Curriculum Vitae

Jun Allard

CONTACT INFORMATION

Department of Mathematics
University of California, Irvine
Irvine, CA, USA 92697
E-mail: jun.allard@uci.edu
Web: allardlab.com

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 CAREER DMS-1454739: Mathematical framework for elucidating mechanics at immune cell interfaces (Sole PI)
- NIH R01-GM123068: Control of cargo distributions by microtubule motor physical interactions with cargo, cytoplasm and MAPs (Sole PI)

- 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)
- NSF DMS-1763272: Center for Multiscale Cell Fate Research (PI: Qing Nie, Co-PIs: Jun Allard, Xing Dai, Arthur Lander, John Lowengrub)

Submitted Works

35. Bovyn, M., Gross, S., Allard, J., Molecular motor organization and mobility on cargos can overcome a tradeoff between fast binding and run length. Submitted 2019. Preprint on bioRXiv.org.

34. Paoletti F., El-Sagheer A., Allard, J., Brown T., Dushek O., Esashi F., Molecular flexibility of DNA as a major determinant of RAD51 recruitment. Submitted 2018. Preprint on bioRXiv.org.

33. 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 2019. Preprint on bioRXiv.org.

Publications

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), (2018). †These 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).

Invited talks (selected)

Departmental seminars

(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

(14) AMS Western Regional Meeting, Riverside, CA, 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, 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

- 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-present
- NSF-Simons Center for Multiscale Cell Fate
  - Executive Committee member, 2018-present

Editorial and refereeing

- Open peer review: Biology Direct (2016)
- Peer reviewer: Molecular Biology of the Cell (2019, 2017; 2015, 2011); Physical Review E (2018), PLoS Computational Biology (2018, 2017, 2015); Biophysical Journal (2017, 2016, 2015, 2014, 2013, 2012, 2010); Scientific Reports (2017); Cytoskeleton (2017); Journal of Mathematical Biology (2016); Proceedings of the National Academy of Science (2015); Bulletin of Mathematical Biology (2014); Journal of the American Chemical Society (2014); Journal of Theoretical Biology (2014); Bulletin of Mathematical Biology (2014); Physical Biology (2013); New Journal of Physics (2013); Physics Letters A (2016, 2013)
- Panelist: NIH (2014), NSF (2018, 2017, 2016, 2014)

Conference and session organizing

- 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:
  - Lara Clemens, Mathematical, Computational and Systems Biology, defended November 2019
  - Kathryn Manakova, Mathematical, Computational and Systems Biology, defended December 2018
  - Derek Bryant, Physics and Astronomy, defended November 2016
- PhD advancement committee member at UCI:
  - Physics and Astronomy: Claire Gilpin, Shawn Strausser, Calvin Lau, Mackenzie Walker, Kyle Naughton, Anerudh Kannan, Preston Hinkle, Timothy Ma, Phillise Todd*, Jeremy Eaton*
  - Mathematics: Yutong Sha, Lora Weiss, Chris Rackauckas, Yangyang Wang, Yuchi Qiu, Wei Wang, Catherine Ta*, Aghavni Simonyan, Andrew Thomas*
  - Biomedical Engineering: Seth Figuerosa*, Nancy Drew*, Mingqiu Wan*
  - Chemical and Materials Engineering: Margaret Tse*, Brian Chu*
  - Developmental and Cell Biology: Leonila Lagunes

- MCSB: Srikiran Chandrasekaran*, Luis Lomeli

  * indicates PhD defense committee membership.

- Received UCI Chancellor's Award for Distinguished Fostering of Undergraduate Research, 2015