CATHERINE HIRSHFELD CROUCH, PH.D.

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PRESENT POSITION

Professor of Physics and Department Chair, Swarthmore College (hired at Swarthmore 2003, tenured 2009, promoted on schedule required by Swarthmore 2017, department chair since July 2021*).*

EDUCATION

Postdoctoral Fellow in Applied Physics and Physics Education with Eric Mazur, Harvard University, 1996–2003.

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.

AWARDS and FELLOWSHIPS

Co-PI on NSF IUSE grant, "Investigating how life science students develop lasting skill in making connections between physics and biology" (DUE-2142074), $300k, 2022-25, with PI Benjamin Geller (Swarthmore Physics).

Elected a Fellow of the American Physical Society, through the Topical Group in Physics Education Research, October 2021: "For leadership in physics education research focused on promoting thoughtful use of interactive engagement for all students, and for making physics relevant to life science majors, as well as for supporting others through archiving of key resources, mentoring, and commitment to equity and inclusion in STEM."

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, 2017-20, with co-PIs Benjamin Geller 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 (reviewing primarily for PRPER).

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 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, 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 (through 2018, in collaboration with Kathleen Howard, Swarthmore Chemistry & Biochemistry, and Tobias Baumgart and Liz Rhoades, University of Pennsylvania Chemistry)

SERVICE TO PHYSICS AND PHYSICS EDUCATION COMMUNITY

Education Summit participant and Advisory Member, Center for Living Systems (NSF-funded Frontier Center at University of Chicago), June 2024.

Fellowship Selection Committee member, APS Topical Group on Physics Education Research, 2024, 2025.

Panelist and reviewer for National Academy of Sciences Decadal Study of the Physics of Life (published 2022).

Steering Committee, APS/AAPT Department Chairs' Conference, 2022, and session organizer, 2023.

Co-Chair (2022 only) and member, APS Committee on Education, 2020-22 (ex officio from FEd Chair line).

Chair Line, APS Forum on Education (2019-22).

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

American Physical Society Outstanding Referee 2016 (reflects cumulative service, primarily reviewing for PRPER).

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 AAPT Summer Meeting 2013, and workshop presenter in 2012.

APS Excellence in Education Award Committee Chair, 2011, and member, 2010.

External review committee, Physics Department, Wheaton College (Wheaton, IL), March 2017.

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

Reviewing for journals and funding agencies:

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

Physics education funding: reviewed proposals to the National Science Foundation for six competitions, invited to serve on two additional panels for which there were unresolvable scheduling conflicts.

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

RELEVANT SERVICE TO SWARTHMORE COLLEGE

Physics and Astronomy department chair, July 2021-June 2022 and July 2023-present.

Member, Financial Resources Study Group, 2023.

Chair of NSE Inclusive Excellence Faculty Working Group, May 2017–July 2021, after developing a proposal for coordinating teaching and learning resources in the NSE Division, with Liz Vallen and Kathy Siwicki (2016-17).

Designed assessment of Swarthmore Summer Scholars Program and led assessment team 2015-2018.

Committee on Faculty Diversity, Fall 2015 – Spring 2018.

Division Chair, Natural Sciences and Engineering, July 2012-June 2013. Included serving *ex officio* on the Curriculum, Assessment and Periodic Review Report Committees.

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

[1] Benjamin D. Geller and Catherine H. Crouch, "Does it stick? A longitudinal study of introductory physics for life sciences at a small college," invited paper (corresponding to conference plenary talk) in *Proceedings of the Physics Education Research Conference 2024,* ed. A. Pawl, AIP Publishing (2024, in press).

[2] Catherine H. Crouch and Benjamin D. Geller, "Introductory Physics for Life Sciences: Preparing and Engaging Students through Authentic Interdisciplinary Connections," Ch. 20 in *The International Handbook of Physics Education Research: Learning Physics,* eds. M. F. Tasar and P. R. L. Heron, AIP Publishing (2023).

[3] Benjamin D. Geller, Jack Rubien,* Sara M. Hiebert, and Catherine H. Crouch, "The impact of introductory physics for life sciences in a senior biology capstone course," Phys. Rev. Phys. Educ. Res. **18**, 010120 (2022).

[4] Benjamin D. Geller, Maya Tipton,* Brandon Daniel-Morales,* Nikhil Tignor,* Calvin White,* and Catherine H. Crouch, "The role of introductory physics for life sciences in supporting students to use models flexibly," Phys. Rev. Phys. Educ. Res. **18**, 010131 (2022).

[5] Catherine H. Crouch and John W. Hirshfeld, Jr, "Teaching the electrical origins of the electrocardiogram: An introductory physics laboratory for life science students," American Journal of Physics **88**, 526 (2020).

[6] 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).

[7] 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).

[8] 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).

[9] 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).

[10] 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).

[11] 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).

[12] 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).

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

[14] 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).

[15] 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] With co-presenter Benjamin Geller, "Does it stick? A longitudinal study of introductory physics for life sciences at a small college," plenary talk at the 2024 Physics Education Research Conference, Boston, MA, July 2024.

[2] "Developing physical modeling skills in introductory physics for life sciences," AAPT Summer Meeting, July 2024.

[3-8] "Supporting interdisciplinary, enduring learning: Strategy and results from introductory physics for the life sciences," Amherst College (April 2023), Harvard University Learning Incubator talk series (March 2023), UMass

STEM Education seminar (May 2021); George Washington University Walker Lecture, Oct 2020; NSF-funded high school teacher development workshop, July 2020; Widener University, March 2020.

[9] Invited panelist for National Academy of Sciences decadal study of biological physics, April 2020.

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

[11-13] "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, May 2019, and Harvard, March 2019; and AAPT Winter Meeting, January 2019.

[14] "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.

[15, 16] "Living Physics Portal: Community and Resources for Physics for Life Sciences," AAPT Summer Meeting, July 2018 and American Physical Society (APS) March Meeting, March 2019.

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

[18-29] "Teaching Introductory Physics in Biological Context," UCLA Biology Department, Feb. 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; APS April Meeting, April 2014; AAPT National Meeting, July 2013; Univ. of Pittsburgh, Feb. 2013; Univ. of Maryland-Baltimore County, May 2011; AAPT/APS New Faculty Reunion Workshop, Oct. 2012.

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

[31] "Reforming the Introductory Physics Course for Life Science Students," workshop offered at the AAPT Summer Meeting, July 2012, organized by Dawn Meredith.

[32] "Biomedical-Inspired Laboratories for Introductory Physics," workshop offered at AAPT Summer Meeting, with organizer Mark Reeves and co-presenter Suzanne Amador Kane, Portland, OR, July 2010.

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

[34] "Gender and student achievement with Peer Instruction," 2008 Physics Education Research Conference, Edmonton, Alberta, Canada, July 2008. Also served as organizer for one of six invited sessions.

[35-37]"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.

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

[39, 40]"Classroom demonstrations: Learning Tools or Entertainment?" 19th Biennial Conference on Chemical Education, August 2006; APS April Meeting, Philadelphia, PA, April 2003.

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] Nikhil Tignor, Lundy Zheng, Drake Roth, Catherine H. Crouch, Stephen Hackler, Lili Cui, Daniel Young, and Benjamin D. Geller, “Characterizing “Physics Affinity” in Introductory Physics for Life Sciences at Three Institutions,” contributed talk at the summer 2024 American Association of Physics Teachers meeting (Boston, MA), and poster at the Physics Education Research conference immediately after.

[2] Lundy Zheng, Nikhil Tignor, Drake Roth, Catherine H. Crouch, Stephen Hackler, and Benjamin D. Geller, “Key Features of a Successful Introductory Physics for Life Sciences Course Ecosystem,” contributed talk at the summer 2024 American Association of Physics Teachers meeting (Boston, MA), and poster at the Physics Education Research conference immediately after.

[3] Drake Roth, Angelina Tjia, Catherine H. Crouch, Stephen Hackler, and Benjamin D. Geller, “Student Perceptions of Instructor Priorities in an IPLS Classroom,” contributed talk at the summer 2023 American Association of Physics Teachers meeting (Sacramento, CA), and poster at the Physics Education Research conference immediately after.

[4] Angelina Tjia, Drake Roth, Kya Butterfield, Catherine H. Crouch, Lili Cui, Alfredo Sanchez, and Benjamin D. Geller, “Development of physics affinity in introductory physics for life science students across three institutions,” contributed talk at the summer 2023 American Association of Physics Teachers meeting (Sacramento, CA), and poster at the Physics Education Research conference immediately after.

[5] Stephen Hackler, Angelina Tjia, Drake Roth, Catherine H. Crouch, and Benjamin D. Geller, “Linking Gains in Physics Affinity to Pedagogy in Introductory Physics for Life Sciences (IPLS),” contributed talk at the summer 2023 American Association of Physics Teachers meeting (Sacramento, CA), and poster at the Physics Education Research conference immediately after.

[6] Gwendolyn Rak, Benjamin Geller, and Catherine H. Crouch, “Assessing the Lasting Impact of IPLS on Student Interdisciplinary Attitudes,” contributed talk at the summer 2020 American Association of Physics Teachers meeting (virtual), and poster at the Physics Education Research conference immediately after.

[7] Jack Rubien, Catherine H. Crouch, Sara Hiebert Burch, and Benjamin Geller, “The impact of IPLS in a senior biology capstone course,” contributed talk at the summer 2020 American Association of Physics Teachers meeting (virtual), and poster at the Physics Education Research conference immediately after.

[8] Maya Tipton, Catherine H. Crouch, and Benjamin Geller, “Does IPLS help students apply physics to biology?” contributed talk at the summer 2020 American Association of Physics Teachers meeting (virtual), and poster at the Physics Education Research conference immediately after.

[9] 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.

[10] 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.

[11] 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.

[12] 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.

[13] 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.

[14] 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.

[15] 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

[16] 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.

[17] 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.

[18] 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.

[19] 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.

[20] 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 AAPT meeting, Sacramento, CA.

[21] 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).

[22] 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.

[23] 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.

[24] 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.

[25] 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.

[26] 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.

[27] 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.

[28] 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.

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

[30] 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).

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

[32] 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).

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.

Living Physics Portal. Multi-institution NSF-funded project (Swarthmore DUE–1624017, 2016-2020) led by Robert Hilborn (American Association of Physics Teachers) to disseminate curricular materials for reformed introductory physics for life science courses. The site is maintained and I am still contributing, although the grant has ended.

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