

Curriculum Vitae

Joshua W. Shaevitz

Associate Professor of Physics and Genomics
Princeton University

CONTACT INFORMATION

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PROFESSIONAL EXPERIENCE

Princeton University, Princeton, NJ 2013–present
Associate Professor, Department of Physics and Lewis-Sigler Institute for Integrative Genomics

Princeton University, Princeton, NJ 2007–2013
Assistant Professor, Department of Physics and Lewis-Sigler Institute for Integrative Genomics

Howard Hughes Medical Institute, Ashburn, VA 2012–present
Visiting Scientist, Janelia Farm Research Campus

JILA (NIST-CU), Boulder, CO 2012
Distinguished Visitor

University of California at Berkeley, Berkeley, CA USA 2004–2007
Miller Research Fellow, Miller Institute for Basic Research in Science

EDUCATION

Ph.D. in Physics, Stanford University, Stanford, CA, June 2004
Thesis Topic: “The Biophysics Of Molecular Motors: Optical Trapping Studies Of Kinesin
And RNA Polymerase.” Advisor: Professor Steven M. Block

M.S. in Physics, Stanford University, Stanford, CA, June 2002

B.A. in Physics, Columbia University, New York, NY May 1999

HONORS AND AWARDS

Howard Hughes Medical Institute, Janelia Farm Visiting Scientist 2012–present

JILA (NIST-CU Boulder) Distinguished Visitor 2012

Presidential Early Career Award for Scientists and Engineers (PECASE) 2009

Pew Scholar in the Biomedical Sciences 2009–2013

National Science Foundation CAREER Award 2009–2014

Human Frontier Science Program Young Investigator Award.....2008–2011
 Sloan Research Fellowship.....2008–2010
 Miller Institute for Basic Research in Science Postdoctoral Fellowship2004–2007
 First International Nanoscale/Molecular Mechanics Conference Travel Grant2002
 Physics Department Alfred Moritz Michaelis Award, Columbia University.....1999
 I. I. Rabi Scholarship, Columbia University.....1995–1999

SERVICE

Executive Committee for the Lewis-Sigler Institute2012–present
 Freshman and Sophomore Academic Advisor for Rockefeller College2010–present
 Graduate Program in QCB Admissions Committee2009–present
 Biophysics Seminar Series Organizer2009–2010
 Physics Department Graduate Admissions Committee2008–present
 Executive Committee for the Graduate Program in QCB2008–present
 Lewis-Sigler Fellow Search Committee Chair.....2008–present
 Physics Department Experimental Project Orals Examiner2008–2009

Guest editor for peer-reviewed publications in PNAS2010
 Scientific content reviewer for peer-reviewed publications including:

Applied Optics, Biophysical Chemistry, Biophysical Journal, Current Biology, Journal of Bacteriology, Journal of Theoretical Biology, Laser and Photonics Reviews, Molecular Microbiology, Nature, Nature Biotechnology, Nature Methods, Nature Photonics, Optics and Lasers in Engineering, Optics Express, Optics Letters, Physical Biology, Physical Chemistry Chemical Physics, Physical Review E, Physical Review Letters, PNAS, Science, Soft Matter, Structure

Grant review panelist for the National Science Foundation (MCB and PHY)2009–2012
 Grant reviewer for funding agencies including:

Agence Nationale de la Recherche (France), Israel Science Foundation (Israel), National Institutes of Health (USA), National Science Foundation (USA), Natural Sciences and Engineering Research Council (Canada)

TEACHING AND ADVISING

PHY412 Biological Physics2008–2013
 ISC231–234 An Integrated, Quantitative Introduction to the Natural Sciences2008–2013
 MOL515 Guest lecturer, Method and Logic in Quantitative Biology2009
 Guest lecturer in several classes at UC Berkeley2004–2007

PhD Theses: Siyuan Wang (2011), Yi Deng (2012)

Current PhD Students:

David B. Borenstein, Daniel Choi, Jeffrey Nguyen, Nikolay Ouzounov

Current Postdoctoral Fellows:

Gordon Berman, Benjamin Bratton, Fabian Czerwinski, Shashi Thutupalli, Akeisha Belgrave

INVITED RESEARCH TALKS

Rockefeller University	2013
Aspen Center for Physics	
Myxo2013 Meeting	
Zing meeting on Bacterial Cell Biology	
MIT Biophysics Seminar	2012
Boston University Bioinformatics Seminar	
Brandeis University Biophysics Seminar	
University of Arizona Physics Colloquium	
Harvard Behavioral Research Seminar	
Brandeis Physics Colloquium	
Dutch Annual Meeting on Molecular and Cellular Biophysics Plenary Lecture	
Annual Meeting of the Biophysical Society of Japan Plenary Lecture	
Banff Tissue Growth and Morphogenesis Workshop	
University of Chicago James Franck Institute Seminar	
University of Toronto Physical Chemistry Seminar	
Institute for Advanced Study Systems Biology Seminar	2011
Woods Hole Physiology Course	
Texas A&M Biochemistry seminar	
University of Chicago Biochemistry & Molecular Biology Colloquium	
EPFL Bioengineering Cross-Disciplinary Seminar, Lausanne, Switzerland	
Biophysical Society Symposium Speaker	
NYU Biology Colloquium	
CUNY Symposium on Collective Behavior	
University of California, San Diego Biophysics Seminar	
Gordon Research Conference on Bacterial Cell Surfaces	2010
Thermodynamics and Mechanics of Molecular Motors Conference, Sante Fe, NM	
Indiana University Physics Colloquium	
Harvard University FAS Center for Systems Biology	
University of Colorado, Boulder Physics Colloquium	
Harvard University Microbial Sciences Initiative Seminar	
Gordon Research Conference on Signal Transduction in Microorganisms	
Lehigh University Physics Colloquium	2009
Aspen Center for Physics Summer Workshop	
Los Alamos National Laboratory	
American Physical Society invited Symposium speaker	
University of Alberta Physics Colloquium	
Stanford University Department of Biology Graduate Student Invited Seminar	
American Society for Cell Biology Symposium speaker	2008
CNRS Marseille Chemical Biology Seminar	
European Science Foundation Workshop on Microswimming	2007
Department of Plant and Microbial Biology, University of California Berkeley	2006
IBM Almaden Research Center Science Colloquium	
Department of Physics, University of British Columbia	
American Physical Society Invited Symposium Speaker	
Department of Molecular Biophysics and Biochemistry	
Department of Physics and Lewis-Sigler Institute for Integrative Genomics, Princeton University	

Department of Molecular and Cellular Biology, University of California at Davis
 Rockefeller University Monday Lecture
 Department of Physics, University of California Berkeley
 Center for Cell Analysis and Modeling, University of Connecticut Health Center
 Department of Bioengineering, California Institute of Technology
 Stanford Linear Accelerator Center Experimental Seminar
 Lewis-Sigler Institute for Integrative Genomics, Princeton University 2004
 Fermi National Accelerator Laboratory Colloquium

PEER-REVIEWED PUBLICATIONS

1. David Borenstein, Yigal Meir, **Joshua W Shaevitz**, Ned Wingreen. Diffusion of public goods prevents coexistence of cooperators and cheaters in a stochastic competition model. *PLoS One* *in press*.
2. Fabian Czerwinski, **Joshua W Shaevitz**. The biophysics of *Myxococcus xanthus* motility. Invited chapter for American Society of Microbiology book on *Myxococcus xanthus*, *in press*.
3. Siyuan Wang and **Joshua W Shaevitz**. The mechanics of shape in prokaryotes. *Frontiers in Bioscience*, doi:10.2741/S390, 2013.
4. Kerwyn Casey Huang, David W. Ehrhardt, **Joshua W. Shaevitz** The molecular origins of chiral growth in walled cells *Current Opinions in Microbiology*, doi:10.1016/j.mib.2012.11.002, 2012.
5. Teuta Pilizota, **Joshua W Shaevitz**. Fast, Multiphase Volume Adaptation to Hyperosmotic Shock by *Escherichia coli*. *PLoS One* 7, e35205, 2012.
6. Siyuan Wang, Leon Furchgott, Kerwyn Casey Huang, and **Joshua W Shaevitz**. Helical insertion of peptidoglycan produces elongation and chiral ordering of the bacterial cell wall. *Proceedings of the National Academy of Sciences* 107(10):E595-E604, 2012
7. Sven van Teeffelen, **Joshua W Shaevitz**, Zemer Gitai. Image analysis in fluorescence microscopy: Bacterial dynamics as a case study *BioEssays* 34, 427-436, 2012.
8. Yong Zhang, Adrien Ducret , **Joshua W Shaevitz**, Tãm Mignot. From individual cell motility to collective behaviors: insights from a prokaryote, *Myxococcus xanthus*. *FEMS Microbiology Reviews* 36:149-164, 2012.
9. Yi Deng, Mingzhai Sun, and **Joshua W Shaevitz**. Direct Measurement of Cell Wall Stress Stiffening and Turgor Pressure in Live Bacterial Cells. *Physical Review Letters*, 107(15):158101, 2011.
10. Sven van Teeffelen, Siyuan Wang, Leon Furchtgott, Kerwyn Casey Huang, Ned S Wingreen, **Joshua W Shaevitz**, and Zemer Gitai. The bacterial actin MreB rotates, and rotation depends on cell-wall assembly. *Proceedings of the National Academy of Sciences*, 108(38): 15822-15827, 2011.
11. Mingzhai Sun, Morgane Wartel, Eric Cascales, **Joshua W Shaevitz**, and Tãm Mignot. Motor-driven intracellular transport powers bacterial gliding motility. *Proceedings of the National Academy of Sciences*, 108(18):7559-7564, 2011.

12. Muthuvel Arigovindan, **Joshua W Shaevitz**, John McGowan, John W Sedat, and David A Agard. A parallel product-convolution approach for representing the depth varying point spread functions in 3D widefield microscopy based on principal component analysis. *Optics Express*, 18: 6461-6476, 2010.
13. **Joshua W Shaevitz** and Simon Nørrelykke. The cytoskeleton: I-beams of the cell. *Physics Today*, 63(2), 2010.
14. Siyuan Wang, Hugo Arellano-Santoyo, Peter A Combs, and **Joshua W Shaevitz**. Measuring the bending stiffness of bacterial cells using an optical trap. *Journal of Visualized Experiments*, (38), 2010.
15. **Joshua W. Shaevitz** and Zemer Gitai. The structure and function of bacterial actin homologs. *Cold Spring Harbor Perspectives in Biology*, 2(9), 2010.
16. Siyuan Wang, Hugo Arellano-Santoyo, Peter A Combs, and **Joshua W Shaevitz**. Actin-like cytoskeleton filaments contribute to cell mechanics in bacteria. *Proceedings of the National Academy of Sciences*, 107(20):9182-5, 2010.
17. Yi Deng and **Joshua W Shaevitz**. Effect of aberration on height calibration in three-dimensional localization-based microscopy and particle tracking. *Applied Optics*, 48(10):1886-90, 2009.
18. **Joshua W Shaevitz**. Bayesian Estimation of the Axial Position in Astigmatism-Based Three-Dimensional Particle Tracking. *International Journal of Optics*, ID 896208, 2009.
19. Stefano Marchesini, Sebastien Boutet, Anne E Sakdinawat, Michael J Bogan, Sasa Bajt, Anton Barty, Henry N Chapman, Matthias Frank, Stefan P Hau-Riege, Abraham Szoke, Congwu Cui, David A Shapiro, Malcolm R Howells, John C H Spence, **Joshua W Shaevitz**, Joanna Y Lee, Janos Hajdu, and Marvin M Seibert. Massively parallel x-ray holography. *Nature Photonics*, 2(9):560-563, 2008.
20. **Joshua W Shaevitz**. Super-resolution for a 3D world. *Nature Methods*, 5(6):471-2, 2008.
21. **Joshua W Shaevitz** and Daniel A Fletcher. Curvature and torsion in growing actin networks. *Physical Biology*, 5(2):26006, 2008.
22. Michael J Rosenbluth, Ailey Crow, **Joshua W Shaevitz**, and Daniel A Fletcher. Slow stress propagation in adherent cells. *Biophysical Journal*, 95(12):6052-9, 2008.
23. Tãm Mignot and **Joshua W Shaevitz**. Active and passive mechanisms of intracellular transport and localization in bacteria. *Current opinion in microbiology*, 11(6):580-5, 2008.
24. Tãm Mignot, **Joshua W Shaevitz**, Patricia L Hartzell, and David R Zusman. Evidence that focal adhesion complexes power bacterial gliding motility. *Science*, 315(5813):853-6, 2007.
25. **Joshua W Shaevitz** and Daniel A Fletcher. Enhanced three-dimensional deconvolution microscopy using a measured depth-varying point-spread function. *Journal of the Optical Society of America A*, 24(9):2622-7, 2007.
26. **Joshua W Shaevitz** and Daniel A Fletcher. Load fluctuations drive actin network growth. *Proceedings of the National Academy of Sciences*, 104(40):15688-92, 2007.

27. **Joshua W Shaevitz**, Steven M Block, and Mark J Schnitzer. Statistical kinetics of macromolecular dynamics. *Biophysical Journal*, 89(4):2277-85, 2005.
28. **Joshua W Shaevitz**, Joanna Y Lee, and Daniel A Fletcher. Spiroplasma swim by a processive change in body helicity. *Cell*, 122(6):941-5, 2005.
29. Elio A Abbondanzieri, **Joshua W Shaevitz**, and Steven M Block. Picocalorimetry of transcription by RNA polymerase. *Biophysical Journal*, 89(6):L61-3, 2005.
30. Elio A Abbondanzieri, William J Greenleaf, **Joshua W Shaevitz**, Robert Landick, and Steven M Block. Direct observation of base-pair stepping by rna polymerase. *Nature*, 438(7067):460-5, 2005.
31. **Joshua W Shaevitz***, Elio A Abbondanzieri*, Robert Landick, and Steven M Block. Backtracking by single rna polymerase molecules observed at near-base-pair resolution. *Nature*, 426(6967):684-7, 2003.
32. Steven M Block, Charles L Asbury, **Joshua W Shaevitz**, and Matthew J Lang. Probing the kinesin reaction cycle with a 2D optical force clamp. *Proceedings of the National Academy of Sciences*, 100(5):2351-6, 2003.
33. Matthew J Lang, Charles L Asbury, **Joshua W Shaevitz**, and Steven M Block. An automated two-dimensional optical force clamp for single molecule studies. *Biophysical Journal*, 83(1):491-501, 2002.

CURRENT AND PAST FUNDING

Active Grants

8/1/11–5/31/15, NIH R01 GM098090

“A New Paradigm for Quantifying Animal Behavior in a Model Genetic System”

Annual Direct Costs: \$278,124

Total Direct Costs: \$1,060,692

7/1/09–6/30/13, Pew Charitable Trusts Scholars Program

“Mechanisms of Cellular Organization and Force Production in Bacteria”

Annual Direct Costs: \$55,555

Total Direct Costs: \$222,220

3/1/09–2/28/14, NSF 0844466

“CAREER: Organization and Force Production in Bacteria”

Annual Direct Costs: \$129,097

Total Direct Costs: \$663,344

9/1/04–8/31/14, NIH P50 GM071508 (PI: D. Botstein)

“Center for Quantitative Biology”

Annual Direct Costs: \$1,956,000

Total Direct Costs: \$9,780,000

Completed Grants

9/15/08–9/14/10, Alfred P. Sloan Research Fellowship

“Physical Control of Cell Shape and Dynamics in Bacteria”

Total Direct Costs: \$50,000

09/01/08–08/28/11, Human Frontier Science Program Young Investigator Award (co-PI with Mignot)

“Biophysics of bacterial gliding motility”

Total Direct Costs: \$710,658