

**SHIXIN LIU**  
The Rockefeller University  
1230 York Avenue, New York, NY 10065, USA  
Tel: (212) 327-8844  
Fax: (212) 327-8845  
Email: shixinliu@rockefeller.edu  
Website: <http://liu.rockefeller.edu>  
Twitter: @InLiuOfBulkExps

### **Independent Position**

2016-present    Assistant Professor, The Rockefeller University  
Head, Laboratory of Nanoscale Biophysics and Biochemistry  
Faculty Member, Tri-Institutional PhD Program in Chemical Biology  
Faculty Member, Tri-Institutional MD-PhD Program

### **Academic Training**

	<b>Role / Degree:</b>	<b>Institution and Location:</b>	<b>Advisor:</b>
2010-2015	Postdoc, Biophysics	UC Berkeley, CA, USA	Carlos J. Bustamante
2003-2009	Ph.D., Chemistry	Harvard University, MA, USA	Xiaowei Zhuang
1998-2003	B.S., Biology	USTC, Hefei, China	Mian Wu

### **Honors**

2020            Pershing Square Sohn Prize  
2018            NIH Director's New Innovator Award  
2018            Sinsheimer Scholar  
2017            Kimmel Scholar  
2017            March of Dimes Basil O'Connor Scholar  
2017            Quadrivium Award for Innovative Research in Epigenetics  
2016            Monique Weill-Caulier Career Scientist Award  
2013            NIH Pathway to Independence Award  
2012            Biophysical Society Education Travel Award  
1998            #1 Ranked Freshman in the Special Class for the Gifted Young, USTC

### **Publications**

(\* denotes equal contribution; # denotes corresponding author)

#### *Research articles*

1. Mickolajczyk KJ\*, Shelton PM\*, Grasso M\*, Cao X\*, Warrington SR, Aher A, **Liu S#**, Kapoor TM#. Force-dependent stimulation of RNA unwinding by SARS-CoV-2 nsp13 helicase. *Biophys J* 2020 Dec 17:S0006-3495(20)33210-0. doi:10.1016/j.bpj.2020.11.2276. Online ahead of print
2. Leicher R, Ge EJ\*, Lin X\*, Reynolds MJ\*, Xie W, Walz T, Zhang B#, Muir TW, **Liu S#**. (2020) Single-molecule and in silico dissection of the interaction between Polycomb repressive complex 2 and chromatin. *Proc Natl Acad Sci U S A* 117, 30465-30475. doi:10.1073/pnas.2003395117
3. Mei L, de los Reyes SE, Reynolds MJ, Leicher R, **Liu S**, Alushin GM. (2020) Molecular mechanism for direct actin force-sensing by  $\alpha$ -catenin. *eLife* 9, e62514. doi:10.7554/eLife.62514

4. Wang L\*, Johnson ZL\*, Wasserman MR\*, Levring J\*, Chen J#, **Liu S#**. (2020) Characterization of the kinetic cycle of an ABC transporter by single-molecule and cryo-EM analyses. *eLife* 9, e56451. doi:10.7554/eLife.56451
5. Li S, Zheng EB, Zhao L, **Liu S#**. (2019) Nonreciprocal and conditional cooperativity directs the pioneer activity of pluripotency transcription factors. *Cell Rep* 28, 2689-2703. doi:10.1016/j.celrep.2019.07.103
6. Wasserman MR\*, Schauer GD\*, O'Donnell ME#, **Liu S#**. (2019) Replication fork activation is enabled by a single-stranded DNA gate in CMG helicase. *Cell* 178, 600-611. doi:10.1016/j.cell.2019.06.032
7. Ju X, Li D, **Liu S#**. (2019) Full-length RNA profiling reveals pervasive bidirectional transcription terminators in bacteria. *Nat Microbiol* 4, 1907-1918. doi:10.1038/s41564-019-0500-z
8. Zheng Q, Omans ND, Leicher R, Osunsade A, Agustinus AS, Finkin-Groner E, D'Ambrosio H, Liu B, Chandarlapaty S, **Liu S**, David Y. (2019) Reversible histone glycation is associated with disease-related changes in chromatin architecture. *Nat Commun* 10, 1289. doi:10.1038/s41467-019-09192-z
9. Tafoya S, Large SJ, **Liu S**, Bustamante C, Sivak DA. (2019) Using a system's equilibrium behavior to reduce its energy dissipation in nonequilibrium processes. *Proc Natl Acad Sci U S A* 116, 5920-5924. doi:10.1073/pnas.1817778116
10. Wang L, Mo CY, Wasserman MR, Rostøl JT, Marraffini LA, **Liu S#**. (2019) Dynamics of Cas10 govern discrimination between self and non-self in type III CRISPR-Cas immunity. *Mol Cell* 73, 278-290. doi:10.1016/j.molcel.2018.11.008
11. Tafoya S, **Liu S**, Castillo JP, Atz R, Morais MC, Grimes S, Jardine PJ, Bustamante C. (2018) Molecular switch-like regulation enables global subunit coordination in a viral ring ATPase. *Proc Natl Acad Sci U S A* 115, 7961-7966. doi:10.1073/pnas.1802736115
12. Cheng B, Wu S, **Liu S**, Rodriguez-Aliaga P, Yu J, Cui S. (2015) Protein denaturation at a single-molecule level: the effect of nonpolar environments and its implications on the unfolding mechanism by proteases. *Nanoscale* 7, 2970-2977. doi:10.1039/c4nr07140a
13. **Liu S\***, Chistol G\*, Hetherington CL\*, Tafoya S, Aathavan K, Schnitzbauer J, Grimes S, Jardine PJ, Bustamante C. (2014) A viral packaging motor varies its DNA rotation and step size to preserve subunit coordination as the capsid fills. *Cell* 157, 702-713. doi:10.1016/j.cell.2014.02.034
14. Dangkulwanich M\*, Ishibashi T\*, **Liu S\***, Kireeva ML, Lubkowska L, Kashlev M, Bustamante C. (2013) Complete dissection of transcription elongation reveals slow translocation of RNA polymerase II in a linear ratchet mechanism. *eLife* 2, e00971. doi:10.7554/eLife.00971
15. Chistol G\*, **Liu S\***, Hetherington CL, Moffitt JR, Grimes S, Jardine PJ, Bustamante C. (2012) High degree of coordination and division of labor among subunits in a homomeric ring ATPase. *Cell* 151, 1017-1028. doi:10.1016/j.cell.2012.10.031
16. **Liu S\***, Harada BT\*, Miller JT, Le Grice SF, Zhuang X. (2010) Initiation complex dynamics direct the transitions between distinct phases of early HIV reverse transcription. *Nat Struct Mol Biol* 17, 1453-1460. doi:10.1038/nsmb.1937
17. Chung S, Wendeler M, Rausch JW, Beilhartz G, Gotte M, O'Keefe BR, Bermingham A, Beutler JA, **Liu S**, Zhuang X, Le Grice SF. (2010) Structure-activity analysis of vinylogous urea inhibitors of human immunodeficiency virus-encoded ribonuclease H. *Antimicrob Agents Chemother* 54, 3913-3921. doi:10.1128/AAC.00434-10
18. **Liu S**, Abbondanzieri EA, Rausch JW, Le Grice SF, Zhuang X. (2008) Slide into action: dynamic shuttling of HIV reverse transcriptase on nucleic acid substrates. *Science* 322, 1092-1097. doi:10.1126/science.1163108
19. **Liu S**, Bokinsky G, Walter NG, Zhuang X. (2007) Dissecting the multistep reaction pathway of an RNA enzyme by single-molecule kinetic "fingerprinting". *Proc Natl Acad Sci U S A* 104, 12634-12639. doi:10.1073/pnas.0610597104
20. Bokinsky G, Nivón LG, **Liu S**, Chai G, Hong M, Weeks KM, Zhuang X. (2006) Two distinct binding modes of a protein cofactor with its target RNA. *J Mol Biol* 361, 771-784. doi:10.1016/j.jmb.2006.06.048
21. Song Z, **Liu S**, He H, Hoti N, Wang Y, Feng S, Wu M. (2004) A single amino acid change (Asp53->Ala53) converts Survivin from anti-apoptotic to pro-apoptotic. *Mol Biol Cell* 15, 1287-1296. doi:10.1091/mbc.e03-07-0512

### Review articles

1. Bustamante CJ#, Chemla YR#, **Liu S#**, Wang MD#. Optical tweezers in single-molecule biophysics. *Nature Reviews Methods Primers* (in press)
2. Wasserman MR, **Liu S#**. (2019) A tour de force on the double helix: exploiting DNA mechanics to study DNA-based molecular machines. *Biochemistry* 58, 4667-4676. doi:10.1021/acs.biochem.9b00346
3. **Liu S\***, Chistol G\*, Bustamante C#. (2014) Mechanical operation and intersubunit coordination of ring-shaped molecular motors: insights from single-molecule studies. *Biophys J* 106, 1844-1858. doi:10.1016/j.bpj.2014.03.029

### Book chapters

1. **Liu S#**, Tafoya S, Bustamante C#. (2017) Deciphering the molecular mechanism of the bacteriophage  $\phi$ 29 DNA packaging motor. In *Optical Tweezers: Methods and Protocols* (eds. Gennerich A, Humana Press), *Methods Mol Biol* vol 1486, pp 343-355. doi:10.1007/978-1-4939-6421-5\_13
2. Rausch JW, Abbondanzieri EA, **Liu S**, Zhuang X, Le Grice SF. (2010) Retrovirus replication: new perspectives on enzyme and substrate dynamics. In *Recent Advances in Human Retroviruses: Principles of Replication and Pathogenesis* (eds. Lever A, Jeang KT, Berkhout B. World Scientific), pp 307-343. doi:10.1142/9789814295314\_0010

### Patent

**Liu S**, Ju X. *US 62/851,969 application*. Methods of full-length RNA profiling

### Invited talks

Jun 2021	Helicases and Nucleic Acid-based Machines Meeting, Aussois, France ( <i>Pending</i> )
Feb 2020	Biophysical Society Annual Meeting, Nanoscale Biophysics Subgroup, San Diego, CA
Jul 2019	Gordon Research Conference on Mechanisms of Microbial Transcription, Lewiston, ME
Jul 2019	Biophysical Society Thematic Meeting on Single-Molecule Biology, Lima, Peru
Jun 2019	Dynamic Single-Molecule Meeting, Tianjin, China
Apr 2019	Department of Biology, Johns Hopkins University, Baltimore, MD
Mar 2019	Cell Press LabLinks on Single Molecule Technologies, New York City
Jan 2019	Molecular Biophysics Seminar Series, New York University, NY
Sep 2018	Department of Chemistry, Georgetown University, DC
Jul 2018	Telluride Workshop on Chromatin Dynamics, Telluride, CO
Jun 2018	Bionanoscience Colloquium, Delft University of Technology, Netherlands
Mar 2018	IAS Focused Program on Mechanisms of Transcription, HKUST, Hong Kong
Nov 2017	Genome Integrity Discussion Group, New York Academy of Sciences, NY
Nov 2016	Biophysics Seminar, University of Maryland, College Park, MD
Jul 2015	Peking Union Medical College, Beijing, China
Jun 2015	Tsinghua University, Beijing, China
Jun 2015	Peking University, Beijing, China
Fall 2014 - Spring 2015	California Institute of Technology; University of California, San Diego; University of Texas Southwestern Medical Center; Massachusetts Institute of Technology; University of Michigan; The Rockefeller University ( <i>Job search talks</i> )
Jan 2013	Shanghai Jiao Tong University, Shanghai, China
Jul 2009	University of Science and Technology of China, Hefei, China

## **Professional activities**

Member, Biophysical Society (2005-present)

Journal article reviewer for *Cell*, *eLife*, *JACS*, *Mol Cell*, *Nature*, *Nat Commun*, *Nat Microbiol*, *NAR*, *PLoS One*, *PNAS*, *Science*, *Sci Rep*

Ad hoc proposal reviewer for *HK Research Grants Council*, *Novo Nordisk Foundation*, *Wellcome Trust*

--

*Updated 02/22/2021*