Stephanie L. Johnson, Ph.D.

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Profile

Scientist with a broad interdisciplinary background in experimental biophysics, biochemistry, and computation.

- 12 years of experience designing and implementing projects that bring cutting-edge tools from physics, microscopy, and machine learning to bear on difficult problems in biology.
- Exceptional quantitative and critical reasoning skills, trained through Ph.D. work in an applied physics lab at the California Institute of Technology, and postdoctoral work in quantitative enzymology at the University of California, San Francisco.
- Accustomed to mastering new techniques and new topics from diverse fields quickly and routinely, and to communicating and collaborating between fields, due to a highly interdisciplinary career.
- Strong record of productivity, with: 10 publications, one recognized by the Faculty of 1000; two open-source software packages released on GitHub; and a Best Poster Prize at an American Society for Biochemistry and Molecular Biophysics symposium.

Education

California Institute of Technology
Ph.D. in Biochemistry and Molecular Biophysics 2012

Stanford University
B.S. with Distinction and Honors in Biology 2006
Minor in Symbolic Systems combining computer science and linguistics (self-designed)

Skills

Communication: Strong verbal and written communication skills, especially across disciplines; wrote three successful grants and have given talks at both biophysics and biology conferences.

Management: Extensive experience teaching and mentoring students, and guiding students' research projects both one-on-one and in small teams; and in taking projects from concept to completion independently, with minimal oversight.

Methodology: PCR, cloning, protein purification from *E. coli* and *S. cerevisiae*, site-specific protein and DNA labeling, surface attachment chemistry, and standard *in vitro* chromatin reconstitution techniques, including large-scale nucleosome assembly from purified octamer and DNA.

Assays: Gel-based and fluorescence-based analytical techniques, and single-molecule approaches (tethered particle motion, single-molecule FRET, optical trapping).

Microscopy: Light microscopy (including differential interference contrast) and total internal reflection fluorescence microscopy. Experience with microscopy automation via Micro-Manager programming.

Programming: Proficient in Matlab. Experience with Python (numpy, scipy, matplotlib).

Computation/Modeling: Training in statistical mechanics, and in analyzing reaction kinetics at both ensemble and single molecule levels. Experience with statistical modeling and inference, including Expectation-Maximization and Markov chain Monte Carlo fitting methods for hidden Markov models.

Research experience

University of California, San Francisco San Francisco, CA
Postdoctoral Scholar in Biochemistry and Biophysics February 2013 – present
Advisor: Geeta Narlikar
Project: Biophysical and biochemical characterization of chromatin remodeling enzymes.

- Primary responsibility was to establish the biophysical assay of single molecule FRET in Dr. Narlikar's biochemistry lab, which had no prior experience with such techniques, and to

use this assay to dissect the mechanisms and dynamics of complex enzymes that are relatively refractory to conventional biochemistry approaches.

- Developed fast, robust, open source analysis software for single molecule FRET and microscopy image analysis.
- Direct supervisor for two San Francisco State masters students.
- Wrote a successful Leukemia and Lymphoma Society fellowship and an NIH R01 grant.
- Resulted in a Best Poster Prize at a 2016 American Society for Biochemistry and Molecular Biophysics special symposium, and 2 publications, plus 3 submitted/in preparation.

California Institute of Technology Pasadena, CA
Postdoctoral Scholar in Applied Physics May 2012 – December 2012
Ph.D. in Biochemistry and Molecular Biophysics September 2006 – April 2012
Advisor: Rob Phillips
Thesis: DNA mechanics and transcriptional regulation in the *E. coli lac* operon.

- Extended the single molecule technique of tethered particle motion, with a statistical mechanical model of the system, to make robust, quantitative measurements of DNA-protein binding constants and of the mechanical properties of DNA.
- Wrote a successful NSF Graduate fellowship to support this work.
- Culminated in five publications, one recognized by the Faculty of 1000 as being of special significance in its field.

Stanford University Stanford, CA
Undergraduate Research Assistant June 2004 – May 2006
Advisor: Steven Block
Honors thesis project: Worked toward a single-molecule optical trapping assay for studying the ability of *E. coli* RNA Polymerase to transcribe through DNA-bound factors.

Software

Traces (github.com/stephlj/Traces), for extracting time course data from microscopy images of single-molecule fluorescence resonance energy transfer (FRET).

Slopey (github.com/stephlj/slopey), continuous-time hidden Markov model for quantifying non-instantaneous state transitions in noisy time course data with sub-camera-frame resolution.

Awards/ Honors

University of California, San Francisco
Leukemia and Lymphoma Society Career Development Program Fellow (2014-2017)
Best Poster Prize at the American Society for Biochemistry and Molecular Biology special symposium, Transcriptional Regulation: Chromatin and RNA Polymerase II (2016)

California Institute of Technology
First-author publication Johnson et al (2012) recommended by the Faculty of 1000 (2012)
National Science Foundation Graduate Research Fellow (2008-2011)
Virginia Gilloon Fellowship for Women in Science and Engineering (2006)

Stanford University
Phi Beta Kappa (2006)

Teaching / Mentoring

2015 - present: Mentored a younger female graduate student as she transitions from a cell biology background to a biophysics lab.

2014 - 2016: Direct supervisor for two San Francisco State masters students as part of a joint UCSF–SF State program to recruit under-represented minorities into post-graduate STEM programs. One student is now a Clinical Trials Associate at ProTrials Research Inc and is applying to medical school; the other is an Associate Scientist at SutroVax.

2007 - 2012: Mentored three younger graduate students at Caltech representing minorities in the sciences who are now in postdoctoral positions at the NIH and at two University of California schools.

2009, 2010, 2012: Teaching assistant for BE/APh 161: Physical Biology of the Cell at the California Institute for Technology (graduate course in the application of statistical mechanics to problems in biology). Head TA 2009 and 2010.

2007, 2008, 2009, 2011: Teaching assistant for BE/APh 262: Physical Biology Bootcamp at the California Institute for Technology (week-long intensive intensive introductory biophysics lab course). Responsibilities included giving lectures on Matlab and basic molecular biology, and leading 3-4 person teams in exploratory biophysics projects.

2008: Teaching assistant for Bi 1: Biology and Biophysics of Viruses at the California Institute for Technology (introductory biology for non-majors).

2006: Teaching assistant for Bi/Ch 110: Introduction to Biochemistry at the California Institute for Technology.

Funding

National Institutes of Health 2016 – 2018
PI: Dr. Geeta Narlikar R01GM073767
Wrote substantial portions of this R01, based on my postdoctoral work in the Narlikar lab.

Leukemia and Lymphoma Society Career Development Program 2014 – 2017
PI: Dr. Stephanie Johnson
Postdoctoral fellowship; $55,000 for each of three years.

National Science Foundation 2008 – 2011
PI: Stephanie Johnson
Graduate fellowship; $40,500 for each of three years.

Virginia Gilloon Fellowship for Women in Science and Engineering 2006
California Institute of Technology internal fellowship for graduate students; $53,595 for one year.

Presentations

Oral Presentations

"Regulation of rapid nucleosome sliding by the INO80 chromatin remodeling complex," at the 2018 Biophysics of Nuclear Organization and Function QB3 Symposium, Berkeley, CA, July 24, 2018.

"Mechanism of nucleosome sliding in yeast INO80 as revealed by single-molecule FRET," at the EMBO conference The Nucleosome: From Atoms to Genomes, at EMBL in Heidelberg, Germany, August 31st, 2017.

"Protomer coordination in a dimeric chromatin remodeling motor," Best Poster Prize talk at the 2016 American Society for Biochemistry and Molecular Biology special symposium on Transcriptional Regulation: Chromatin and RNA Polymerase II, Snowbird, UT, October 10th, 2016.

"Transcription Factor Mediated Looping and the Role of DNA Flexibility," at the Coarse-Grain Mechanics of DNA: Part II From Electrons to Oligomers CECAM conference at the Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland, September 1st, 2011.

Recent Poster Presentations

"Regulation of rapid nucleosome sliding by substrate cues and accessory subunits in the yeast INO80 chromatin remodeling complex," with Zhou C.Y., Lee L.J., Longhurst A.D., Johnson M.J., and Narlikar G.J., at the 2018 Genome Biophysics: Integrating Genomics and Biophysics to Understand Structural and Functional Aspects of Genomes meeting, Santa Cruz, CA, August 22, 2018.

"Mechanism of nucleosome sliding in yeast INO80 as revealed by single-molecule FRET," with Zhou C.Y., Lee L.J., Longhurst A., Johnson M.J., and Narlikar G.J., at the 2018 annual Biophysical Society Meeting, San Francisco, CA, February 2th, 2018.

"Single-molecule mechanistic dissection of ATP-dependent chromatin remodeling," with Johnson M.J., Gamarra N.I., and Narlikar G.J., at the 2016 American Society for Biochemistry

and Molecular Biology special symposium on Transcriptional Regulation: Chromatin and RNA Polymerase II, Snowbird, UT, October 7th, 2016. *Winner of one of two Best Poster awards.*

"Single-molecule mechanistic dissection of a chromatin remodeling motor," with Johnson M.J., Gamarra N.I., and Narlikar G.J., at the 2016 annual Biophysical Society Meeting, Los Angeles, CA, February 28th, 2016.

"The effect of poly(dA:dT) tracts on DNA flexibility and nucleosome positioning", with Liu C., Widom J., and Phillips R., at the first annual NCI Physical Sciences-Oncology Center Network Investigators' Meeting, National Harbor, MD, April 5th, 2010.

Publications

Peer-reviewed publications

Gamarra N., **Johnson S.L.**, Trnka, M.J., Burlingame, A.L., and Narlikar G.J. (2018) The nucleosomal acidic patch relieves auto-inhibition by the ISWI remodeler SNF2h. *eLIFE* 7: e35322.

Zhou C.Y.*, **Johnson S.L.***, Lee L.J., Longhurst A.D., Beckwith S., Johnson M.J., Morrison A., and Narlikar G.J. (2018) The yeast INO80 complex operates as a tunable DNA length-sensitive switch to regulate nucleosome sliding. *Mol Cell* 69:677-688. **(* equal contribution)**

Zhou C.Y., **Johnson S.L.**, Gamarra N.I., and Narlikar G.J. (2016) Mechanisms of ATP-dependent chromatin remodeling motors. *Annu Rev Biophys* 45: 153-81.

Chen Y.-J.*, **Johnson S.***, Mulligan P.*, Spakowitz A., and Phillips R. (2014) Modulation of DNA loop lifetimes by the free energy of loop formation. *Proc Natl Acad Sci* 111(49): 17402-17407. PMCID: PMC4267329 **(* equal contribution)**

Johnson S., van de Meent J.-W., Phillips R., Wiggins C., and Lindén M. (2014) Multiple Lac-mediated loops revealed by Bayesian statistics and tethered particle motion. *Nucleic Acids Res* 42(16): 10265-10277. PMCID: PMC4176382

Johnson S.*, Chen Y.-J.*, and Phillips R. (2013) Poly(dA:dT)-rich DNAs are highly flexible in the context of DNA looping. *PLOS ONE* 8(10): e75799. PMCID: PMC3795714 **(* equal contribution)**

Boedicker J., Garcia H.G., **Johnson S.**, and Phillips R. (2013) DNA sequence-dependent mechanics and protein-assisted bending in repressor-mediated loop formation. *Physical Biology* 10(6): 066005. PMCID: 3915735.

Johnson S., Lindén M., and Phillips R. (2012) Sequence dependence of transcription factor-mediated DNA looping. *Nucleic Acids Res* 40(16): 7728-7738. PMCID: PMC3439888. *Recommended by the Faculty of 1000 as being of special significance in its field.*

Submitted manuscripts

Armache J.-P.*, Gamarra N.*, **Johnson S.L.**, Leonard J.D., Wu S., Narlikar G.J., and Cheng Y. (2019) Electron cryo-microscopy structure of remodeler-nucleosome intermediates suggest allosteric control through the nucleosome. *bioRxiv preprint.* DOI: 10.1101/550970. (*equal contribution)

Gebala M., **Johnson S.L.**, Narlikar G.J., and Herschlag D. (2019) Ion counting demonstrates a high electrostatic potential of the nucleosome. *bioRxiv preprint.* DOI: 10.1101/514471.