, cytoplasm and MAPs
- NSF CAREER DMS-1454739: Mathematical framework for elucidating mechanics at immune cell interfaces

Submitted Works

42. Corrette, J., Li, J., Shao, H., Veerasubramanian, P., Spakowitz, A., Downing, T.L. *, Allard, J. *, Nucleosome placement and polymer mechanics explain genomic contacts on 100kbp scales. *Co-corresponding. Submitted 2024

Publications

41. Reddy, B., Allipeta, N., Allard, J., Gross, S., A new method to experimentally quantify dynamics of initial protein-protein interactions. Communications Biology 7:311 (2024)
40. Liang, G., Yin, H., Allard, J., Ding, F., Cost-efficient boundary-free surface patterning achieves high effective-throughput of time-lapse microscopy experiments. PLoS One,17(10):e0275804 (2022)
39. Park, S.†, Kim, H.†, Want, Y., Eom, D.-S.*, Allard, J.*, Zebrafish airinemes optimize between ballistic and diffusive search. eLife (2022). †Equal contribution, *Co-corresponding
38. Taylor, R., Allard, J., Read., E., Simulation of receptor triggering by kinetic segregation shows role of oligomers and close-contacts. Biophys J 121, 1-15 (2022),
37. Goyette, J., Depoil, D., Yang, Z., Isaacson, S., Allard, J., van der Merwe, A., Gaus, K., Dustin, M.L., Dushek, O., Dephosphorylation accelerates the dissociation of ZAP70 from the T cell receptor. Proc Natl Acad Sci USA, 119 (9) e2116815119 (2022)
36. Clemens, L., Kutuzov, M., Goyette, J., Allard, J., Dushek, O., Determination of the molecular reach of the tyrosine phosphatase SHP-1. Biophys J, 120(1) 2054-2066 (2021).
35. Bovyn, M., Gross, S., Allard, J., Diffusion of kinesin motors on cargo can enhance binding and run lengths during intracellular transport. Molecular Biology of the Cell 32(9) (2021).
34. Clemens, L., Dushek, O., Allard, J. Intrinsic disorder in the T cell receptor creates cooperativity and controls ZAP70 binding. Biophys J, 120(2) 379-392 (2021)
33. Paoletti F., El-Sagheer A., Allard, J., Brown T., Dushek O., Esashi F., Molecular flexibility of DNA as a major determinant of RAD51 recruitment. EMBO J 39:e103002 (2020).
32. Zhang Y., Clemens, L., Goyette, J., Allard, J., Dushek, O., Isaacson, S.A., The influence of molecular reach and diffusivity on the efficacy of membrane-confined reactions. Biophys J 117(7) 1189-1201 (2019).

31. Allard, J., Doumic, M., Mogilner, A., Oelz, D., Bidirectional sliding of two parallel microtubules generated by multiple identical motors. J Math Biol 79(2):571-594 (2019).

30. Liu, K., Chu, B, Newby, J., Read, E., Lowengrub, J., Allard, J., Hydrodynamics of transient cell-cell contact: The role of membrane permeability and active protrusion length. PLoS Computational Biology 15(4): e1006352 (2019).

29. Liu, K., Lowengrub, J., Allard, J., Efficient simulation of thermally fluctuating biopolymers immersed in fluids on 1-micron, 1-second scales. J Comp Phys, 386:248-263 (2019).

28. Wang, M., Allard, J., Haun, J., Extracting multivalent nanoparticle detachment rates from heterogeneous populations. Physical Chemistry Chemical Physics, 20:21430-21440 (2018).

27. Bergman, J. P.†, Bovyn, M. J.†, Gudheti, M. V., Gross, S. P., Allard, J. F.*, Vershinin, M. D.*, Cargo navigation across 3D microtubule intersections. Proceedings of the National Academy of Sciences (USA), 115 (3) 537-542 (2018). †These authors (two first authors) contributed equally. *These authors (two last authors) contributed equally.

26. Raz-Ben Aroush, D., Ofer, N., Abu Shah, E., Allard, J., Krichevsky, O., Mogilner, A., Keren, K., Actin turnover in lamellipodial fragments. Current Biology, 27:19 2963 (2017).

25. Liu, K., Marple, G., Allard, J., Li, S., Veerapaeni, S., Lowengrub, J. Dynamics of a multicomponent vesicle in shear flow. Soft Matter 13, 3521-3531 (2017).

24. Goyette, J., Solis Salas, C., Coker-Gordon, N., Bridge, M., Isaacson, S.A., Allard, J., Dushek, O., A novel surface plasmon resonance assay for tethered enzymatic reactions applied to the tyrosine phosphatase SHP-1. Science Advances 3:e1601692 (2017).

23. Barnhart, E. L.†, Allard, J.†, Theriot, J.A., Mogilner, A., Adhesion-dependent wave generation in crawling cells. Current Biology 27: 27-38 (2017). †These authors contributed equally.

    Featured in Current Biology Dispatch: "Cell Migration: Making the Waves", Muller, J., Sixt, M., January 2017.

22. Bryant, D., Clemens, L., Allard, J., Computational simulation of formin-mediated actin polymerization predicts homologue-dependent mechanosensitivity. Cytoskeleton 74:29-39 (2017).

21. Iniguez, A., Allard, J., Spatial pattern formation in microtubule post-translational modifications and the tight localization of motor-driven cargo. Journal of Mathematical Biology, DOI 10.1007/s00285-016-1053-x (2016).

20. Liu, K., Hamilton, C., Allard, J., Lowengrub, J., Li, S., Wrinkling dynamics of fluctuating vesicles in time-dependent viscous flow. Soft Matter 12, 5663-5675 (2016).

19. Mukhopadhyay, H., de Wet, B., Clemens, L., Maini, P.K., Allard, J., van der Merwe, P.A., Dushek, O., Multisite phosphorylation of the T cell receptor ζ-chain enhances the potency but not the switch-like response. Biophysical Journal 110, 1896-1906 (2016).

    Featured in Biophysical Journal New & Notable: "Reductionism is dead, long live reductionism! Systems modeling needs reductionist experiments," Faeder, J., April 2016.

18. Manakova, K, Yan, H., Lowengrub, J., Allard, J., Cell surface mechanochemistry and the determinants of bleb formation, healing and travel. Biophysical Journal 110(7):1636-47 (2016).

17. Newby, J., Allard, J., First-passage time to clear the way for receptor-ligand binding in a crowded environment. Physical Review Letters 116 128101 (2016).

16. Aland, S., Allard, J., Lowengrub, J., Numerical simulation of endocytosis: Viscous flow driven by membranes with non-uniformly distributed curvature-inducing molecules. Journal of Computational Physics 309 pp. 112-128 (2016).

15. Lewis, O., Guy, R., Allard, J.* Actin-myosin spatial patterns from a simplified isotropic viscoelastic model. Biophysical Journal 107(4) pp. 863-870 (2014). *Corresponding author.

14. Gou, J., Edelstein-Keshet, L., Allard, J.* Mathematical model with spatially uniform regulation explains long-range bidirectional transport of early endosomes in fungal hyphae. Molecular Biology of the Cell 25(16) pp. 2408-2415 (2014). *Corresponding author.

13. Luo, W., Yu, C., Allard, J., Mogilner, A., Sheetz, M., Bershadsky, A., Organization and dynamics of cytoplasmic actin networks. Journal of Cell Biology 202(7) pp.1057-1073 (2013).

12. Danuser, G., Allard, J., Mogilner, A., Mathematical modeling of eukaryotic cell migration: insights beyond experiments. Annual Reviews in Cell and Developmental Biology 29:18.1 (2013).

11. Allard, J., Mogilner, A. Traveling waves in actin dynamics and cell motility. Current Opinions in Cell Biology 25(1) pp. 107-115 (2013).

10. Mogilner, A., Allard, J., Wollman, R. Cell polarity: Quantitative modeling as a tool in cell biology. Science 336 pp.175-179 (2012).

    Featured in Faculty of 1000: Cell Biology

9. Allard, J.†, Dushek, O.†, Coombs, D., van der Merwe, P. A. Mechanical modulation of receptor-ligand interactions at cell-cell interfaces. Biophysical Journal 102 pp. 1265-1273 (2012). †These authors contributed equally.

8. Cytrynbaum, E., Li, Y.-N., Allard, J., Mehrabian, H. Estimating the bending modulus of a FtsZ bacterial-division protein filament. Physical Review E 85, 011902 (2012).

7. Ambrose, J. C., Allard, J. F., Cytrynbaum, E. N., Wasteneys, G. O. A CLASP-modulated cell edge barrier mechanism drives cell-wide cortical microtubule organization in Arabidopsis. Nature Communications 2:430 (2011).

    Featured in The New York Times, "A Protein That Bosses Plant Cells Around", August 22, 2011

6. Allard, J. F., Ambrose, J. C., Wasteneys, G. O., Cytrynbaum, E. N., Mechanochemical model explains interactions between cortical microtubules in plants. Biophysical Journal 99 pp. 1082-1090 (2010).

5. Allard, J. F., Wasteneys, G. O., Cytrynbaum, E. N. Mechanisms of self-organization of cortical microtubules in plants revealed by computational simulation. Molecular Biology of the Cell 21 pp. 278-286 (2010).

4. Allard, J. F., Rutenberg, A. D. Pulling helices inside bacteria: Imperfect helices and rings. Physical Review Letters 102, 158105 (2009).

3. Allard, J. F., Cytrynbaum, E. N. Force generation by a dynamic Z-ring in *Escherichia coli* cell division. Proceedings of the National Academy of Science (USA) 106(1) pp. 145–150 (2009).

2. Allard, J. F., Rutenberg, A. D. Steady-state helices of the actin homolog MreB inside bacteria: Dynamics without motor proteins. Physical Review E 76, 031916 (2007).

1. Allard, J., Hill, A., Rutenberg, A. Heterocyst patterns without patterning proteins in cyanobacterial filaments. Developmental Biology 312(1) pp. 427–434 (2007).

Other publications

1. Bovyn, M., Reddy, B., Gross, S., Allard, J. Roles of motor on-rate and cargo mobility in intracellular transport. Submitted. Preprint on bioRxiv.org.

2. Boudreau, V., Hazel, J., Sellinger, J.K., Chen, P., Manakova, K., Radzyminski, R., Garcia, H.G., Allard, J., Gatlin, J., Maddox. P.S., Nucleo-cytoplasmic trafficking regulates nuclear surface area during nuclear organogenesis. Submitted. Preprint on bioRxiv.org.

Invited talks (selected)

Departmental seminars

(24) UC Davis, Mathematical Biology seminar, 2024

(23) Oxford University, Dunn School of Pathology seminar, 2024

(22) CSU Northridge, Physics Colloquium, 2024

(21) University of Notre Dame, Biophysics seminar, 2023

(20) UC Riverside Interdisciplinary Center for Quantitative Modeling in Biology seminar, 2023

(19) UC San Diego Biophysics seminar, January 2023

(18) University of British Columbia, Mathematical Biology seminar, May 2021

(17) "The Cold Place" remote Mathematical Biology seminar, March 2021

(16) UC Riverside Mathematical Biology seminar, March 2020

(15) Brandeis University Mathematics Colloquium, joint with MRSEC, December 2019

(14) Harvey Mudd Physics Seminar, March 2019

(13) UC Merced Physics Seminar, March 2019

(12) CSU Fullerton Physics Seminar, February 2019

(11) UCLA Biophysics seminar, May 2018

(10) UC Santa Barbara, Fluid Dynamics seminar, January 2018

(9) University of Utah, Mathematical Biology seminar, September 2016

(8) Yale University, Sackler Institute for Biological, Physical and Engineering Sciences, January 2016

(7) University of Maryland, Biophysics seminar, September 2015

(6) University of North Carolina, Chapel Hill, Department of Biology, September 2015

(5) UC Davis Mathematics, Department of Mathematics, May 2015

(4) Claremont College, Applied Mathematics, January 2015

(3) Oxford University, Dunn School of Pathology, June 2014

(2) UC San Diego, Department of Mechanical and Aerospace Engineering, October 2014

(1) Dalhousie University, Department of Physics and Atmospheric Science, August 2013

Invited conference talks

(22) Society for Mathematical Biology annual meeting, Seoul, 2024

(21) Allen Institute for Cell Science, Summit on Interpretable Quantitative Cell Representations, 2024

(20) International Congress on Industrial and Applied Mathematics, Tokyo, 2024

(19) Interdisciplinary Conference on Nuclear Morphology and Dynamics, Kylemore Abbey Global Center, Ireland, 2023

(18) Gordon Conference on Stochastic Physics in Biology, Ventura, CA, 2023

(17) Simons Foundation MathBioSys Annual Meeting 2022, New York, NY, 2023

(16) SIAM Life Sciences meeting, Pittsburgh, PA, 2022

(15) AMS Western Regional Meeting, Riverside, CA, 2019

(14) CAIMS (Canadian Applied and Industrial Mathematics Society) Annual Meeting, Whistler, 2019

(13) SIAM Life Sciences meeting, Minneapolis, MN, 2018

(12) Banff International Research Station Meeting on Mathematics for Developmental Biology, Banff, Canada, 2017

(11) Isaac Newton Institute workshop on Stochastic Dynamics in Biology, Cambridge, UK, 2016

(10) SIAM Life Sciences meeting, Boston, MA, 2016

(9) Quantitative Cell Biology: Modeling Cell Biology workshop, San Francisco, 2015

(8) Banff International Research Station Meeting on Particle-based Diffusion in Biology, Banff, Canada 2014

(7) Banff International Research Station Meeting on Mathematical modeling of Cell Motility and the Cytoskeleton, Banff, Canada, 2014

(6) Biomathematics and Ecology Education and Research, Claremont, CA, 2014

(5) SoCal Systems Biology regional meeting, Irvine, CA, 2014

(4) SIAM Life Sciences meeting, Charlotte, NC, 2014

(3) SIAM Nonlinear Waves, Cambridge, United Kingdom, 2014

(2) Pacific Institute for Mathematical Sciences IGTC in Mathematical Biology, Banff, Canada, 2013

(1) American Society for Cell Biology Annual Meeting, New Orleans, LA, 2013

Teaching

UC Irvine

- MATH 113A: Mathematical Models in Biology; MATH 2B: Single variable integral calculus; MATH 5A: Single variable differential calculus for the life sciences; MATH 5B: Single variable integral calculus for the life sciences; MATH 227C: Stochastic models in biology
- PHYC 230A: Graduate Biological Physics; PHYC 50: Mathematical methods for physics
- BIOSCI 193/CHEM 193/PHYC 193: Research methods for CalTeach (high school teacher preparation program)

Short courses

- Lecturer, NIH National Short Course in Systems Biology, 2018-present

- Lecturer, NIH National Short Course in Systems Biology, 2014-2017

Online learning / MOOCs

- Lecturer, COSMOS "Computation and Machine Learning: Physics, Big Data, and Our Understanding of the Universe", 2018-2023
- Lecturer, Emergent Phenomena MOOC, UCI Division of Teaching and Learning

  Lectures on microtubule patterns are freely available online at www.coursera.org.
- Lecturer, Graduate Summer Course in Mathematical Cell Biology, Pacific Institute for Mathematical Sciences, Vancouver, May 2012

  Lectures on cell mechanics are freely available online at www.mathtube.org.

Professional Activity

University service, selected

- Graduate program in Mathematical, Computational and Systems Biology
  - Director of Gateway program, 2018-present
  - Interim Director of Gateway, 2017-2018
  - Associate Director, 2017-present
  - Chair of Admissions Committee, 2017-present
  - Chair of Curriculum Committee, 2018
- NSF-Simons Center for Multiscale Cell Fate
  - Executive Committee member, 2018-2023

Editorial and refereeing

- Guest editor: PLoS Computational Biology
- Open peer review: Biology Direct
- Peer reviewer (selected): Biophysical Journal; Bulletin of Mathematical Biology; Cytoskeleton; Journal of Mathematical Biology; Journal of the American Chemical Society; Journal of Theoretical Biology; Molecular Biology of the Cell; New Journal of Physics; Physical Biology; Physical Review E; Physical Review X Life; Physics Letters A; PLoS Computational Biology; Proceedings of the National Academy of Science; Scientific Reports; Soft Matter;
- Panelist: NIH (2014), NSF (2019,2018, 2017, 2016, 2014)

Conference and session organizing

- Co-organizer, NSF-Simons Center for Multiscale Cell Fate Early Career Researcher Symposium, 2018, 2019, 2022, 2023;
- Co-organizer, Mathematics of the Cell: Mechanical and Chemical Signaling across Scales, Banff International Research Station, 2018, with Alexandra Jilkine (Notre Dame) and Arpita Upadhyaya (Maryland)
- Co-organizer, Mechanobiology Symposium: The Mechanome in Action, UC Irvine, 2018, with Medha Pathak, Albert Siryaporn and Tim Downing (UC Irvine)
- Co-organizer, Workshop on Spatially-distributed Stochastic Processes in Biology, Isaac Newton Institute, Cambridge, UK, 2016
- Chair, Session on Systems Biology, UC Bioengineering Symposium 2014, Irvine
- Co-organizer, Session on Mechanics at the Cell Surface at Biophysical Society Annual Meeting 2014, San Francisco, with Jesse Goyette (UNSW)
- Co-organizer, Minisymposium on Actin Dynamics, SIAM Life Sciences Meeting 2012, San Diego, with Nessy Tania (Smith College, MA)
- Co-organizer, Minisymposium on Patterns in Cells, Annual Meeting of the Society for Mathematical Biology 2012, Knoxville, with Alexandra Jilkine (Notre Dame)
- Organizer, Minisymposium on Bacterial Polymers, Annual Meeting of the Society for Mathematical Biology 2009, Vancouver

Advising

- Former PhD students:
  - Sohyeon Park, Mathematical, Computational and Systems Biology, defended 2023
  - Rob Taylor, Physics and Astronomy, defended 2022
  - Matt Bovyn, Physics and Astronomy, defended 2021
  - Lara Clemens, Mathematical, Computational and Systems Biology, defended 2020
  - Kathryn Manakova, Mathematical, Computational and Systems Biology, defended 2018
  - Derek Bryant, Physics and Astronomy, defended 2016
- Received UCI Chancellor's Award for Distinguished Fostering of Undergraduate Research, 2015