CATHERINE HIRSHFELD CROUCH, PH.D.

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PRESENT POSITION

Professor of Physics, Swarthmore College (at Swarthmore since 2003, tenured 2009, promoted 2017).
Courses taught since 2009: (years not listed for courses taught multiple times)

Electricity, Magnetism, and Waves: Intensive for sophomore physics majors with more limited high school physics or mathematics background (Physics 8S) Spring 2018
Quantum Physics for sophomore physics majors (Physics 18) Spring 2018
Elective seminar in Biophysics (Physics 139, cross-listed as Chemistry 114) Fall 2016
Introductory Biophysics (Physics 139A, half-credit course) Fall 2017
General Physics I with Biomedical Applications (Physics 3L, course developed by CHC) Fall 2015
General Physics II with Biomedical Applications (Physics 4L, course developed by CHC)
Spacetime and Quanta (Physics 5, co-taught with Eric Jensen (F2011), David Cohen (F2012), Tristan Smith (F2016))
Seminar in Classical Electrodynamics for junior physics majors (Physics 112)
Seminar in Quantum Mechanics for junior physics majors (Physics 113)
Introductory, intermediate, and advanced laboratories (including scientific writing in Physics 81-82)

EDUCATION

Postdoctoral Fellow in Applied Physics with Eric Mazur, Harvard University, 2000–2003.

Postdoctoral Fellow in Physics Education with Eric Mazur, Harvard University, 1996–2000.

Ph.D. in Physics with Robert M. Westervelt, Harvard University, September 1996.

B.A. in Physics *summa cum laude* with Highest Honors, Williams College, 1990.

FELLOWSHIPS and AWARDS

PI on NSF IUSE grant "Do Connections Persist? A Pilot Study Investigating the Lasting Impact of a Physics Course Designed to Facilitate Connections With Biology" (DUE-1710875), $220k over three years (2017-20), with co-PIs Benjamin Geller (Swarthmore Physics) and Sara Hiebert Burch (Swarthmore Biology).

Co-PI on NSF IUSE grant "Collaborative Research: Community Sourcing of Introductory Physics for the Life Sciences" (DUE–1624017), PI Robert Hilborn (American Association of Physics Teachers); $58k to Swarthmore (2016-2019), funding summer salary for CHC and Ben Geller for disseminating curricular resources.

American Physical Society Outstanding Referee 2016 (reflects cumulative service).

Hungerford Fund award for external consultant to support research on student learning in Physics 3L-4L curriculum (used 2015-16 along with HHMI funds).

Co-PI on NSF TUES grant "Creating a Common Thermodynamics," DUE-1122941, PI Edward F. Redish (University of Maryland); $20k to Swarthmore (2011-2014), funding release time for CHC.

National Science Foundation Research Opportunity Award for 1.5 months salary to join the laboratory of Prof. Tobias Baumgart, University of Pennsylvania as part of 2010-11 sabbatical.

James A. Michener Faculty Fellowship for second semester leave salary and research funds, Swarthmore College, 2010-2011 and 2006-2007.

Co-PI on NSF award "Conference on Scientific Foundations of Future Physicians: How do physics departments respond?" DUE-0965156, PI Mark Reeves, funded October 2009 conference held at George Washington University.

ACTIVE and RECENT RESEARCH INTERESTS

Outcomes (immediate and long-term) of introductory physics for life science students (current)

Cell membrane biophysics and the role of proteins in cell membrane curvature generation (current)

Optical properties of semiconductor nanoparticles (through 2011)

CURRENT CURRICULUM AND TEXTBOOK DEVELOPMENT PROJECTS

Introductory Physics for the Life Sciences (Swarthmore College Physics 3L- 4L). Courses developed and taught with HHMI support (Physics 4L first offered Spring 2008; Physics 3L first offered Fall 2015.) Complete description at materials.physics.swarthmore.edu/IPLS.

Introductory Physics for Life Sciences Portal. Multi-institution NSF-funded project (Swarthmore DUE–1624017) led by Robert Hilborn (American Association of Physics Teachers) to disseminate curricular materials for reformed introductory physics for life science courses.

Contributing author for *University Physics for the Life Sciences (*Pearson Education/Addison-Wesley), with lead authors Randall Knight, Brian Jones, and Stuart Field, target publication date fall 2020.

SWARTHMORE UNDERGRADUATES INVOLVED IN RESEARCH

Nathan Landy ’06	summer 2004, summer 2005, research for credit fall 2005
Tara Finley Bartiromo ’06	summer 2005
Thomas Emmons ’08	summer 2006, summer 2007, research for credit fall 2007
Benjamin Blonder ’08 and Benjamin Plotkin-Swing ’09	summer 2007 (with Prof. Carl Grossman)
Corey White ’11	research assistant spring 2007, summer 2007
Robert Mohr ’09 (Honors)	research assistant spring 2007, summer 2008, honors research fall 2008
Margaret Cosgriff ’09	summer 2008 (with Prof. Carl Grossman)
Orion Sauter ’11	summer 2008 (with Prof. Carl Grossman) and 2009, research assistant 2008-09 and 09-10
Robert Purcell ’11	summer 2009
Sandra Liss ’11	research assistant (analyzing physics education data) fall 2010, spring 2011
Ayman Abunimer ’12	summer 2011
Tiffany Lee ’12	summer 2011, research for credit fall 2011 (in collaboration with Tobias Baumgart)
Hannah Deming ’12	fall 2011 curriculum development assistant for Physics 4L
Panchompoo Wisittanawat ’13 (Honors)	academic year 2012-13 (with Ann Renninger)
Tae Kim ’14 (Honors)	June 2012 – May 2014 (with Kathleen Howard and Carl Grossman)
Mariel Freyre ’15	September 2014 – May 2015 (with Kathleen Howard and Carl Grossman)
Margaret Bost ’17	summer 2015 (with Kathleen Howard and Carl Grossman)
Tessa Williams ’17	summer 2015 (with Benjamin Geller)
Bryan Green ’16	September 2015 – May 2016 (with Kathleen Howard)
Haley Gerardi ’17	summers 2016, 2019 (with Benjamin Geller)
Tyler Alexander ’17	fall 2016 (with Kathleen Howard)
Max Franklin ’19	summers 2016 and 2017 (with Benjamin Geller)
Jess Li ’19	summer 2017 (with Benjamin Geller)
Jonathan Solomon ’20	summer 2018 (with Benjamin Geller)
Katherine Lima ’20	summer 2018 (with Benjamin Geller)
Nathaniel Peters ’18	summers 2018, 2019 (with Benjamin Geller)
Tarzan Aqil MacMood ’20	summer 2019 (with Benjamin Geller)

Also supervised Ethan Deyle ’08 writing his physics honors thesis, after he did his thesis research with Craig Arnold at Princeton University.

PEER-REVIEWED PUBLICATIONS SINCE 2003: PHYSICS EDUCATION (*Swarthmore undergraduate)

[1] Catherine H. Crouch and John W. Hirshfeld, Jr, "Teaching the electrical origins of the electrocardiogram: An introductory physics laboratory for life science students," submitted to Am. Journal of Physics (June 2019).

[2] Catherine H. Crouch, Panchompoo Wisittanawat*, Ming Cai, and K. Ann Renninger, "Supporting life science students' interest in physics by embedding physics in life science contexts: An exploratory study," Phys. Rev. Phys. Educ. Res. **14**, 010111 (2018). doi.org/10.1103/PhysRevPhysEducRes.14.010111

[3] Benjamin Geller, Chandra Turpen, and Catherine H. Crouch, "Sources of student engagement in introductory physics for life sciences," Phys. Rev. Phys. Educ. Res. **14**, 010118 (2018). doi.org/10.1103/PhysRevPhysEducRes. 14.010118

[4] Catherine H. Crouch and Kenneth Heller, "Introductory Physics in Biological Context: An Approach to Improve Introductory Physics for Life Science Students," American Journal of Physics **82**, 378 (2014). doi.org/10.1119/1.4870079

[5] E. F. Redish, C. Bauer, K. L. Carleton, T. J. Cooke, M. Cooper, C. H. Crouch, B. W. Dreyfus, B. Geller, J. Giannini, J. Svoboda Gouvea, M. W. Klymkowsky, W. Losert, K. Moore, J. Presson, V. Sawtelle, C. Turpen, and K. Thompson, "NEXUS/Physics: An interdisciplinary repurposing of physics for biologists," American Journal of Physics **82**, 368 (2014). doi.org/10.1119/1.4870386

[6] Catherine H. Crouch, Panchompoo Wisittanawat,* and K. Ann Renninger, "Initial Interest, Goals, and Changes in CLASS Scores in Introductory Physics for Life Sciences," in *Proceedings of the 2013 Physics Education Research Conference*, Paula Engelhardt, editor (American Association of Physics Teachers, 2013). http://www.compadre.org/per/items/detail.cfm?ID=13120

[7] Catherine H. Crouch and Kenneth Heller, "Teaching physics to life science students: examining the role of biological context," in *Proceedings of the 2011 Physics Education Research Conference*, Sanjay Rebello, editor (American Association of Physics Teachers, 2011).

[8] Catherine H. Crouch, Jessica Watkins, Adam P. Fagen, and Eric Mazur, "Peer Instruction: Engaging students one-on-one, all at once," in *Research-Based Reforms in University Physics*, Edward F. Redish, editor (American Association of Physics Teachers, 2007, online at http://www.compadre.org/PER/items/detail.cfm?ID=4990).

[9] Mercedes Lorenzo, Catherine H. Crouch, and Eric Mazur, "Reducing the gender gap in the physics classroom," American Journal of Physics **74**, 118 (2006).

[10] Catherine H. Crouch, Adam P. Fagen, J. Paul Callan, and Eric Mazur, "Classroom demonstrations: learning tools or entertainment?" American Journal of Physics **72**, 835 (2004).

[11] K. Kelvin Cheng, BethAnn Thacker, Richard L. Cardenas, and Catherine H. Crouch, "Using an online homework system enhances students' learning of physics concepts in an introductory physics course," American Journal of Physics **72**, 1447 (2004).

PEER-REVIEWED PUBLICATIONS SINCE 2003: EXPERIMENTAL (*Swarthmore undergraduate)

[1] Catherine H. Crouch, Margaret H. Bost,* Tae H. Kim,* Bryan M. Green,* D. Stuart Arbuckle, Carl H. Grossman, and Kathleen P. Howard, "Optimization of Detergent-Mediated Reconstitution of an Integral Membrane Protein," *Membranes* 8(4), 103 (2018). https://doi.org/10.3390/membranes8040103

[2] Siying Wang, Claudia Querner, Tali Dadosh, Catherine H. Crouch, Dmitry Novikov, and Marija Drndic, "Collective fluorescence enhancement in nanoparticle clusters," *Nature Communications* **2**, 364 (2011). http://dx.doi.org/10.1038/ncomms1357

[3] Catherine H. Crouch, Orion Sauter*, Xiaohua Wu, Robert Purcell*, Claudia Querner, Marija Drndic, and Matthew Pelton, "Facts and artifacts in the blinking statistics of semiconductor nanocrystals," *Nano Letters* **10**, 1692 (2010). http://dx.doi.org/10.1021/nl100030e

[4] Catherine H. Crouch, Robert Mohr*, Thomas Emmons*, Siying Wang, and Marija Drndic, "Excitation energy dependence of fluorescence intermittency in CdSe/ZnS core-shell nanocrystals," *Journal of Physical Chemistry C* **113**, 12059 (2009). http://dx.doi.org/10.1021/jp8104216

[5] Siying Wang, Claudia Querner, Michael D. Fischbein, Lauren Willis, Dmitry Novikov, Catherine H. Crouch and Marija Drndic, "Blinking statistics correlated with nanoparticle number," Nano Letters **8**, 4020 (2008). http://dx.doi.org/10.1021/nl802696f

[6] Mengyan Shen, James E. Carey, Catherine H. Crouch, Maria Kandyla, Howard A. Stone, and Eric Mazur, "High-density regular arrays of nanometer-scale rods formed on silicon surfaces via femtosecond laser irradiation in water," Nano Letters **8**. 2087 (2008).

[7] Siying Wang, Claudia Querner, Thomas Emmons*, Marija Drndic, and Catherine H. Crouch, "Fluorescence blinking statistics from CdSe core and core-shell nanorods," Journal of Physical Chemistry B **110**. 23221 (2006). http://dx.doi.org/10.1021/jp064976v

[8] James E. Carey, Catherine H. Crouch, Mengyan Shen, and Eric Mazur, "Visible and near-infrared responsivity of femtosecond laser-structured photodiodes," Optics Letters **30** (14), 1773 (2005).

[9] C. H. Crouch, J. E. Carey, M. Y. Shen, E. Mazur, and F. Y. Génin, "Infrared absorption by sulfur-doped silicon formed by femtosecond laser irradiation," Applied Physics A **79**, 1635 (2004).

[10] C. H. Crouch, J. E. Carey, J. M. Warrender, M. J. Aziz, and E. Mazur, "Comparison of structure and properties of femtosecond and nanosecond laser-structured silicon," Applied Physics Letters **84**, 1850 (2004).

[11] M. Y. Shen, C. H. Crouch, J. E. Carey, and E. Mazur, "Femtosecond laser-induced formation of submicrometer spikes on silicon in water," Applied Physics Letters **85**, 5694 (2004).

[12] M. Y. Shen, C. H. Crouch, J. E. Carey, R. Younkin, M. Sheehy, C. M. Friend, and E. Mazur, "Formation of ordered silicon microspikes by femtosecond laser irradiation through a mask," Applied Physics Letters **82**, 1715 (2003).

INVITED PRESENTATIONS SINCE 2003: PHYSICS EDUCATION

[1] Catherine H. Crouch, "Balancing Methods and Content: Good for Everyone and Good for Inclusion," American Association of Physics Teachers Summer Meeting 2019, Provo, UT.

[2-4] "Does it stick? Assessing the long-term impact of IPLS" (with co-authors Benjamin Geller, Chandra Turpen, Jonathan Solomon, and Nathaniel Peters), discipline-based education research (DBER) colloquia at Cornell University, May 2019, and Harvard University, March 2019; and American Association of Physics Teachers Winter Meeting, January 2019.

[5] "Supporting interdisciplinary learning: Experiences and results from teaching physics to life science students," Discipline-Based Science Education and Research Center colloquium, University of Pittsburgh, April 2019.

[6, 7] "Living Physics Portal: Community and Resources for Physics for Life Sciences," American Association of Physics Teachers Summer Meeting, July 2018 and American Physical Society March Meeting, March 2019.

[8] Benjamin Geller, Chandra Turpen, Nathaniel Peters, Jonathan Solomon, and Catherine H. Crouch, "Do connections persist? Assessing the longitudinal impact of IPLS" American Association of Physics Teachers Summer Meeting 2018, Washington DC.

[9-18] "Teaching Introductory Physics in Biological Context," UCLA Biology Department, February 2015; Harvard University Derek Bok Center for Teaching and Learning, November 2014; Seattle Physics Education Research Seminar Series, October 2014; plenary speaker for June 2014 Gordon Research Conference in Physics and Education; Yale Center for Scientific Teaching, May 2014; University of North Carolina-Chapel Hill, April 2014; American Physical Society April Meeting, April 2014; American Association of Physics Teachers National Meeting, July 2013; University of Pittsburgh, February 2013, and University of Maryland-Baltimore County, May 2011; American Association of Physics Teachers New Faculty Reunion Workshop, October 2012.

[19] "Science Teaching for the New Millenium," science pedagogy seminar, Williams College, November 2013.

[20] "Reforming the Introductory Physics Course for Life Science Students," workshop offered at the American Association of Physics Teachers Summer Meeting, July 2012, organized by Dawn Meredith. (Also declined to present at similar workshop July 2014 due to other professional conflicts.)

[21] "Biomedical-Inspired Laboratories for Introductory Physics," workshop offered at the American Association of Physics Teachers Summer Meeting, with organizer Mark Reeves and co-presenter Suzanne Amador Kane, Portland, OR, July 2010.

[22] "Teaching Underrepresented Groups with Peer Instruction," American Association of Physics Teachers Summer Meeting, Portland, OR, July 2010.

[23] "Gender and student achievement with Peer Instruction," 2008 Physics Education Research Conference, Edmonton, Alberta, Canada, July 2008. Also served as invited session organizer (the conference included only six invited sessions).

[24 – 26]"Reducing the gender gap in introductory physics," Physics Education Research Group seminar, Rutgers University, October 2007; University of Maryland, September 2007; University of Colorado, March 2007.

[27] "Promise and pitfalls of reformed instruction for female students," workshop at Physics Teacher Education Coalition 2007 conference, Boulder, CO, March 2007.

[28] "Classroom demonstrations: Learning Tools or Entertainment?" 19th Biennial Conference on Chemical Education, August 2006.

[29] "Demonstrations: More than just entertainment?" American Physical Society April Meeting, Philadelphia, PA, April 2003.

Also declined an invitation to present on Peer Instruction to the American Association of Medical Physicists' conference (summer 2010) due to a conflict with the summer AAPT meeting (items [21, 22]).

INVITED PRESENTATIONS SINCE 2003: EXPERIMENTAL

[1] "Making Model Cell Membranes to Study How Proteins Reshape Cells," Swarthmore College Physics Colloquium, April 2016.

[2] "Studying Virus Budding with Physics," Williams College Physics Colloquium, November 2013.

[3] "Membrane-Protein Binding: Basic Physics and Two (Fairly) New Experimental Techniques," Swarthmore College Physics Colloquium, February 2012.

[4] Catherine H. Crouch, Orion Sauter*, Xiaohua Wu, Robert Purcell*, Claudia Querner, Marija Drndic, and Matthew Pelton, "Facts and artifacts in the blinking statistics of CdSe nanoparticles," DOE Triennial Review, Argonne National Laboratory, May 2010.

[5] "Dynamics on the Nanoscale: Light Emission from Single Semiconductor Nanorods," Swarthmore College Physics Colloquium, February 2008.

[6] "Fluorescence blinking statistics from CdSe core and core-shell nanorods," Workshop on Fluorescence Intermittency in Molecules, Quantum Dots, and Quantum Wires, Notre Dame University, April 2007.

[7 - 9] "Intermittent fluorescence from semiconductor nanorods," Argonne National Laboratory Nanomaterials seminar, June 2007; Laboratory for Surface Modification Seminar, Rutgers University, October 2007; and Materials Science Graduate Student Seminar, Princeton University, December 2006.

[10 - 12] "Light emission from single quantum rods," Physics Colloquium, Wheaton College, October 2007; Amherst College, November 2006; and St. Joseph's University, November 2006.

[13] "Light emission from single quantum rods: Research as education and vocation," keynote address at Erickson Undergraduate Research Conference, Seattle Pacific University, May 2006.

[14] "Black silicon: changing structure and properties with light," Physics Colloquium, Haverford College, March 2004.

Declined an invitation to present the same material as item [4] at the Argonne National Laboratory Annual User's Conference (June 2011) due to a conflict with the start date for summer research students; presenting would have required delaying the start of student summer projects by several days.

CONTRIBUTED CONFERENCE PRESENTATIONS: PHYSICS EDUCATION

[1] Nathaniel Peters, Chandra Turpen, Catherine H. Crouch, and Benjamin Geller, "Assessing the lasting impact of an IPLS course in an Animal Physiology Course," contributed talk at the summer 2019 American Association of Physics Teachers meeting, Provo, UT, and poster at the Physics Education Research conference immediately after.

[2] Aqil MacMood, Nathaniel Peters, Haley Gerardi, Benjamin Geller, and Catherine H. Crouch, "Exploring the impact of an IPLS course on student learning in neurobiology," contributed talk at the summer 2019 American Association of Physics Teachers meeting, Provo, UT, and poster at the Physics Education Research conference.

[3] Haley Gerardi, Chandra Turpen, Catherine H. Crouch, and Benjamin Geller, "Enduring attitudes of life science students toward physics and interdisciplinary learning," contributed talk at the summer 2019 American Association of Physics Teachers meeting, Provo, UT, and poster at the Physics Education Research conference.

[4] Catherine H. Crouch, Benjamin Geller, and Sara Hiebert Burch, "Two physicists and a physiologist think and teach about energy," poster at the June 2018 Gordon Conference on Physics Research and Education.

[5] Benjamin Geller, Chandra Turpen, Katherine Lima, and Catherine H. Crouch, "Transformative Experience in a Physics Course Designed to Facilitate Connections to Biology," juried talk at the 2018 Physics Education Research Conference.

[6] Jonathan Solomon, Nathaniel Peters, Benjamin Geller, Chandra Turpen, and Catherine H. Crouch, "Assessing the lasting impact of an IPLS course," contributed talk at the summer 2018 American Association of Physics Teachers meeting, Washington, DC, and poster at the Physics Education Research conference immediately after.

[7] Katherine Lima, Chandra Turpen, Benjamin Geller and Catherine H. Crouch, "Transformative experience in a physics course designed to facilitate connections to biology," poster at the summer 2018 American Association of Physics Teachers meeting, Washington, DC, and at the Physics Education Research conference immediately after

[8] Benjamin Geller and Catherine H. Crouch, "Saving the best for last: introductory physics as a capstone," presented as a talk at the summer 2017 American Association of Physics Teachers meeting, Cincinnati, OH.

[9] Max Franklin, Benjamin Geller, and Catherine H. Crouch, "Self-efficacy in introductory physics," presented as a poster at the summer 2017 American Association of Physics Teachers meeting, Cincinnati, OH.

[10] Ben Geller, Chandra Turpen, and Catherine H. Crouch, "The sources of student interest in IPLS," presented in both a talk at the summer 2016 American Association of Physics Teachers meeting and a poster at both the AAPT meeting and the associated Physics Education Research Conference, Sacramento, CA.

[11] Haley Gerardi, Max Franklin, Benjamin Geller, Chandra Turpen, and Catherine H. Crouch, "Traditional physics versus IPLS: Comparing student experiences," presented in both a talk and a poster at the summer 2016 American Association of Physics Teachers meeting, Sacramento, CA.

[12] Mary Ann Klassen, John W. Hirshfeld Jr., and Catherine H. Crouch, "Modeling the heart's dipole moment in the introductory physics laboratory," poster presentation at the summer 2016 American Association of Physics Teachers meeting, Sacramento, CA.

[13] K. Ann Renninger, Ming Cai, Panchompoo Wisittanawat, and Catherine H. Crouch, "Life science students learning physics with life science examples: A context for thinking about situational interest," presented as part of the symposium "Understanding Situational Interest" (K. A. Renninger, organizer) at the 15th International Conference on Motivation, Thessalonii, Greece (August 2016).

[14] Ben Geller, Chandra Turpen, K. Ann Renninger, Panchompoo Wisittanawat, and Catherine H. Crouch, "Unpacking the sources of student interest in an IPLS course," presented in both a talk at the summer 2015 American Association of Physics Teachers meeting and a poster at the associated Physics Education Research Conference, College Park, MD.

[15] Tessa Williams, Ben Geller, Chandra Turpen, K. Ann Renninger, and Catherine H. Crouch, "Traditional physics versus IPLS: Comparing student interest and engagement," presented in both a talk at the summer 2015 American Association of Physics Teachers meeting and a poster at the associated Physics Education Research Conference, College Park, MD.

[16] K. Ann Renninger, Panchompoo Wisittanawat, Ming Cai and Catherine H. Crouch, "Life Science Students Learning Physics with Life Science Examples," talk presented as part of a symposium at the April 2015 American Educational Research Association conference.

[17] Catherine H. Crouch, Panchompoo Wisittanawat, and K. Ann Renninger, "Initial Interest, Goals, and Changes in CLASS Scores in Introductory Physics for Life Sciences," at the summer 2013 Physics Education Research Conference, as part of the American Association of Physics Teachers meeting, Portland, OR.

[18] Panchompoo Wisittanawat, K. Ann Renninger, and Catherine H. Crouch, "The effect of interest on including life science contexts in introductory physics," at the summer 2013 Physics Education Research Conference, as part of the American Association of Physics Teachers meeting, Portland, OR.

[19] E. F. Redish, C. Bauer, K. L. Carleton, T. J. Cooke, M. Cooper, C. H. Crouch, B. W. Dreyfus, B. Geller, J. Giannini, J. Svoboda Gouvea, M. W. Klymkowsky, W. Losert, K. Moore, J. Presson, V. Sawtelle, C. Turpen, and K. Thompson, "NEXUS/Physics: Rethinking Introductory Physics for Biologists," *Vision and Change* Conference, American Association for the Advancement of Science, August 2013.

[20] Catherine H. Crouch and Kenneth Heller, "Teaching physics to life science students: examining the role of biological context," at the summer 2011 Physics Education Research Conference, as part of the American Association of Physics Teachers meeting, Omaha, NE.

[21] Catherine H. Crouch, "Capstone examples for second semester IPLS: confocal microscopy and nerve signaling," American Association of Physics Teachers Winter Meeting, Jacksonville, FL (2011).

[22] Catherine H. Crouch, "A stand-alone course in optics, electricity, and magnetism for the life sciences," American Association of Physics Teachers Summer Meeting, Ann Arbor, MI (2009).

[23] Catherine H. Crouch, Mercedes Lorenzo, and Eric Mazur, "Reducing the gender gap in the physics classroom," American Physical Society March meeting, Boulder, CO (2007).

[24] Catherine H. Crouch, "Electricity, Magnetism, and Optics for the Life Sciences," Physics Education and Research Gordon Conference, Mt. Holyoke College, June 2006.

CONTRIBUTED CONFERENCE PRESENTATIONS: EXPERIMENTAL (* indicates undergraduate coauthors)

[1] Mariel Freyre, Tae Kim, Carl Grossman, Kathleen Howard, and Catherine H. Crouch, "Characterizing detergent mediated reconstitution of viral protein M2 in large unilamellar vesicles," American Physical Society March meeting, San Antonio, TX, March 2015.

Tae Kim '14 submitted an abstract to the April 2014 Biophysical Society meeting (San Francisco) on our work together, but had to withdraw it due to conflicts with MD/PhD program interviews. Due to the distance and my spring teaching schedule I was unable to attend the meeting in his place.

[2] Siying Wang, Tali Dadosh, Claudia Querner, Michael Fischbein, Lauren Willis, Dmitry Novikov, Catherine H. Crouch, and Marija Drndic, "Fluorescence intermittency in CdSe nanoparticles," Frontiers in Nanoscale Science and Technology Workshop, Harvard University, May 2009.

[3] Robert Mohr*, Thomas Emmons*, and Catherine H. Crouch, "Excitation energy dependence of fluorescence intermittency in single CdSe/ZnS nanocrystals," American Physical Society March Meeting, Pittsburgh, PA, March 2009.

[4] Nicholas Kattamis, Neal McDaniel, Ethan Deyle*, Corey White*, Catherine Crouch, Stefan Bernhard, and Craig Arnold, "Laser Direct Write Printing of Small Molecule Organic Materials for Light Harvesting and Emitting Applications", Spring Meeting of the Materials Research Society, San Francisco, CA, April 2008.

[5] Nicholas Kattamis, Neal McDaniel, Ethan Deyle*, Corey White*, Catherine Crouch, Stefan Bernhard, and Craig Arnold, "Laser Direct Write Printing of Small Molecule Organic Materials for Organic Electronics", Photonics West, San Jose, CA, January 2008.

[6] Siying Wang, Claudia Querner, Thomas Emmons*, Marija Drndic, and Catherine H. Crouch, "Size dependence of fluorescence blinking statistics from single CdSe nanorods," APS March Meeting, Denver, CO (2007).

[7] Thomas Emmons*, Siying Wang, Claudia Querner, Marija Drndic, and Catherine H. Crouch, "Effect of experiment duration on power law fluorescence blinking from semiconductor nanorods," APS Division of Laser Science meeting, Rochester, NY (2006).

[8] Siying Wang, Nathan Landy*, Tara Finley*, Hugo Romero, Marija Drndic, and Catherine H. Crouch, "Truncated power law fluorescence blinking from seminconductor nanorods," APS March Meeting, Baltimore, MD (2006).

RECENT EXERIMENTAL PROPOSALS (approved/funded proposals indicated by *)

*National Science Foundation Research Opportunity Award, a supplement to Prof. Tobias Baumgart's National Science Foundation grant, to support CHC working with Prof. Baumgart's research group as part of her 2010-2011 sabbatical.

National Science Foundation Research at Undergraduate Institutions proposal (Experimental Physical Chemistry), "Excitation energy dependence of fluorescence lifetimes and fast-timescale fluorescence intermittency in colloidal semiconductor nanocrystals," with co-principal investigator Carl Grossman, submitted November 2008. Reviewer rankings: One "excellent," four "very good." Panel recommendation: "Recommend." Not funded.

*Argonne National Laboratory Center for Nanoscale Materials User proposal, "Quantum Rod Blinking and Fluorescence Lifetimes on Sub-Microsecond Timescales," approved September 2007, for use of ANL facilities. Renewal proposal submitted October 2008 and approved January 2009.

RECENT CURRICULUM DEVELOPMENT AND ASSESSMENT PROPOSALS AND FUNDING (approved/funded indicated by *)

*National Science Foundation proposal, "Do Connections Persist? A Pilot Study Investigating the Lasting Impact of a Physics Course Designed to Facilitate Connections With Biology", 9/2017–8/2020, with co-PIs Benjamin Geller, Swarthmore Physics, and Sara Hiebert Burch, Swarthmore Biology (DUE-1710875).

*National Science Foundation collaborative proposal, "Community Sourcing Introductory Physics for the Life Sciences," PI Robert C. Hilborn (American Association of Physics Teachers), 9/2016-8/2019. I am a co-PI on this project (DUE–1624017).

*National Science Foundation collaborative proposal, "Creating a Common Thermodynamics," PI Edward F. Redish (University of Maryland), 8/2011–8/2014. I am a co-PI on this project.

*Hired Benjamin Geller as postdoctoral research associate (half-time 1/2015-5/2017, along with half-time teaching funded through leave replacement position) for assessment of Physics 3L and 4L funded through Swarthmore College Howard Hughes Medical Institute (HHMI) grant.

*Sabbatical salary and lab releases (spring 2014, fall 2015) for development and assessment of Physics 3L funded through Swarthmore College Howard Hughes Medical Institute (HHMI) Science and Education grant, 2012–2016; course release (fall semester 2007) for development of Physics 4L funded through 2007–2011 grant.

National Science Foundation collaborative proposal, "Introductory Physics in Biological Context: Developing a Disseminatable Course," with co-PI Kenneth Heller (University of Minnesota), submitted Jan 2011 and again Jan 2012; received reviews of "Very Good," funding declined. I am the PI for this project.

*NSF award "Conference on Scientific Foundations of Future Physicians: How do physics departments respond?" 10/2009-9/2010 (DUE-0965156). I am a co-PI on this project; the award was made to George Washington University

and PI Mark Reeves, with other co-PIs Timothy McKay, Suzanne Amador Kane, and Robert Hilborn. This grant supported an October 2009 conference held at GWU.

*Travel funds to attend Gordon Conference on Physics Education and Research (2006), and American Association of Physics Teachers Summer Meetings (2007 and 2009), for presentation and discussion of materials for Physics 4L, provided by Swarthmore College HHMI grant.

SERVICE TO SWARTHMORE COLLEGE AND TRICO COMMUNITY

Chair of NSE Inclusive Excellence Faculty Working Group, summer 2017–present, after developing a preliminary proposal for coordinating teaching and learning resources in the NSE Division, in collaboration with Liz Vallen and Kathy Siwicki (2016-17).

Project Director for application to Howard Hughes Medical Institute Inclusive Excellence competition for $1M, proposal due October 10, 2017 (proposal not funded).

Teaching in Swarthmore Summer Scholars Program, Summer 2016 (co-teaching with Frank Moscatelli) and 2017 (co-teaching with David Cohen). Preparation of materials, archiving materials for use by future instructors, participating in selection process for summer mentors and program participants, teaching classes, participating in weekend trips, and mentoring four student participants throughout their four years at Swarthmore.

Designed assessment of Swarthmore Summer Scholars Program and led assessment team 2015-2018 (includes Robin Shores and Jason Martin from Institutional Research managing statistical data analysis and Elizabeth Derickson from the Dean's Office managing interview data analysis), including primary responsibility for the report on outcomes from the first three cohorts of the program.

Contributed literature review and materials based on Physics 3L and 4L to HHMI Capstone report summarizing outcomes of 28 years of funding to Swarthmore College.

Organized Mellon Brainstorming meetings "Coherence across the introductory science curriculum" during June 2016 and January 2017.

Faculty chaperone for Dec 2016 – Jan 2017 Israel-Palestine study trip through Peace & Conflict Studies 053 (led by Sa'ed Atshan).

Richard Rubin Scholars program mentor for Sara Lentricchia '15, Ivan Lomeli '19, and Kat Lima '20.

Committee on Faculty Diversity, Fall 2015 – Spring 2018.

Search Committee for the Director of the InterCultural Center/Dean of the Sophomore Class, Spring 2016.

College Judiciary Committee, 2015-16

Breakout session leader at workshop on teaching strategies to support diverse populations offered at Bryn Mawr, August 2015.

Organized workshop on interactive teaching for NSE faculty (June 2015) and led interactions with ITS to provide more extensive support for instructors using clickers beginning with Fall 2015; provided follow-up meetings in October 2015 and January 2016.

Led initial response to student concerns about climate in physics department, spring 2014, prior to going on leave.

Presenter at Institute for the Liberal Arts Faculty Retreat, September 2013, on attending Nora Johnson's Shakespeare honors seminar.

Second Tuesday Science Café presenter, October 2014.

HHMI Steering Committee and Faculty-Staff Benefits Committee, 2013-14.

Division Chair, Natural Sciences and Engineering, July 2012-June 2013. In addition to usual Division Chair business, I planned and led discussions of NSE chairs on the transition for the four-course load, and oversaw the initial transition to an electronic application system for summer research fellowships. During the 2013-14 year I continued to support new Chair Aimee Johnson specifically on the implementation of the application system. Included serving *ex officio* on the Curriculum, Assessment and Periodic Review Report Committees.

Ad Hoc Committee on Academic Initiatives, Spring 2012. Planning for transition to four-course load.

Contributor to 2012 HHMI Science Education grant proposal, May – October 2011. Contributed ideas for grant throughout planning process, wrote sections describing Physics 3L-4L portion of proposal, and provided references and general information for PI Kathy Siwicki. Also served on HHMI Steering Committee Fall 2011-present.

Committee on Fellowships & Prizes, 2009-10. Interviewed candidates for Rhodes, Marshall, and Goldwater Scholarships, and participated in decisions for College prizes.

Health Sciences Advisory Committee, 2007-10 and 2011-12, Provided feedback to Health Sciences Advisor Gigi Simeone on summary letters of recommendation for medical school applicants and on applicant ranks. Reviewed system used for ranking applicants.

Contributed to writing of College grant proposal to the Howard Hughes Medical Institute (requesting funds for laboratory equipment for Physics 4L), summer 2007.

Writing Program Review Committee, 2005–06. Committee Chair: Peter Schmidt (English). Evaluated the Writing Program, including the training and use of Writing Associates, the functioning of the Writing Center, and other writing-related activities at Swarthmore. The committee prepared a report to the Provost consisting of our evaluation and recommendations, and each member wrote several sections of the report. As the sole committee member from the Division of Natural Sciences and Engineering, gathered feedback from faculty in the Division and represented the unique needs and issues related to writing in mathematics, natural sciences, and engineering to the committee.

Committee on Academic Requirements, 2004-05 and 2005-06. Committee Chair: Dean Robert Gross. Evaluated records of students with poor academic standing and recommended appropriate responses.

Expanding Your Horizons: Swarthmore student-run conference organized by Nicole Belanger ’08 for local middle school girls and parents, March 2005, 2006, and 2009. Presented workshop for parents on factors contributing to girls’ success in mathematics and science.

SERVICE TO PHYSICS AND PHYSICS EDUCATION COMMUNITY

Vice-Chair, APS Forum on Education (elected Fall 2018 to Chair succession line for 2019-22).

Member-at-Large, APS Topical Group on Physics Education Research, 2016-2018.

American Physical Society Outstanding Referee 2016 (reflects cumulative service).

American Physical Society Forum on Education Program Committee, 2014-15.

Co-organizer of NSF-Funded conferences on introductory physics for life sciences, April 2014 (NSF DUE 1322895, $97,513, PI R. Hilborn, co-PIs: J. Burciaga, D. Meredith, M. Reeves, and P. Soto.) and October 2009 (DUE-0965156, $31,465, PI M. Reeves, co-PIs C. Crouch, S. Amador Kane, and T. McKay). With co-organizers of 2014 meeting, prepared a conference report for APS and AAPT with recommendations for national reforms of this course. With co-organizers of 2009 meeting, wrote APS News Back Page (editorial) summarizing directions for reform.

Workshop organizer for Am. Assoc. of Physics Teachers Summer Meeting 2013, and workshop presenter in 2012.

American Physical Society Excellence in Education Award Committee Chair, 2011, and member, 2010.

External review committee, Physics Department, Wheaton College (Wheaton, IL), March 2017. Declined invitations to serve on review committees at Amherst College and Hamilton College due to conflicts with other obligations.

Tenure dossier reviewer for physics and chemistry faculty at numerous peer institutions.

Reviewing for journals and funding agencies:

Physics/chemistry journals: reviewed submitted manuscripts for *Science*, *Physical Review Letters*, *Nano Letters*, *Physical Review B*, *Journal of Physical Chemistry B*, *Langmuir*, *Applied Physics Letters*, *Applied Physics A*

Physics/chemistry funding: reviewed proposals to the Army Research Office and internal university grants

Physics education journals: reviewed articles for *American Journal of Physics, Physical Review Physics Education Research*, *Journal of Research in Science Teaching*, and *The Physics Teacher* (as well as for the *Physics Education Research Conference* proceedings, required of all who submit articles)

Physics education funding: reviewed proposals to the National Science Foundation for three competitions (EHR CORE spring 2015, IUSE spring 2014, and REESE fall 2013), invited to serve on two additional panels for which there were unresolvable scheduling conflicts.