

# Stanford

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## Jan Liphardt

Associate Professor of Bioengineering

### Bio

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#### ACADEMIC APPOINTMENTS

- Associate Professor, Bioengineering
- Member, Bio-X
- Member, Stanford Cancer Institute

#### ADMINISTRATIVE APPOINTMENTS

- Director and Principal Investigator, Bay Area Physical Sciences Oncology Center, (2009-2015)

#### HONORS AND AWARDS

- Thomas and Polly Bredt Faculty Scholar, Stanford University (2013-17)
- MDV Innovator's Award, Mohr Davidow Ventures (2007)
- Searle Scholar, Chicago Community Trust (2006-08)
- Sloan Research Fellow, Alfred P. Sloan Foundation (2006-07)
- Hellman Faculty Fund Award, UC Berkeley (2005)
- Fellow, Program in Mathematics and Molecular Biology, NSF/Burroughs Wellcome Fund (1999-00)
- Gwyneth Pretty Studentship, Cambridge University (1997-99)

#### LINKS

- Liphardt lab site: <http://liphardtlab.stanford.edu/>
- My personal blog: <http://janliphardt.com>

### Teaching

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#### COURSES

##### 2022-23

- Advanced Imaging Lab in Biophysics: APPPHYS 232, BIO 132, BIO 232, BIOPHYS 232, GENE 232 (Spr)
- Beyond Bitcoin: Applications of Distributed Trust: BIOE 60 (Win)
- Senior Capstone Design I: BIOE 141A (Aut)
- Senior Capstone Design II: BIOE 141B (Win)

##### 2021-22

- Beyond Bitcoin: Applications of Distributed Trust: BIOE 60 (Aut)

- Senior Capstone Design I: BIOE 141A (Aut)
- Senior Capstone Design II: BIOE 141B (Win)

#### 2020-21

- Beyond Bitcoin: Applications of Distributed Trust: BIOE 60 (Win)
- Senior Capstone Design I: BIOE 141A (Aut)
- Senior Capstone Design II: BIOE 141B (Win)

#### 2019-20

- Beyond Bitcoin: Applications of Distributed Trust: BIOE 60 (Win)
- Introduction to Bioengineering (Engineering Living Matter): BIOE 80, ENGR 80 (Spr)
- Senior Capstone Design I: BIOE 141A (Aut)
- Senior Capstone Design II: BIOE 141B (Win)

## STANFORD ADVISEES

### Master's Program Advisor

Emilie Kono, Kenna McRae

### Doctoral (Program)

Cyrus Knudsen, Ethan Li, Scott Longwell, Eric Nguyen

## Publications

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### PUBLICATIONS

- **A fluorogenic array for temporally unlimited single-molecule tracking** *NATURE CHEMICAL BIOLOGY*  
Ghosh, R. P., Franklin, J., Draper, W. E., Shi, Q., Betran, B., Spakowitz, A. J., Liphardt, J. T.  
2019; 15 (4): 401-+
- **Optical Control of Fast and Processive Engineered Myosins In Vitro and in Living Cells**  
Ruijgrok, P. V., Ghosh, R. P., Nakamura, M., Zemsky, S., Chen, R., Vachharajani, V., Liphardt, J. T., Bryant, Z.  
CELL PRESS.2019: 259A
- **Satb1 integrates DNA binding site geometry and torsional stress to differentially target nucleosome-dense regions.** *Nature communications*  
Ghosh, R. P., Shi, Q. n., Yang, L. n., Reddick, M. P., Nikitina, T. n., Zhurkin, V. B., Fordyce, P. n., Stasevich, T. J., Chang, H. Y., Greenleaf, W. J., Liphardt, J. T.  
2019; 10 (1): 3221
- **Origins of chemoreceptor curvature sorting in Escherichia coli** *NATURE COMMUNICATIONS*  
Draper, W., Liphardt, J.  
2017; 8
- **ATAC-se reveals the accessible genome by transposase-mediated imaging and sequencing.** *Nature methods*  
Chen, X., Shen, Y., Draper, W., Buenrostro, J. D., Litzenburger, U., Cho, S. W., Satpathy, A. T., Carter, A. C., Ghosh, R. P., East-Seletsky, A., Doudna, J. A., Greenleaf, W. J., Liphardt, et al  
2016
- **Molecular Architecture and Assembly Principles of Vibrio cholerae Biofilms** *SCIENCE*  
Berk, V., Fong, J. C., Dempsey, G. T., Develioglu, O. N., Zhuang, X., Liphardt, J., Yildiz, F. H., Chu, S.  
2012; 337 (6091): 236-239
- **NuSeT: A deep learning tool for reliably separating and analyzing crowded cells** *PLoS Computational Biology*  
Yang, L., et al  
2020

- **Strong triaxial coupling and anomalous Poisson effect in collagen networks** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Ban, E., Wang, H., Franklin, J., Liphardt, J. T., Janmey, P. A., Shenoy, V. B.  
2019; 116 (14): 6790–99
- **Strong triaxial coupling and anomalous Poisson effect in collagen networks.** *Proceedings of the National Academy of Sciences of the United States of America*  
Ban, E., Wang, H., Franklin, J. M., Liphardt, J. T., Janmey, P. A., Shenoy, V. B.  
2019
- **A fluorogenic array for temporally unlimited single-molecule tracking.** *Nature chemical biology*  
Ghosh, R. P., Franklin, J. M., Draper, W. E., Shi, Q., Beltran, B., Spakowitz, A. J., Liphardt, J. T.  
2019
- **Physical confinement induces malignant transformation in mammary epithelial cells.** *Biomaterials*  
Lu, Y. C., Chu, T. n., Hall, M. S., Fu, D. J., Shi, Q. n., Chiu, A. n., An, D. n., Wang, L. H., Pardo, Y. n., Southard, T. n., Danko, C. G., Liphardt, J. n., Nikitin, et al  
2019; 217: 119307
- **A Mutation in Histone H2B Represents a New Class of Oncogenic Driver.** *Cancer discovery*  
Bennett, R. L., Bele, A. n., Small, E. C., Will, C. M., Nabet, B. n., Oyer, J. A., Huang, X. n., Ghosh, R. P., Grzybowski, A. T., Yu, T. n., Zhang, Q. n., Riva, A. n., Lele, et al  
2019
- **Optical Control of Fast and Processive Engineered Myosins: Optimization and Characterization in Vitro and in Living Cells**  
Ruijgrok, P. V., Ghosh, R. P., Nakamura, M., Chen, R., Vachharajani, V., Liphardt, J., Bryant, Z.  
CELL PRESS.2018: 318A
- **Mechanisms of Plastic Deformation in Collagen Networks Induced by Cellular Forces** *BIOPHYSICAL JOURNAL*  
Ban, E., Franklin, J., Nam, S., Smith, L. R., Wang, H., Wells, R. G., Chaudhuri, O., Liphardt, J. T., Shenoy, V. B.  
2018; 114 (2): 450–61
- **Importin-beta modulates the permeability of the nuclear pore complex in a Ran-dependent manner** *ELIFE*  
Lowe, A. R., Tang, J. H., Yassif, J., Graf, M., Huang, W. Y., Groves, J. T., Weis, K., Liphardt, J. T.  
2015; 4
- **Human breast cancer invasion and aggression correlates with ECM stiffening and immune cell infiltration** *INTEGRATIVE BIOLOGY*  
Acerbi, I., Cassereau, L., Dean, I., Shi, Q., Au, A., PARK, C., Chen, Y. Y., Liphardt, J., Hwang, E. S., Weaver, V. M.  
2015; 7 (10): 1120-1134
- **Rapid disorganization of mechanically interacting systems of mammary acini** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Shi, Q., Ghosh, R. P., Engelke, H., Rycroft, C. H., Cassereau, L., Sethian, J. A., Weaver, V. M., Liphardt, J. T.  
2014; 111 (2): 658-663
- **Single-molecule superresolution imaging allows quantitative analysis of RAF multimer formation and signaling** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Nan, X., Collisson, E. A., Lewis, S., Huang, J., Tamgueney, T. M., Liphardt, J. T., McCormick, F., Gray, J. W., Chu, S.  
2013; 110 (46): 18519-18524
- **A single-molecule analysis reveals morphological targets for cellulase synergy** *NATURE CHEMICAL BIOLOGY*  
Fox, J. M., Jess, P., Jambusaria, R. B., Moo, G. M., Liphardt, J., Clark, D. S., Blanch, H. W.  
2013; 9 (6): 356-?
- **A physical sciences network characterization of non-tumorigenic and metastatic cells** *SCIENTIFIC REPORTS*  
Agus, D. B., Alexander, J. F., Arap, W., Ashili, S., Aslan, J. E., Austin, R. H., Backman, V., Bethel, K. J., Bonneau, R., Chen, W., Chen-Tanyolac, C., Choi, N. C., Curley, et al  
2013; 3
- **Scaffold nucleoporins Nup188 and Nup192 share structural and functional properties with nuclear transport receptors.** *eLife*  
Andersen, K. R., Onischenko, E., Tang, J. H., Kumar, P., Chen, J. Z., Ulrich, A., Liphardt, J. T., Weis, K., Schwartz, T. U.  
2013; 2

- **Importin-Beta and Ran Regulate the Passive Permeability Barrier in the Nuclear Pore Complex** *Biophysical Journal*  
Tang, J. H., Lowe, A. R., Yassif, J. M., Weis, K., Liphardt, J. T.  
2013; 104: 120
- **Multiscale Imaging of Tissue Mechanics** *Biophysical Journal*  
Liphardt, J.  
2013; 2 (104): 185a
- **mMaple: A Photoconvertible Fluorescent Protein for Use in Multiple Imaging Modalities** *PLOS ONE*  
McEvoy, A. L., Hoi, H., Bates, M., Platonova, E., Cranfill, P. J., Baird, M. A., Davidson, M. W., Ewers, H., Liphardt, J., Campbell, R. E.  
2012; 7 (12)
- **Scanning angle interference microscopy reveals cell dynamics at the nanoscale** *NATURE METHODS*  
Paszek, M. J., DuFort, C. C., Rubashkin, M. G., Davidson, M. W., Thorn, K. S., Liphardt, J. T., Weaver, V. M.  
2012; 9 (8): 825-?
- **Single molecules: Thermodynamic limits** *Nature Physics*  
Liphardt, J.  
2012; 8: 638–639
- **What does physics have to do with cancer?** *NATURE REVIEWS CANCER*  
Michor, F., Liphardt, J., Ferrari, M., Widom, J.  
2011; 11 (9): 657-670
- **CELLS WITH NON-NATURAL PHYSIOLOGIES DERIVED BY EXPRESSING LIGHT-POWERED PROTON PUMPS IN ONE OR MORE MEMBRANES** *US Patent App.*  
Liphardt, J. T., Walter, J. M., Rine, J., Bustamante, C.  
2011; 44 (13): 728
- **Forcing Tumor Cell Invasion: The Role of Extracellular Matrix Mechanics and Topology** *MOLECULAR BIOLOGY OF THE CELL*  
Cassereau, L., Lopez, J., Frantz, C., Acerbi, I., Yu, H., Lakins, J., Liphardt, J.  
2011; 22
- **Selectivity mechanism of the nuclear pore complex characterized by single cargo tracking** *NATURE*  
Lowe, A. R., Siegel, J. J., Kalab, P., Siu, M., Weis, K., Liphardt, J. T.  
2010; 467 (7315): 600-U126
- **Potential of light-harvesting proton pumps for bioenergy applications** *CURRENT OPINION IN BIOTECHNOLOGY*  
Walter, J. M., Greenfield, D., Liphardt, J.  
2010; 21 (3): 265-270
- **PLASMON RULERS AS DYNAMIC MOLECULAR RULERS IN ENZYMOLOGY** *METHODS IN ENZYMOLOGY, VOL 475: SINGLE MOLECULE TOOLS, PT B*  
Reinhard, B. M., Yassif, J. M., Vach, P., Liphardt, J.  
2010; 475: 175-198
- **Q&A: Single-molecule localization microscopy for biological imaging** *BMC biology*  
McEvoy, A., Greenfield, D., Bates, M., Liphardt, J.  
2010; 1 (8): 106
- **Self-Organization of the Escherichia coli Chemotaxis Network Imaged with Super-Resolution Light Microscopy** *PLOS BIOLOGY*  
Greenfield, D., McEvoy, A. L., Shroff, H., Crooks, G. E., Wingreen, N. S., Betzig, E., Liphardt, J.  
2009; 7 (6)
- **Mechanical conversion of low-affinity Integration Host Factor binding sites into high-affinity sites** *arXiv preprint arXiv*  
Siu, M., Shroff, H., Siegel, J., McEvoy, A., Sivak, D., Maris, A., Liphardt, J.  
2009; 904: 1900
- **Fabrication of 10 nm diameter hydrocarbon nanopores** *APPLIED PHYSICS LETTERS*  
Radenovic, A., Trepagnier, E., Csencsits, R., Downing, K. H., Liphardt, J.

2008; 93 (18)

- **Optical measurement of mechanical forces inside short DNA loops** *BIOPHYSICAL JOURNAL*  
Shroff, H., Sivak, D., Siegel, J. J., McEvoy, A. L., Siu, M., Spakowitz, A., Geissler, P. L., Liphardt, J.  
2008; 94 (6): 2179-2186
- **Controlling DNA capture and propagation through artificial nanopores** *NANO LETTERS*  
Trepagnier, E. H., Radenovic, A., Sivak, D., Geissler, P., Liphardt, J.  
2007; 7 (9): 2824-2830
- **Tunable nanowire nonlinear optical probe** *NATURE*  
Nakayama, Y., Pauzauskie, P. J., Radenovic, A., Onorato, R. M., Saykally, R. J., Liphardt, J., Yang, P.  
2007; 447 (7148): 1098-U8
- **Use of plasmon coupling to reveal the dynamics of DNA bending and cleavage by single EcoRV restriction enzymes** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Reinhard, B. M., Sheikholeslami, S., Mastroianni, A., Alivisatos, A. P., Liphardt, J.  
2007; 104 (8): 2667-2672
- **Light-powering Escherichia coli with proteorhodopsin** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Walter, J. M., Greenfield, D., Bustamante, C., Liphardt, J.  
2007; 104 (7): 2408-2412
- **Direct optical measurement of stresses inside circularized DNA loops** *51st Annual Meeting of the Biophysical-Society*  
Siegel, J., Shroff, H., Sivak, D., McEvoy, A., Spakowitz, A., Geissler, P., Liphardt, J.  
CELL PRESS.2007: 350A-350A
- **The great hunt for extra compliance** *Biophysical journal*  
Liphardt, J.  
2007; 12 (93): 4099
- **Simple electric circuits describe the motility and proton motive force of E. coli with proteorhodopsin** *BIOPHYSICAL JOURNAL*  
Greenfield, D., Walter, J. M., Bustamante, C., Liphardt, J.  
2007: 334A-334A
- **Nanowire assembly, eg for optical probes, comprises optically trapping high aspect ratio semiconductor nanowire with infrared single-beam optical trap and attaching nanowire to organic or inorganic structure**  
Pauzauskie, P., Radenovic, A., Trepagnier, E., Liphardt, J., Yang, P.  
2007
- **Electrophoretic threading kinetics of optically trapped DNA through synthetic nanopores.** *BIOPHYSICAL JOURNAL*  
Trepagnier, E. H., Radenovic, A., Liphardt, J. T.  
2007: 164A-164A
- **DNA pre-stress increases IHF-DNA affinity and rescues binding affinity for mutated sequences.** *BIOPHYSICAL JOURNAL*  
Siu, M., Shroff, H., Siegel, J., McEvoy, A., Maris, A., Spakowitz, A.  
2007: 233A-233A
- **ZnO-Al2O3 and ZnO-TiO2 core-shell nanowire dye-sensitized solar cells** *JOURNAL OF PHYSICAL CHEMISTRY B*  
Law, M., Greene, L. E., Radenovic, A., Kuykendall, T., Liphardt, J., Yang, P.  
2006; 110 (45): 22652-22663
- **Optical trapping and integration of semiconductor nanowire assemblies in water** *NATURE MATERIALS*  
Pauzauskie, P. J., Radenovic, A., Trepagnier, E., Shroff, H., Yang, P. D., Liphardt, J.  
2006; 5 (2): 97-101
- **Calibration of dynamic molecular rule based on plasmon coupling between gold nanoparticles** *NANO LETTERS*  
Reinhard, B. M., Siu, M., Agarwal, H., Alivisatos, A. P., Liphardt, J.  
2005; 5 (11): 2246-2252

- **Biocompatible force sensor with optical readout and dimensions of 6 nm(3)** *NANO LETTERS*  
Shroff, H., Reinhard, B. M., Siu, M., Agarwal, H., Spakowitz, A., Liphardt, J.  
2005; 5 (7): 1509-1514
- **The nonequilibrium thermodynamics of small systems** *PHYSICS TODAY*  
Bustamante, C., Liphardt, J., Ritort, F.  
2005; 58 (7): 43-48
- **A molecular ruler based on plasmon coupling of single gold and silver nanoparticles** *NATURE BIOTECHNOLOGY*  
Sonnichsen, C., Reinhard, B. M., Liphardt, J., Alivisatos, A. P.  
2005; 23 (6): 741-745
- **Nanoscale sensors of mechanical force** *BIOPHYSICAL JOURNAL*  
Shroff, H., Reinhard, B., Siu, M., Liphardt, J.  
2005; 1 (88): 364A-364A
- **Experimental test of Hatano and Sasa's nonequilibrium steady-state equality** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Trepagnier, E. H., Jarzynski, C., Ritort, F., Crooks, G. E., Bustamante, C. J., Liphardt, J.  
2004; 101 (42): 15038-15041
- **Identifying kinetic barriers to mechanical unfolding of the T-thermophila ribozyme** *SCIENCE*  
Onoa, B., Dumont, S., Liphardt, J., Smith, S. B., Tinoco, I., Bustamante, C.  
2003; 299 (5614): 1892-1895
- **Identifying kinetic barriers to mechanical unfolding of the T. thermophila ribozyme** *Science*  
Onoa, B., Dumont, S., Liphardt, J., Smith, S. B., Tinoco, I., Bustamante, C.  
2003; 5614 (299): 1892-1895
- **Equilibrium information from nonequilibrium measurements in an experimental test of Jarzynski's equality** *SCIENCE*  
Liphardt, J., Dumont, S., Smith, S. B., Tinoco, I., Bustamante, C.  
2002; 296 (5574): 1832-1835
- **Experimental test of Jarzynski's equality: Recovering equilibrium information from nonequilibrium measurements** *Biophysical journal*  
Liphardt, J. T., Dumont, S., Smith, S. B., Tinoco, I., Bustamante, C.  
2002; 1 (82): 193A-194A
- **Mechanical unfolding of individual T. thermophila ribozymes** *BIOPHYSICAL JOURNAL*  
Onoa, B., Liphardt, J. T., Dumont, S., Smith, S. B., Tinoco, I., Bustamante, C. J.  
2002; 1 (82): 49A-49A
- **Reversible unfolding of single RNA molecules by mechanical force** *SCIENCE*  
Liphardt, J., Onoa, B., Smith, S. B., Tinoco, I., Bustamante, C.  
2001; 292 (5517): 733-737
- **RNA tertiary and secondary unfolding monitored by mechanical stretching of single molecules** *BIOPHYSICAL JOURNAL*  
Onoa, G. B., Liphardt, J. T., Smith, S. B., Tinoco, I., Bustamante, C. J.  
2001; 1 (80): 155A-155A
- **Single-molecule studies of DNA mechanics** *CURRENT OPINION IN STRUCTURAL BIOLOGY*  
Bustamante, C., Smith, S. B., Liphardt, J., Smith, D.  
2000; 10 (3): 279-285
- **The role of RNA pseudoknot stem 1 length in the promotion of efficient-1 ribosomal frameshifting** *JOURNAL OF MOLECULAR BIOLOGY*  
Naphine, S., Liphardt, J., Bloys, A., Routledge, S., Brierley, I.  
1999; 288 (3): 305-320
- **Evidence for an RNA pseudoknot loop-helix interaction essential for efficient-1 ribosomal frameshifting** *JOURNAL OF MOLECULAR BIOLOGY*  
Liphardt, J., Naphine, S., Kontos, H., Brierley, I.  
1999; 288 (3): 321-335