

Dr. Jesse L. Silverberg

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Research Interests

- Multiscale biophysics integrating continuum mechanics with systems-level regulation
- Theoretical interface of geometry, mechanics, and microstructure
- Maker-style instrumentation powered by application-oriented custom software

Education

- **Harvard University** Cambridge, MA
Postdoctoral Fellow, Wyss Institute for Biologically Inspired Engineering 2014 - current
 - NIH Ruth L. Kirschstein Postdoctoral Fellow (F-32)
 - TEDx Speaker
 - Designed, developed, and commercialized software related to the Molecular Atlas Platform
- **Cornell University** Ithaca, NY
PhD, Physics 2009 - 2014
MS, Physics
 - PhD thesis: *Experiments at the Intersection of Geometry, Mechanics, and Microstructure*
 - NSF Graduate Research Fellow
- **Northeastern University** Boston, MA
BS, Physics 2004 - 2009
BS, Mathematics
BS, Philosophy
Minor, Graphic Design
 - Undergraduate thesis: *Fabrication and Investigation of Transport in Novel Nanostructures*
 - IGERT Fellow
 - Matthews Fellow
 - Graduated *summa cum laude*
 - Dean's list for 5 consecutive years

Professional Activities

MEMBERSHIPS

- Member of **American Physical Society** [2004 - current]
- Member of **Biophysical Society** [2014 - current]

SERVICE ACTIVITIES

- Referee for: Science · Physical Review Letters · Scientific Reports · Physical Review E · PLoS ONE · Physics Letters A · Science Advances · Osteoarthritis and Cartilage · ASME Journal of Applied Mechanics · Plant Methods · International Journal of Nanomedicine · Journal of Experimental Botany
- Co-organized and co-hosted banquet entertainment for the 21st International Conference on DNA Computing and Molecular Programming [Aug 2015]
- Designed informational brochures and pens for **American Physical Society's Topical Group on Soft Matter Physics** (APS GSOF) [Jul 2015]
- Session chair at **APS March Meeting** [Mar 2015]
- Poster judge for **Cornell Undergraduate Research Board's** 29th Annual spring research forum [Apr 2014]
- Invited contributor to **Physics Olympiad Resource Generation Camp** (Mumbai, India) Homi Bhabha Center [Sep 2007]
- Contributor to **National Knowledge Commission for Science Education** (Mumbai, India) Tata Institute of Fundamental Research [Aug 2007]
- Organized **NEU Topics in Applied Mathematics Seminar** [Apr 2008]

PROFESSIONAL DEVELOPMENT

- Attended 3 day intensive **optical microscopy bootcamp** run by Harvard Medical School's Imaging Core Facility Director Dr. Jennifer Walters covering diffraction-limited resolution fundamentals, signal-to-noise considerations, digital imaging, fluorescence microscopy, confocal microscopy, Total Internal Reflection Fluorescence (TIRF) microscopy, super-resolution microscopy, and digital image analysis [Jun 2015]
- Attended 12 week professional development course **Leadership: Theory and Practice** at Cornell University's Johnson Graduate School of Management [Sep - Dec, 2013]
- Visiting student at **Technical University of Munich** (Garching, Germany) Hosted by Prof. Andreas Bausch [Aug - Sep, 2012]
- Visiting student at **Tata Institute of Fundamental Research** (Mumbai, India) Hosted by Dr. Vikram Tripathi [Jul - Dec, 2007]
- Visiting student at **Indian Institute of Science** (Bangalore, India) Hosted by Prof. Arindam Ghosh [Nov 2007]

- Received **CLRA Level 1 tutor certification** [2008]

Honors, Awards, and Fellowships

- **NIH Ruth L. Kirschstein Postdoctoral Fellowship (F-32)** 2016
"The Molecular Atlas Project" (Research proposal ranked in top 1%)
- **The Platypus Award for Innovations in Sound** 2014
An annual pop-sci award sponsored by *Mental Floss* for research on the physics of mosh pits
- **Cornell University Graduate Student Travel Grant** 2014
Support attendance at *6OSME Conference* (Tokyo, Japan)
- **APS-GSNP Student Speaker Finalist** 2014
For contributed talk at the 2014 APS March Meeting by a graduate student in the area of Statistical and Nonlinear Physics
- **Poster Award** 2013
Gordon Research Conference: Soft Condensed Matter
- **Douglas Fitchen Memorial Award** 2012
Support attendance at *Int'l Plant Biomechanics Conference* (Clermont-Ferrand, France)
- **Cornell University Graduate Student Travel Grant** 2012
Support attendance at *Int'l. Plant Biomechanics Conference* (Clermont-Ferrand, France)
- **Cornell University Graduate Student Travel Grant** 2012
Support attendance at *APS March Meeting* (Baltimore, MD)
- **Poster Award** 2011
Gordon Research Conference: Soft Condensed Matter
- **NSF Graduate Research Fellowship** 2010
"Mechanical Properties of Biological Shock Absorbers: A Study of Cartilage"
- **NSF Graduate Research Fellowship Honorable Mention** 2009
"Applications of Quantum Degenerate Plasma to Controlled Nuclear Fusion"
- **Matthews Undergraduate Fellowship** 2008
"Transport Studies of One Dimensional Nanostructures"
- **CEA-Way Scholarship** 2007
"Probing Fermi Liquids in Cold Atom Systems"
- **IGERT Research Fellowship** 2006
"Development and Fabrication of a Device For Neuronal Cell Stimulation"
- **Lawrence Award** 2006
"Fabrication and Investigation of Transport Phenomena in Novel Nanostructures"
- **Provost Undergraduate Research Award** 2006
"Fabrication and Magnetostatic Characterization of Ferromagnetic Bifurcated Nanowires"

Publications

SCIENTIFIC ARTICLES

1. W. T. Walker, **J. L. Silverberg**, C. E. Kawcak, B. B. Nelson, L. A. Fortier, “Morphological Characteristics of Subchondral Bone Cysts in Medial Femoral Condyles of Adult Horses as Determined by Means of Computed Tomography,” *Am. J. Vet. Med.* **77**, 265-274 (2016).
2. T. H. Tan, **J. L. Silverberg**, D. Floss, M. J. Harrison, C. L. Henley, I. Cohen, “How Grow-and-Switch Gravitropism Generates Root Coiling and Root Waving Growth Responses in *Medicago truncatula*,” *Proc. Natl. Acad. Sci.* **112**, 12938-12943 (2015).
3. A. A. Evans, **J. L. Silverberg**, C. D. Santangelo, “Lattice mechanics of origami tessellations,” *Phys. Rev. E* **92**, 013205-1 (2015). [see also arXiv:1503.05756] [**Editor’s Choice**]
4. A. M. Paya, **J. L. Silverberg**, J. Padgett, T. L. Bauerle, “X-ray Computed Tomography Uncovers Root-Root Interactions: Quantifying Spatial Relationships Between Interacting Root Systems in Three Dimensions,” *Front. Plant Sci.* **6**, 274 (2015).
5. **J. L. Silverberg**, J. H. Na, A. A. Evans, B. Liu, T. Hull, C. D. Santangelo, R. J. Lang, R. C. Hayward, I. Cohen, “Origami Structures With a Critical Transition to Bistability Arising From Hidden Degrees of Freedom,” *Nat. Mater.* **14**, 289-393 (2015). [**Featured in News and Views**]
6. **J. L. Silverberg**, A. R. Barrett, M. Das, P. B. Peterson, L. Bonassar, I. Cohen, “Structure-Function Relations in Neonatal Bovine Articular Cartilage Under Shear,” *Biophys. J.* **107**, 7 (2014). [**Cover article**]
7. D. J. Griffin, J. Vicari, M. R. Buckley, **J. L. Silverberg**, I. Cohen, L. Bonassar, “The Effects of Enzymatic Treatments on the Depth-Dependent Viscoelastic Shear Properties of Articular Cartilage,” *J. Ortho. Res.* **32**, 1 (2014).
8. **J. L. Silverberg**, A. A. Evans, L. McLeod, R. C. Hayward, T. Hull, C. D. Santangelo, I. Cohen, “Using Origami Design Principles to Fold Reprogrammable Mechanical Metamaterials,” *Science* **345**, 647 (2014). [**Featured in Perspective Piece**]
9. H. Holmes, B. Wilson, J. Goerger, **J. L. Silverberg**, I. Cohen, L. Fortier, “BMAC and PRP Enhance Endogenous Stem Cell Migration” *Submitted*.
10. **J. L. Silverberg**, M. Bierbaum, J. P. Sethna, I. Cohen, “Collective Motion of Moshers at Heavy Metal Concerts,” *Phys. Rev. Lett.* **110**, 228701-1 (2013). [see also arXiv:1302.1886]
11. **J. L. Silverberg**, S. Dillavou, L. Bonassar, I. Cohen, “Anatomic Variation of Depth-Dependent Mechanical Properties in Neonatal Bovine Articular Cartilage,” *J. Ortho. Res.* **31**, 686-691 (2013).
12. **J. L. Silverberg**, R. D. Noar, M. S. Packer, M. J. Harrison, C. L. Henley, I. Cohen, S. Gerbode, “3D Imaging and Mechanical Modeling of Helical Buckling in *Medicago truncatula* Plant Roots,” *Proc. Natl. Acad. Sci.* **109**, 16794-16799 (2012).
13. A. Widom, J. Swain, **J. Silverberg**, S. Sivasubramanian, Y.N. Srivastava, “Theory of the Maxwell Pressure Tensor and the Tension in a Water Bridge,” *Phys. Rev. E* **80**, 016301-1 (2009).

14. **J. Silverberg**, “A Model for Conductive Percolation in Ordered Nanowire Arrays,” *J. Appl. Phys.* **105**, 044306-1 (2009).
15. B. Aycock, A. Roe, **J. Silverberg**, A. Widom, “Classical Hamiltonian Dynamics and Lie Group Algebras,” arXiv:0807.4725v1 (2008).
16. **J. Silverberg**, A. Friedman, L. Menon, “Growth and Magnetic Properties of Polycrystalline Self-Assembled Bifurcated Co Nanowires,” *J. Nanomaterials* **2008**, 782930 (2008).
17. S. Saha, **J. Silverberg**, D. O’Malley, L. Menon, “Nanowire Array Technologies for Investigation of Neural Activity,” *Proc. 2007 NSTI Nano Conf.* **2**, 795-798 (2007).
18. **J. Silverberg**, S. Saha, D. O’Malley, L. Menon, “Development of Au Nanowires for Recording Electrical Activity in Neural Cells,” *Mater. Res. Soc. Symp. Proc.* **951**, 0951-E08-10 (2007).
19. **J. Silverberg**, A. Widom, “Classical Analytical Mechanics and Entropy Production,” *Am. J. Phys.* **75**, 993-996 (2007).

COMMENTARIES and OP-EDs

1. **J. L. Silverberg**, “Folding Physics,” *APS New England Section Newsletter* **21**, 2 (2015).
2. **J. L. Silverberg**, “A Big Tent for Soft Matter,” *APS News, The Back Page* **24**, 5 (2015).
3. **J. L. Silverberg**, “Soft Matters Matter,” *Physics Today* **68**, 8 (2015).

Conferences and Workshops

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|--|-----------------|
| 1. Presented Poster @ Biophysical Society Meeting
“The Molecular Atlas Project” | <i>Feb 2016</i> |
| 2. Attendee @ New England Complex Fluids Workshop | <i>Dec 2015</i> |
| 3. Attendee @ 21st International Conference on DNA Computing and Molecular Programming | <i>Aug 2015</i> |
| 4. Presented Talk @ APS March Meeting
“Geometry, Mechanics, and Microstructure: The Physics of Origami” | <i>Mar 2015</i> |
| 5. Presented Poster @ Biophysical Society Meeting
“DNA-PAINT and Exchange-PAINT for Multiplexed 3D Super-Resolution Microscopy” | <i>Feb 2015</i> |
| 6. Presented Talk @ Society of Rheology
“Structure-Function Relations and Rigidity Percolation in Bovine Articular Cartilage” | <i>Oct 2014</i> |
| 7. Presented Talk @ New England Complex Fluids Workshop
“Revenge of the Mosh Pits: Raw Data and Preliminary Observations” | <i>Sep 2014</i> |
| 8. Presented Talk @ 6th International Meeting on Origami in Science, Mathematics, and Education (6OSME)
“Mechanics of Snap-Through Transitions in Twisted Origami” | <i>Aug 2014</i> |
| 9. Presented Talk @ APS March Meeting
“Mechanics of Miura-ori Origami Lattice Defects” | <i>Mar 2014</i> |

10. Presented Talk @ **APS March Meeting** *Mar 2014*
 “Structure-function relations in cartilage under shear: Does fiber organization matter?”
11. Presented Talk @ **Gordon Research Conference: Soft Condensed Matter** *Aug 2013*
 “Origami Mechanics: Measurements of Miura Ori Moduli and Lattice Defects”
12. Presented Poster @ **Gordon Research Conference: Soft Condensed Matter** *Aug 2013*
 “Origami Mechanics: Measurements of Miura Ori Moduli and Lattice Defects”
13. Presented Talk @ **APS March Meeting** *Mar 2013*
 “Spatially Localized Structure-Function Relations in the Elastic Properties of Sheared AC”
14. Presented Talk @ **7th International Plant Biomechanics Conference** *Aug 2012*
 “Helical Buckling of Plant Roots: Mechanics and Morphology”
15. Presented Poster @ **Next-Generation Materials Characterization Symposium** *May 2012*
 “Cartilage Mechanics: Measuring the Depth-Dependent Properties of Biological Materials”
16. Presented Talk @ **APS March Meeting** *Mar 2012*
 “Helical Buckling of Plant Roots: Mechanics and Morphology”
17. Presented Talk @ **Orthopedic Research Society Conference** *Jan 2012*
 “Anatomical Variation of Shear Energy Absorption in Articular Cartilage”
18. Presented Talk @ **Gordon Research Conference: Soft Condensed Matter** *Aug 2011*
 “Self-Organization in the Mosh Pit: Collective Motion in Human Crowds”
19. Presented Poster @ **Gordon Research Conference: Soft Condensed Matter** *Aug 2011*
 “Self-Organization in the Mosh Pit: Collective Motion in Human Crowds”
20. Presented Talk @ **APS March Meeting** *Mar 2011*
 “Helical Root Buckling: A Transient Mechanism for Stiff Interface Penetration”
21. Presented Poster @ **UMass Amherst Soft Solids & Complex Fluids Workshop** *Jun 2010*
 “Helical Root Buckling: A Transient Mechanism for Stiff Interface Penetration”
22. Presented Poster @ **Northeastern University Honors Evening Expo** *Apr 2009*
 “Development of Au Nanowires for Recording Electrical Activity in Neural Cells”
23. Presented Talk @ **Yale Conference for Undergraduate Women in Physics** *Jan 2009*
 “Observations and Questions of Localization in One-Dimensional Wires”
24. Presented Talk @ **NEU Topics in Applied Mathematics Seminar** *Apr 2008*
 “A Model for Conductive Percolation in Ordered Nanowire Arrays”
25. Attendee @ **New England Peer Tutoring Association Conference** *Mar 2007*
26. Attendee @ **Correlated Electrons and Frustrated Magnetism Workshop** *Dec 2007*
 Organized by International Centre for Theoretical Sciences (Goa, India)
27. Presented Poster @ **NEU Research and Scholarship Expo** *Mar 2007*
 “Nanowire Array Technologies for Investigation of Neural Activity”
28. Presented Talk @ **Materials Research Society Meeting** *Nov 2006*
 “Development of Gold Nanowires for Recording Electrical Activity in Neural Cells”
29. Presented Poster @ **Gordon Research Conference: Nanostructure Fabrication** *Nov 2006*
 “Development of Gold Nanowires for Recording Electrical Activity in Neural Cells”

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| 30. Presented Poster @ Women in Science and Engineering Expo
“Non-Lithographic Nanofabrication using Porous Alumina Membranes” | <i>Apr 2006</i> |
| 31. Attendee @ New England Peer Tutoring Association conference | <i>Mar 2006</i> |

Invited Talks

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|---|-----------------|
| 1. HSDM/HMS/MGH Bone Research Workshop Series (Boston, MA) | <i>Jan 2016</i> |
| 2. Centre for Interdisciplinary Mathematics (Uppsala, Sweden) | <i>Nov 2015</i> |
| 3. Lewis-Sigler Institute at Princeton University (Princeton, NJ) | <i>May 2015</i> |
| 4. University of California, Irvine (Irvine, CA) | <i>Apr 2015</i> |
| 5. Kavli Institute at Harvard University (Cambridge, MA) | <i>Apr 2015</i> |
| 6. Tufts University (Somerville, MA) | <i>Apr 2015</i> |
| 7. TEDx Conference (Yale University, New Haven, CT) | <i>Apr 2015</i> |
| 8. Bridgewater State University (Bridgewater, MA) | <i>Mar 2015</i> |
| 9. APS March Meeting (San Antonio, TX) | <i>Mar 2015</i> |
| 10. Institute for Advanced Study at HKUST (Clear Water Bay, Hong Kong) | <i>Dec 2014</i> |
| 11. Boston Area Physics of Living Systems Hangout at MIT (Boston, MA) | <i>Sep 2014</i> |
| 12. Tel Aviv University (Tel Aviv, Israel) | <i>Aug 2014</i> |
| 13. Weizmann Institute (Rehovot, Israel) | <i>Aug 2014</i> |
| 14. University of Eastern Finland (Kuopio, Finland) | <i>Aug 2014</i> |
| 15. University of Jyväskylä (Jyväskylä, Finland) | <i>Aug 2014</i> |
| 16. Aalto University (Helsinki, Finland) | <i>Jul 2014</i> |
| 17. University of Leiden (Leiden, the Netherlands) | <i>Jul 2014</i> |
| 18. AMOLF (Amsterdam, the Netherlands) | <i>Jul 2014</i> |
| 19. TU Delft (Delft, the Netherlands) | <i>Jul 2014</i> |
| 20. University of Amsterdam VU (Amsterdam, the Netherlands) | <i>Jul 2014</i> |
| 21. Wyss Institute for Biologically Inspired Engineering (Boston, MA) | <i>Dec 2013</i> |
| 22. University of Massachusetts Amherst (Amherst, MA) | <i>Nov 2013</i> |
| 23. Rochester Institute of Technology (Rochester, NY) | <i>Nov 2013</i> |
| 24. Nerd Nite (Ithaca, NY) | <i>Oct 2013</i> |
| 25. Chennai Mathematical Institute (Chennai, India) | <i>Jul 2009</i> |

Teaching

- Co-advising Ph.D. student **Arianna Bottinelli** [Apr 2015 - current]
Currently conducting studies at Uppsala University in Sweden
- Mentored graduate student **Lauren McLeod** [Jul - Dec, 2013]
Currently continuing studies at Cornell University, Physics Department
- Mentored M.S. student **Hannah Holmes** [May 2013 - Aug 2014]
Currently DVM student at Cornell College of Veterinary Medicine
- Mentored undergraduate student **Tzer Han Tan** [Jan 2013 - current]
Currently graduate student at MIT, Applied Physics
- Mentored undergraduate student **Karen Cronk** [Sep - Dec, 2012]
- Graduate student adviser for **Chris Heidelberger** [Feb - May, 2012]
- Mentored undergraduate student **Sam Dillavou** [Jan 2011 - Mar 2012]
Currently graduate student at Harvard University, Physics Department
- Mentored undergraduate student **Michael Packer** [May - Sep 2010]
Currently graduate student at Harvard University, Biophysics Program
- Teaching Assistant for **Phys 101: Introductory Physics for Life Sciences** [Sep - Dec, 2009]
Worked one-on-one with students in an experimental self-paced auto-tutorial course helping setup/run labs, answer homework questions, and performing 15 minute “notebook checks,” which are individualized ungraded quizzes.
- Teaching Assistant for **Phys 102: Introductory Physics for Life Sciences** [Jan - May, 2010]
Worked one-on-one with students in an experimental self-paced auto-tutorial course helping setup/run labs, answer homework questions, and performing 15 minute “notebook checks,” which are individualized ungraded quizzes.
- Tutored at **Northeastern University Peer Tutoring Center** in all levels of physics and mathematics courses [2007 - 2009]

Outreach Activities

- Presented research on human collective motion at **TEDx: “Moment of Impact”** event hosted by Yale University. The talk was recorded for broader online viewing at <https://youtu.be/rjvaiiXIySc> [Apr 2015].
- Presented research on cartilage mechanics in a press-only event at the American Physical Society March Meeting [Mar 2015].

- Significant media attention developed around research on origami mechanical metamaterials including press interviews and news articles featured on the New York Times, NBC, LA Times, Washington Post, Boston Globe, Phys.org, Physics World, APS News, MRS Magazine, Inside Science, Sydney Morning Herald, Value Walk, Science Codex, Science Daily, Spiegel Online, Christian Science Monitor, Factor Tech, Next, The Age, Red Orbit, Nanowerk, TechDec, and INCH Magazine. In addition, the broad-audience math magazine *What's Happening in the Mathematical Sciences*, published by the American Mathematical Society, featured a long-form article featuring this work along with interviews and broader discussion of the field [Aug 2014].
- Contributed to the 2014 APS March Meeting *Gallery of Images* art exhibit with the poster contribution “Origami Mechanics and Reprogrammable Metamaterials.” This event showcased artistic images from scientific studies and included a hands-on demonstration of origami-inspired mechanical metamaterials [Mar 2014].
- Launched the “Soft Matters: Talking Physics, Talking Life” project in collaboration with fellow PhD student Kathryn McGill. The aim of this outreach effort is to showcase research from the frontiers of physics, as well as personal stories from the people doing it. Soft Matters combines video interviews with written blogs (available on the Huffington Post science section) with an emphasis that minimizes technical jargon. A “Science-to-English dictionary” is always included to enhance accessibility for a broader audience, as well as links to additional resources and materials [Sep - Nov 2013].
- Significant media attention developed around research of human collective motion at heavy metal concerts including TV features (Discovery Channel’s Daily Planet, Japan’s WOWOW Nightly News), radio interviews (NPR, CBC, WHCU, WTOP, and 3 separate occasions on Australian public radio), print media (New Scientist), and online media (ABC, NBC, National Geographic, Popular Science, The Atlantic, Physics World, The Telegraph, as well as 85 separate online news sites and blogs). The work was awarded a 2014 Platypus Award from Mental Floss Magazine, which in their words: “The Platties honor ideas that are interdisciplinary: a bit duck, a bit beaver, a bit otter. These are the new ideas and innovations that made us do a double take. At first, we wondered whether they could be real. And when they proved to be, it wasn’t just the little idea, but the little idea’s enormous potential that delighted us” [Feb - Mar 2013, and periodic ongoing media features].
- Participated in panel discussion for a press-only event at the American Physical Society March Meeting highlighting mosh pit related research [Mar 2013].
- Classifying and categorizing activity at the Ithaca Library through the Families Learning Science Together program [Jan 2013; kids 6-12].
- Participated in Northeast Conference for Undergraduate Women in Physics to promote women in physics [Jan 2013].
- Invited contributor to Huffington Post Science Blog [2012 - current].
- Participated in panel discussion for a press-only event at the American Physical Society March Meeting highlighting plant-related research [Feb 2012].
- Interviewed for APS Podcast series Physics Buzz focusing on general interest physics [Feb 2012].
- Polymer science activity at the Ithaca Youth Bureau through the Big Brothers Big Sisters program [Jan 2012; kids age 6-12].
- Polymer science activity at the Greater Ithaca Activities Center [Jan 2012; 5th graders].

- Optics science activity at the Greater Ithaca Activities Center [Jan 2012; 5th graders].
- Professional development activities for New York State high school teachers through the Cornell Institute for Physics Teachers program [Oct 2011].
- Participated in the “Physics of bubbles,” and “Insect zoo” activities at the Expanding Your Horizons conference [Apr 2011; 6-7th grade girls].
- Molecular fluorescence activity at the Ithaca Science Center during the NISE Nano Days event [Apr 2011; all ages].
- Bridge building activity at the Ithaca Library through the Families Learning Science Together program [Mar 2011; kids 6-12].
- Density of fluids activity at the Ithaca Library through the Families Learning Science Together program [Feb 2011; kids 6-12].
- “Science from Junk” activity at the Ithaca Library through the Families Learning Science Together program [Jan 2011; kids 6-12].
- Physics of waves activity through the Ithaca Science Center Homeschooling Program [Dec 2010; kids 6-12].
- “Drop tubes” and “Density of fluids” activities at the Harlem Children’s Zone in the Bronx, New York City [Dec 2010; 6th graders].
- Electricity and magnetism activities at the Ithaca Library through the Families Learning Science Together program [Nov 2011; kids 6-12].
- Participated in International Co-op Mentor Program, and spoke on two discussion panels [Feb and Apr, 2008].