Lauren D. Zarzar

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Education

Harvard University, Cambridge, MA
Ph.D., Chemistry 2013
Advisor: Prof. Joanna Aizenberg
Dissertation: "Dynamic Hybrid Materials: Hydrogel Actuators and Catalytic Microsystems"

University of Pennsylvania, Philadelphia, PA
B.A., Chemistry from the College of Arts and Sciences 2008
B.S., Economics from the Wharton School 2008

Awards

National Science Foundation East Asia and Pacific Summer Institute Fellowship 2013
American Chemical Society AkzoNobel Student Award in Applied Polymer Science 2011
National Defense Science and Engineering Graduate Fellowship 2010
National Science Foundation Graduate Research Fellowship 2010
Best Poster Award, Materials Research Society National Meeting 2009
American Chemical Society Achievement Award, Philadelphia Section 2008
National Science Foundation Research Experiences for Undergraduates Fellowship 2007
Novartis Undergraduate Summer Research Fellowship 2006

Research Experience

Massachusetts Institute of Technology, Department of Chemistry, Cambridge, MA 2013 – present
Postdoctoral Research Advisor: Prof. Timothy Swager
Investigated the chemical and physical properties of complex emulsions that dynamically reconfigure between encapsulated and Janus morphologies in response to changes in the balance of interfacial tensions

University of Tokyo, Department of Chemistry and Biotechnology, Tokyo, Japan Summer 2013
Research Advisor: Prof. Takashi Kato
Explored the self-assembly of functional liquid crystals and liquid crystal polymers within microscale patterned surface confinement

Harvard University, Department of Chemistry and Chemical Biology, Cambridge, MA 2008 – 2013
Graduate Research Advisor: Prof. Joanna Aizenberg
Investigated bio-inspired, chemo-mechanical actuation systems in which stimuli-responsive hydrogel drives the controlled movement of surface-attached, high-aspect-ratio polymeric microstructures

Sandia National Laboratories, Albuquerque, NM Summers 2010 – 2012
Collaborators: Dr. Bryan Kaehr and. Prof. C. Jeffrey Brinker
Conducted research in the Advanced Materials Laboratory in a collaboration with the National Institute for Nano Engineering developing methods for multiphoton patterning of responsive hydrogels and metal catalysts as well as exploring their subsequent integration into functional 3D microsystems

Columbia University, Nanoscale Science and Engineering Center, New York, NY Summer 2007
Research Experiences for Undergraduates Advisor: Prof. Shalom Wind
Studied the selective synthesis of carbon nanotubes by patterned hexabenzocoronene on ruthenium nanodots

University of Pennsylvania, Department of Chemistry, Philadelphia, PA 2005 – 2008
Undergraduate Research Advisor: Prof. So-Jung Park
Researched the synthesis and properties of gold nanoclusters, fluorescent gold-thiolate complexes, and quantum dot/diblock copolymer assemblies

Teaching Experience

Teaching Fellow, Harvard University, Cambridge, MA

- Science of the Physical Universe 27: Science and Cooking – from Haute Cuisine to Soft Matter Science 2012
- Applied Physics 235: Chemistry in Materials Science and Engineering 2010, 2012
- Physical Sciences 1: Chemical Bonding, Energy, and Reactivity: An Introduction to the Physical Sciences 2009, 2011

Teaching Assistant, University of Pennsylvania, Philadelphia, PA

- Chem 223: Advanced Physical Chemistry Lab 2008
- Chem 054: General Chemistry Lab 2007

Publications

12. **L. D. Zarzar**, V. Sresht, E. M. Sletten, J. A. Kalow, D. Blankschtein, T. M. Swager, "Dynamically reconfigurable complex emulsions via tunable interfacial tensions." *Nature* **2015**, *518*, 520-524.
11. B. Hashmi, **L. D. Zarzar**, T. Mammoto, A. Mammoto, A. Jiang, J. Aizenberg, D. E. Ingber, "Developmentally-inspired shrink-wrap polymers for mechanical induction of tissue differentiation." *Advanced Materials* **2014**, *26*, 3253-3257.
10. **L. D. Zarzar**, J. Aizenberg, "Stimuli-responsive chemo-mechanical actuation: a hybrid materials approach." *Accounts of Chemical Research* **2014**, *47*, 530-539.
9. X. He, R. Friedlander, **L. D. Zarzar**, J. Aizenberg, "Chemo-mechanically regulated oscillation of an enzymatic reaction." *Chemistry of Materials* **2013**, *25*, 521-523.
8. **L. D. Zarzar**, Q. Liu, X. He, Y. Hu, Z. Suo, J. Aizenberg, "Multifunctional actuation systems responding to chemical gradients." *Soft Matter* **2012**, *8*, 8289-8293.
7. X. He, M. Aizenberg, O. Kuksenok, **L. D. Zarzar**, A. Shastri, A. Balazs, J. Aizenberg, "Synthetic homeostatic materials with chemo-mechano-chemical self-regulation." *Nature* **2012**, *487*, 214-218.
6. **L. D. Zarzar**, B. S. Swartzentruber, J. Harper, D. Dunphy, C. J. Brinker, J. Aizenberg, B. Kaehr, "Multiphoton lithography of nanocrystalline platinum and palladium for site-specific catalysis in 3D microenvironments." *Journal of the American Chemical Society* **2012**, *134*, 4007-4010.
5. P. Kim, A. K Epstein, M. Khan, **L. D. Zarzar**, D. J. Lipomi, G. M. Whitesides, J. Aizenberg, "Structural transformation by electrodeposition on patterned substrates (STEPS): a new versatile nanofabrication method." *Nano Letters* **2012**, *12*, 527-533.
4. **L. D. Zarzar**, P. Kim, M. Kolle, C. J. Brinker, J. Aizenberg, B. Kaehr, "Direct writing and actuation of 3D-patterned hydrogel pads on micropillar supports." *Angewandte Chemie International Edition* **2011**, *50*, 9356-9360.
3. P. Kim, **L. D. Zarzar**, X. He, A. Grinthal, J. Aizenberg, "Hydrogel-actuated integrated responsive systems (HAIRS): moving towards adaptive materials." *Current Opinion in Solid State & Materials Science* **2011**, *15*, 236-245.
2. **L. D. Zarzar**, P. Kim, J. Aizenberg, "Bio-inspired design of submerged hydrogel-actuated polymer microstructures operating in response to pH." *Advanced Materials* **2011**, *23*, 1442-1446.
1. P. Kim, **L. D. Zarzar**, X. Zhao, A. Sidorenko, J. Aizenberg, "Microbristle in gels: toward all-polymer reconfigurable hybrid surfaces." *Soft Matter* **2010**, *6*, 750-755.

Patents

3. T. M. Swager, E. D. Blankschtein, L. D. Zarzar, V. Sresht, E. M. Sletten, J. A. Kalow, "Compositions and methods for arranging colloid phases." Filed 2014, US Provisional Patent: 62/073915.
2. T. M. Swager, E. D. Blankschtein, L. D. Zarzar, V. Sresht, E. M. Sletten, J. A. Kalow, "Compositions and methods for forming emulsions." Filed 2014, US Provisional Patent: 62/073896.
1. J. Aizenberg, P. Kim, T. Shirman, A. Sutton, L. D. Zarzar, "Environmentally responsive microstructured hybrid actuator assemblies for use in mechanical stimulation of cells." Filed 2013, US Patent: 14/094152.

Conference Proceedings

L. D. Zarzar, P. Kim, M. Kolle, C. J. Brinker, J. Aizenberg, B. Kaehr. "Multiphoton writing of 3D pH and temperature-responsive hydrogels integrated with high-aspect-ratio polymer microbristles." *American Chemical Society Division of Polymeric Materials: Science and Engineering* **2011**, *105*, 25.

L. D. Zarzar, J. Aizenberg, B. Kaehr. "Hydrogel micro-muscles with user-defined 3D shapes." *American Chemical Society Division of Polymeric Materials: Science and Engineering* **2011**, *104*, 150.

P. Kim, L. D. Zarzar, M. Khan, M. Aizenberg, J. Aizenberg. "Environmentally responsive active optics based on hydrogel-actuated deformable mirror arrays." *Proceedings of SPIE* **2011**, 792705-792705-7.

L. D. Zarzar, P. Kim, J. Aizenberg. "Patterned, oscillating, pH-responsive actuation of polymeric microstructures in fluid." *American Chemical Society Division of Polymeric Materials: Science and Engineering* **2010**, *103*, 69.

P. Kim, L. D. Zarzar, A. K. Epstein, J. Aizenberg. "Biomimetic, hierarchical, multidimensional patterning of conductive polymers on high-aspect-ratio microstructures." *American Chemical Society Division of Polymeric Materials: Science and Engineering* **2010**, *103*, 58.

Presentations

L. D. Zarzar, V. Sresht, E. Sletten, J. Kalow, D. Blankschtein, T. Swager, "Dynamically reconfigurable complex droplets via tunable interfacial tensions." American Chemical Society National Meeting, Boston, MA, August 2015. (Oral)

L. D. Zarzar, J. Aizenberg, T. Swager, "Dynamic materials: putting chemistry into motion." American Chemical Society National Meeting, Boston, MA, August 2015. (Poster)

L. D. Zarzar, V. Sresht, E. Sletten, J. Kalow, D. Blankschtein, T. Swager, "Dynamically reconfigurable complex droplets via tunable interfacial tensions." Chemsitry Student Seminar Series, Massachusetts Institute of Technology, Cambridge, MA, April 2015. (Oral)

L. D. Zarzar, J. Aizenberg, "Chemistry in motion: hydrogel actuators and catalytic microsystems." Massachusetts College of Art and Design, Boston, MA, February 2014. (Oral, Invited)

L. D. Zarzar, J. Aizenberg, "Stimuli-responsive chemo-mechanical actuation: a hybrid materials approach." Columbia University, New York, NY, September 2012. (Oral, Invited)

L. D. Zarzar, N. Schade, A. Marblestone, "Programming matter: smart surfaces, molecular machines, and invisibility cloaks." Science in the News, Harvard University, Cambridge, MA, April 2012. (Oral)

L. D. Zarzar, X. He, Q. Liu, P. Kim, Z. Suo, J. Aizenberg, "Patterned and controllable pH-responsive actuation of polymer microstructures." American Chemical Society National Meeting, San Diego, CA, March 2012. (Poster)

L. D. Zarzar, P. Kim, M. Kolle, C. J. Brinker, J. Aizenberg, B. Kaehr, "Multiphoton writing of 3D pH and temperature-responsive hydrogels integrated with high-aspect-ratio polymer microbristles." American Chemical Society National Meeting, Denver, CO, August 2011. (Oral) *Won the AkzoNobel Student Award in Applied Polymer Science*

L. D. Zarzar, P. Kim, J. Aizenberg. "pH-Responsive actuation of polymeric microstructures in fluid." Materials Research Society Fall Meeting, Boston, MA. December 2010. (Oral)

L. D. Zarzar, P. Kim, J. Aizenberg, "Responsive actuation of polymer microstructures in fluid upon pH change." Polydays, Berlin, Germany, October 2010. (Poster)

L. D. Zarzar, P. Kim, J. Aizenberg. "Patterned, oscillating, pH-responsive actuation of polymeric microstructures in fluid." American Chemical Society National Meeting, Boston, MA. August 2010. (Oral)

L. D. Zarzar, P. Kim, X. Zhao, A. Sidorenko, J. Aizenberg. "Hydrogel-actuated high-aspect-ratio polymer nanostructures for reversible pattern generation." Materials Research Society Fall Meeting, Boston, MA. December 2009. (Poster) *Won "Best Poster" award*

Leadership and Outreach

Museum of Science, Boston, MA 2010 – present

Volunteer demonstrator at NanoDays, Inspiring Minds: Meet Women in Science Day, and Making Stuff Day. Participated in the museum's Science Communication Internship in 2010. Developed a hydrogel demonstration that was adapted for use in the nationally-distributed NanoDays Kit from the Nanoscale Informal Science Education (NISE) Network and by the American Chemical Society for use in the 2012 National Chemistry Week publication, "Nanotechnology: The Smallest Big Idea in Science"

Research Host for High School Students 2013 – 2014

Hosted high school students from Commonwealth School who are interested in pursuing science as a career during their "Project Week" internship

Chemistry Dept. Graduate Student and Post-doc Council (GPC), Harvard University 2010 – 2012

Elected Chair (2010 – 2011), Representative (2009 – 2012). Responsibilities included running monthly GPC meetings, planning social events and seminars, and providing organization and leadership within the department