



FACULTY OF
THE CENTER FOR
BIOENGINEERING

CBEPeople



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Department of Mechanical Engineering
University of California
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EDUCATION

Harvard University
Ph.D. Physics (2003)

University of Pennsylvania
M.S. Physics (1999)

Lehigh University
B.S. Physics (1997)

HONORS AND AWARDS

Fulbright Scholar Award; Paris, France
(2015)

NSF CAREER Award (2013)

University of California Regents Junior
Faculty Fellowship (2010)

Burroughs Wellcome Career Award at
the Scientific Interface (2005)

RESEARCH OVERVIEW

The Valentine group seeks to understand how forces are generated and transmitted in living materials, and how these forces control biological outcomes. This highly interdisciplinary work lies at the intersection of engineering, physics, biology and chemistry.

To investigate the biophysical and biochemical basis of cellular mechanics, we use a wide variety of experimental techniques, including: high-precision optical trapping to probe single molecules of motor and crosslinking proteins; micromechanical manipulation of cytoskeletal networks that are reconstituted from purified components or assembled in cell extracts; advanced fluorescence imaging of the self-assembly of large protein complexes; and ultrastructural analysis of biopolymers.

To extend this work to cells and tissues, we have developed a suite of high-force, low-cost magnetic tweezers devices and custom load frames that enable precise manipulation of biological materials and are compatible with a wide range of imaging modalities. We are also developing novel methods of measuring interaction and deformation forces within living cells, and are developing new classes of man-made materials that capture the extraordinary properties of living systems, including the ability to respond to stimuli, move, and heal.

Group Website: <https://me.ucsb.edu/valentinelab/>

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HONORS AND AWARDS

Damon Runyon Cancer
Research Foundation
Postdoctoral Fellowship
(2004)

Selected Publications

1. Emmanouela Filippidi, Daniel G. DeMartini, Paula Malo de Molina, Eric W. Danner, Juntae Kim, Matthew E. Helgeson, J. Herbert Waite and Megan T. Valentine. "The microscopic network structure of mussel (*Mytilus*) adhesive plaques" **Journal of the Royal Society Interface** 12(113) 20150827 (2015).
2. Kenneth W. Desmond, Nicholas A. Zacchia, J. Herbert Waite, and Megan T. Valentine. "Dynamics of Mussel Plaque Detachment" **Soft Matter** 11 6832-6839 (2015)
3. Christian Vaca, Roie Shlomovitz, Yali Yang, Megan T. Valentine, and Alex J. Levine. "Bond breaking dynamics in semiflexible networks under load" **Soft Matter** 11 4899-4911 (2015).
4. Nicholas A. Zacchia and Megan T. Valentine. "Design and optimization of arrays of neodymium iron boron-based magnets for magnetic tweezers applications" **Review of Scientific Instruments** 86 053704 (2015).
5. Benjamin J. Lopez and Megan T. Valentine. "Mechanical effects of EB1 on microtubules depend on GTP hydrolysis state and presence of paclitaxel" **Cytoskeleton** 71:530-541 (2014).
6. Dezhi Yu, Nichole E. Lapointe, Elmer Guzman, Veronica Pessino, Leslie Wilson, Stuart C. Feinstein, and Megan T. Valentine, "Tau Proteins Harboring Neurodegeneration-Linked Mutations Impair Kinesin Translocation in vitro" **Journal of Alzheimer's Disease** 39(2):301-314 (2014).
7. Yali Yang, Mo Bai, William S. Klug, Alex J. Levine, and Megan T. Valentine, "Microrheology of highly crosslinked microtubule networks is dominated by force-induced crosslinker unbinding" **Soft Matter** 9:383-393 (2013).
8. Bugra Kaytanli and Megan T. Valentine, "Evolute-based Hough transform method for characterization of ellipsoids" **Journal of Microscopy** 249:159-164 (2013).
9. Dezhi Yu, Veronica Pessino, Steve Kuei, and Megan T. Valentine, "Mechanical and functional properties of epothilone-stabilized microtubules" **Cytoskeleton** 70:74-84 (2013).
10. David Valdman, Benjamin J. Lopez, Megan T. Valentine, and Paul J. Atzberger, "Force spectroscopy of complex biopolymers with heterogeneous elasticity" **Soft Matter** 9:772-778 (2013).
11. Yali Yang, Jun Lin, Bugra Kaytanli, Omar A. Saleh, and Megan T. Valentine, "Direct correlation between creep compliance and deformation in entangled and sparsely crosslinked microtubule networks" **Soft Matter** 8:1776-1784 (2012).