

Benjamin D. Geller, Ph.D.

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PRESENT POSITION

Visiting Assistant Professor of Physics
Swarthmore College, January 2015 – present

Natural Sciences and Engineering (NSE) Division Education Resource Specialist
Swarthmore College, September 2017 – present

EDUCATION

Ph.D., Physics, 2014
University of Maryland, College Park, Maryland. Advisor: Dr. Edward F. Redish
Dissertation title: *Explanatory coherence in the context of the second law of thermodynamics*

Certificate of Advanced Studies in Mathematics (C.A.S.M.), as Fulbright Scholar, 2004
Part III of the Mathematical Tripos, Department of Applied Mathematics and Theoretical Physics
University of Cambridge, Cambridge, UK

M.A., Philosophical Foundations of Physics, 2003
Columbia University, New York, NY

B.A., Chemistry, 2001
Phi Beta Kappa
Swarthmore College, Swarthmore, PA

PHYSICS EDUCATION RESEARCH & WORK EXPERIENCE

Natural Sciences and Engineering (NSE) Division Education Resource Specialist (9/17 – present) Swarthmore College. I train and supervise the undergraduate peer assistants in the Physics, Mathematics, and Chemistry departments. This involves leading weekly pedagogy workshops, observing the peer assistants as they work with students, and providing feedback to them on a regular basis. I also work with faculty who request support in making their coursework better suited for inclusive learning experiences in the peer-led help sessions.

Co-PI, NSF Grant #1710875, Do connections persist? a pilot study investigating the lasting impact of a physics course designed to facilitate connections with biology. (8/17 – 8/20) I am co-PI on a recently awarded grant to study the longitudinal effects of the Introductory Physics for Life Science (IPLS) course at Swarthmore College. We will collect survey and interview data from life science students as they move into intermediate and advanced biology coursework, to see what role the IPLS experience plays in their subsequent academic and research lives. We will compare these data to data obtained from students who have taken traditional introductory physics.

Swarthmore Co-PI, NSF Grant #11624017, Collaborative research: Community sourcing of Introductory Physics for the Life Sciences (IPLS). (8/16 – 8/20) I am co-PI on a recently awarded grant to create an international online portal that will gather and disseminate materials related to Introductory Physics for Life Sciences (IPLS) courses, and foster the development of a thriving IPLS community.

Postdoctoral Research Associate (1/15 – 8/17) Swarthmore College, Postdoctoral Research Associate in the Physics & Astronomy and Biology departments at Swarthmore College. I worked on the development, implementation, and assessment of a novel Introductory Physics for Life Scientists (IPLS) course, Physics 3L-4L. I also assisted the Swarthmore biology department to increase the amount of student-centered, active learning in the introductory biology courses, and to assess the Biology Scholars Program, a program supporting students who are under-prepared for the Introductory Biology Sequence. I also assess the Swarthmore Summer Scholars Program (S3P), a new initiative to support underrepresented students in STEM at Swarthmore.

Creating a Common Thermodynamics (8/11 – 12/14) University of Maryland, Research Assistant in Dr. Edward Redish's Physics Education Research Group (PERG). I completed a literature review to understand educational issues related to thermodynamics across biology, chemistry, and physics. Developed curriculum to cross disciplinary boundaries. Researched student understanding of thermodynamics across biology, chemistry, and physics.

NEXUS/Physics (8/11 – 12/14) University of Maryland, Research Assistant in Dr. Edward Redish's Physics Education Research Group (PERG). I worked on the design and implementation of a biologically authentic physics curriculum for pre-health profession students.

Interdisciplinary Research Institute in STEM Education (I-RISE) (6/12 – 7/12) Seattle Pacific University, Physics Education Scholar. I worked with Dr. Rachel Scherr and other physics education researchers and students to observe, document, and reflect on an instructional setting in which elementary school science teachers reasoned about energy.

BIOPHYSICS RESEARCH EXPERIENCE

University of California, Berkeley (1/10 – 7/11), Graduate student researcher in Dr. Birgitta Whaley's quantum computation lab. Studied quantum effects in photosynthesis.

University of California, Berkeley (1/07 – 1/09), Graduate student researcher in Dr. Susan Marqusee's protein folding lab. Studied single-molecule protein folding via optical tweezers.

PHYSICS RESEARCH EXPERIENCE

Columbia University (5/02 – 10/02), Research with Dr. Brian Greene and Dr. Mark Jackson on supersymmetry in quantum mechanics. Work supported by the VIGRE program.

Swarthmore College (5/00 – 5/01), Research with Dr. Peter Collings and Dr. Robert Pasternack on the use of resonance light scattering to investigate the self-aggregation properties of ultrathin porphyrin films.

TEACHING EXPERIENCE

Physics:

Instructor of Record (Fall 2017), Department of Physics, Swarthmore College, PHYSICS 3L. General Physics I: Motion, Force, and Energy with Biological and Medical Applications.

Instructor of Record (Spring 2015, Spring 2016, Spring 2017), Department of Physics, Swarthmore College, PHYSICS 4L. General Physics II: Electricity, Magnetism, and Optics with Biological and Medical Applications.

Instructor of Record (Fall 2015, Fall 2016), Department of Physics, Swarthmore College, PHYSICS 095/EDUCATION 075 (cross-listed). Introduction to Science Pedagogy: Theory and Practice.

Instructor of Record (Spring 2014), Department of Physics, University of Maryland, College Park, PHYSICS 299L. Special Problems in Physics: Quantitative Biology and Biophysics. A research experience course taken by both life science and physics students. Designed lesson plans, delivered lectures, assessed student written and oral work, and mentored students.

Head Graduate Student Instructor (9/09 – 5/10; 2 semesters), Department of Physics, University of California, Berkeley, PHYSICS 8A and PHYSICS 8B
Oversaw graduate student instructional activities for the introductory physics sequence taken primarily by life science majors. Contributed to problem and exam design, led course-wide review sessions, advised undergraduates, and gave guest lectures.

Graduate Student Instructor (9/05 – 1/07; 3 semesters), Department of Physics, University of California, Berkeley, PHYSICS 8A and PHYSICS 8B
Led discussion and lab sections for the introductory physics sequence taken primarily by life science majors. Designed lesson plans, led course-wide review sessions, and advised undergraduates.

Instructor of Record (6/03 – 8/03, 6/04 – 8/04), Department of Physics, Columbia University, PHYSICS S1202Q
Served as the lead instructor for General Physics II, a second-semester introductory course taken primarily by life science students. Designed lesson plans, delivered lectures, wrote exams, and assessed student work.

Instructor of Record (6/04 – 8/04), Department of Physics, Columbia University, PHYSICS S0065
Served as the lead instructor for Basic Physics, a course designed to prepare post-baccalaureate pre-medical students who had been out of school for many years for quantitative aspects of the introductory physics pre-med requirements. Designed the structure of the course (since the course had never been taught before), delivered lectures, assessed student work, and provided individual tutoring to each student.

Other:

Volunteer Mathematics Instructor (9/10 – 6/11), Prison University Project at San Quentin Prison.
Tutored inmates in mathematics in an effort to assist them in obtaining a college degree during their time in prison.

Pedagogy Coordinator for the Compass Project (9/06 – 9/08), University of California, Berkeley.

The Compass project aims to promote community within the physics department at Berkeley, to emphasize the importance of effective teaching, and to support the success of women and underrepresented minorities in the physical sciences broadly. The effort was started by graduate students during my time at Berkeley and remains an active community today.

Instructor for the Compass Project (8/09), University of California, Berkeley.

Designed and delivered an interactive course for incoming undergraduates in the physical sciences, titled “What can Quantum Mechanics teach us about Human Vision?”

STUDENTS MENTORED

Jessica Li (Swarthmore undergrad; supervisor for Summer PER research, 2017)

Max Franklin (Swarthmore undergrad; supervisor for Summer PER research, 2016 and 2017)

Haley Gerardi (Swarthmore undergrad; supervisor for Summer and Fall PER research, 2016)

Tessa Williams (Swarthmore undergrad; supervisor for Summer PER research, 2015)

FELLOWSHIPS AND AWARDS

Nominated to be Faculty Speaker at Last Collection, Swarthmore College, 2017

PERTG Travel Grant, Winter AAPT Conference, New Orleans, LA, 2016

Best Poster Award, University of Maryland Bioscience Day, 2014

Jacob K. Goldhaber Travel Grant, University of Maryland, 2013

TRUSE Travel Award, TRUSE Conference, St. Paul, Minnesota, 2012

Interdisciplinary Research Institute in STEM Education (I-RISE) Scholar, Seattle Pacific University, 2012

Outstanding Graduate Student Instructor, University of California, Berkeley, 2006

Presidential Teaching Award (Finalist), Columbia University, 2003

Fulbright Scholarship, University of Cambridge, UK, 2003

American Chemical Society Outstanding Scholar Award, 2001, Swarthmore College

Sarah Kaighn Cooper Scholar, 2000, Swarthmore College

PROFESSIONAL AFFILIATIONS

American Association of Physics Teachers

American Physical Society

Phi Beta Kappa

PUBLICATIONS

Refereed Journal Articles:

Geller, B.D., Turpen, C., Crouch, C.H., “Sources of student engagement in introductory physics for life sciences” *Phys. Rev. ST-Phys. Educ. Res.*, submitted (2017).

Geller, B.D., Dreyfus, B.W., Gouvea, J.S., Sawtelle, V., Turpen, C., Redish, E.F., “Bridging the gaps: Classifying forms of disciplinary boundary crossing in an introductory physics course,” *Phys. Rev. ST-Phys. Educ. Res.*, submitted (2017).

Geller, B.D.,¹ Dreyfus, B.W.¹, Sawtelle, V., Meltzer, D.E., “Resource letter: Teaching thermodynamics and statistical mechanics in physics, chemistry, and biology,” *Am. J. Phys.*, **83**, 5-21 (2015). ¹ Authors contributed equally to this publication.

Geller, B.D., Dreyfus, B.W., Gouvea, J.S., Sawtelle, V., Turpen, C., Redish, E.F., “Entropy and spontaneity in an introductory physics course for life science students,” *Am. J. Phys.*, **82**, 394 (2014).

Dreyfus, B.W., Gouvea, J.S., **Geller, B.D.**, Sawtelle, V., Turpen, C., Redish, E.F., “Chemical energy in an introductory physics course for the life sciences,” *Am. J. Phys.*, **82**, 403 (2014).

Dreyfus, B.W., **Geller, B.D.**, Gouvea, J., Sawtelle, V., Turpen, C., and Redish, E.F., “Ontological metaphors for negative energy in an interdisciplinary context, *Phys. Rev. ST-Phys. Educ. Res.*, **10**, 020108 (2014).

Redish, E.F, Bauer, C., Carleton, K.L, Cooke, T.J., Cooper, M., Crouch, C.H., Dreyfus, B.W., **Geller, B.**, Giannini, J., Gouvea, J.S., Klymkowsky, M.W., Losert, W., Moore, K., Presson, J., Sawtelle, V., Turpen, C., Thompson, K., “NEXUS/Physics: An interdisciplinary repurposing of physics for biologists,” *Am. J. Phys.*, **82**, 368 (2014).

Gouvea, J.S., Sawtelle, V., **Geller, B.D.**, Turpen, C., "A framework for analyzing interdisciplinary tasks: Implications for student learning and curricular design," *Cell Biol. Educ.*, **12**, 187 (2013).

Conley, J., **Geller, B.**, Jackson, M.G., Pomerance, L., Shrivastava, S., “A quantum mechanical model of spherical supermembranes,” *JHEP*, 070 (2003).

Papers in Peer-Reviewed Conference Proceedings:

Geller, B.D., Gouvea, J.S., Sawtelle, V., and Turpen, C., “Sources of affect around interdisciplinary sense making,” *Proceedings of the International Conference of the Learning Sciences*, 1142-1146 (2014).

Geller, B.D., Dreyfus, B.W., Gouvea, J.S., Sawtelle, V., Turpen, C., and Redish, E.F., “Like dissolves like: Unpacking student reasoning about thermodynamic heuristics,” *Proceedings of the 2013 Physics Education Research Conference*, 157-160 (2014).

Dreyfus, B.W., **Geller, B.D.**, Gouvea, J.S., Sawtelle, V., Turpen, C., and Redish, E.F., “Negative energy: Why interdisciplinary physics requires multiple ontologies,” *Proceedings of the 2013 Physics Education Research Conference*, 129-132 (2014).

Dreyfus, B.W., **Geller, B.D.**, Sawtelle, V., Svoboda, J., Turpen, C., Redish, E.F., “Students' Interdisciplinary Reasoning about 'High Energy Bonds' and ATP,” *Proceedings of the 2012 Physics Education Research Conference*, AIP Press, Melville NY **1513**, 122-125 (2013).

Geller, B.D., Dreyfus, B.W., Sawtelle, V., Svoboda, J., Turpen, C., and Redish, E.F., “Students' Reasoning about Interdisciplinarity,” *Proceedings of the 2012 Physics Education Research Conference*, AIP Press, Melville NY, **1513**, 146-149 (2013).

Invited Talks

Geller, B.D., “Bridging the gaps: The role of ‘free energy’ in interdisciplinary education,” Invited talk to the 2018 Physics Research and Education Gordon Research Conference, Smithfield, RI, June 2018 (upcoming).

Geller, B.D., “Curricular content and affective engagement in an Introductory Physics for Life Sciences (IPLS) course,” Invited talk to the Drexel University Physics Department, January 2018 (upcoming).

Geller, B.D., “Sources of student engagement in IPLS,” Invited talk to the PER group at Michigan State University, East Lansing, MI, October 2016.

Geller, B.D., “Sources of student engagement in IPLS,” Invited talk to the PER group at Michigan State University, East Lansing, MI, October 2016.

Geller, B.D., “Sources of student engagement in IPLS,” Invited talk at the 2016 Physics Education Research Conference (PERC), Sacramento, CA, July 2016.

Geller, B.D., “Epistemological and methodological balancing acts in IPLS collaboration,” Invited talk at the Winter AAPT Meeting, New Orleans, LA, January 2016.

Geller, B.D., “Sources of affect around interdisciplinary sense making,” Invited talk to the DBER group at George Washington University, Washington, D.C., April 2014.

Geller, B.D., “Life science student and faculty perspectives on IPLS,” Invited talk for the Workshop on “Teaching Physics For Life Science And Pre-Health Students: Lab Activities And Strategies For Course Design,” Portland State University, Portland, OR, July 2013.

Geller, B.D., Moore, K., “NEXUS/Physics lab curriculum,” Invited presentation for the Workshop on “Teaching Physics For Life Science And Pre-Health Students: Lab Activities And Strategies For Course Design,” Portland State University, Portland, OR, July 2013.

Geller, B.D., Dreyfus, B.W., “Integrating different approaches to physics from different disciplines,” Invited talk, University of Maryland Bioscience Day, College Park, MD, November 2012.

Contributed Presentations (Posters and Talks) at National Conferences:

Geller, B.D., Turpen, C., and Crouch, C.H., “Saving the best for last: Introductory physics as a capstone,” AAPT/PERC, 2017 National Meeting, Cincinnati, OH, July 2017.

Franklin, M., **Geller, B.D.**, and Crouch, C.H. “The role of self-efficacy in introductory physics,” AAPT/PERC, 2017 National Meeting, Cincinnati, OH, July 2017.

Geller, B.D., Turpen, C., and Crouch, C.H., “The source of student engagement in IPLS,” AAPT/PERC, 2016 National Meeting, Sacramento, CA, July 2016.

Gerardi, H., Franklin, M., **Geller, B.D.**, Turpen, C., and Crouch, C.H., “Traditional physics vs IPLS: Comparing student experiences,” AAPT/PERC, 2016 National Meeting, Sacramento, CA, July 2016.

Geller, B.D., Dreyfus, B.W., Gouvea, J.S., Sawtelle, V., and Turpen, C., “Explanatory coherence in an introductory physics for life scientists course,” AAPT/PERC, 2014 National Meeting, Minneapolis, MN, July 2014.

Geller, B.D., Turpen, C., Renninger, K.A., Wisittanawat, P., and Crouch, C.H., “Unpacking the source of student interest in an IPLS course,” Contributed talk and poster, AAPT/PERC, 2015 National Meeting, College Park, MD, July 2015, and Society for the Advancement of Biology Education Research (SABER), 2015 National Meeting, Minneapolis, MN, July 2015.

Williams, T.E., **Geller, B.D.**, Turpen, C., Renninger, K.A., and Crouch, C.H., “Traditional physics versus IPLS: Comparing student interest and engagement,” AAPT/PERC, 2015 National Meeting, College Park, MD, July 2015.

Geller, B.D., Dreyfus, B.W., Gouvea, J.S., Sawtelle, V., and Turpen, C., “Explanatory coherence in an introductory physics for life scientists course,” AAPT/PERC, 2014 National Meeting, Minneapolis, MN, July 2014.

Sawtelle, V., Dreyfus, B.W., **Geller, B.D.**, Redish, E.F., Gouvea, J.S., and Turpen, C., “Designing and refining physics for biologists: The scaling up process,” PERC, 2014 National Meeting, Minneapolis, MN, July 2014.

Gouvea, J.S., Dreyfus, B.W., **Geller, B.D.**, Sawtelle, V., and Turpen, C., “In biology we never explain...: The construction of epistemological stances in course experiences, July 2014, Society for the Advancement of Biology Education Research (SABER), 2014 National Meeting, Minneapolis, MN, July 2014

Geller, B.D., Dreyfus, B.W., Gouvea, J.S., Sawtelle, V., Turpen, C., and Redish, E.F., “Like dissolves like: Unpacking student reasoning about thermodynamic heuristics,” Contributed talk and poster, AAPT/PERC, 2013 National Meeting, Portland, OR, July 2013.

Daane, A.R., **Geller, B.D.**, Sawtelle, V., Scherr, R.E., Redish, E.F., “Connecting learner ideas about energy and free energy,” Contributed poster, AAPT, 2013 National Meeting, Portland, OR, July 2013.

Moore, K., Giannini, J., **Geller, B.D.**, Losert, W., “Research on a laboratory curriculum for NEXUS/Physics,” Contributed talk and poster, AAPT, 2013 National Meeting, Portland, OR, July 2013.

Dreyfus, B.W., **Geller, B.D.**, Gouvea, J.S., Sawtelle, V., Turpen, C., and Redish, E.F., “Negative energy: Why interdisciplinary physics requires multiple ontologies,” Contributed talk and poster, AAPT/PERC, 2013 National Meeting, Portland, OR, July 2013.

Sawtelle, V., Turpen, C., Gouvea, J.S., Dreyfus, B.W., **Geller, B.D.**, “A case study in leveraging biology experiences in physics,” Contributed talk and poster, AAPT/PERC, 2013 National Meeting, Portland, OR, July 2013.

Gouvea, J.S., Dreyfus, B.W., **Geller, B.D.**, Sawtelle, V., Turpen, C., and Redish, E.F., “Mathematical reasoning across the sciences: The case of IPLS,” Contributed poster, AAPT/PERC, 2013 National Meeting, Portland, OR, July 2013.

Redish, E.F., Sawtelle, V., Turpen, C., Dreyfus, B.W., **Geller, B.D.**, “NEXUS/Physics: Rethinking physics for biology and premed students,” Contributed poster, AAPT/PERC, 2013 National Meeting, Portland, OR, July 2013.

Geller, B.D., Daane, A.R., Sawtelle, V., “Reconciling ‘energy’ and ‘free energy’,” Contributed poster, AAPT, 2013 National Meeting, New Orleans, LA, January 2013.

Geller, B.D., Dreyfus, B.W., Sawtelle, V., Svoboda, J., Turpen, C., and Redish, E.F., “Students' reasoning about interdisciplinarity,” Contributed poster, University of Maryland Bioscience Day, College Park, MD, November 2012.

Geller, B.D., Dreyfus, B.W., Sawtelle, V., Svoboda, J., Turpen, C., and Redish, E.F., “Students' reasoning about interdisciplinarity,” Contributed poster, AAPT/PERC, 2012 National Meeting, Philadelphia, PA, August 2012.

Geller, B.D., Giannini, J., Moore, K., Redish, E.F., Losert, W., “Laboratory development efforts in a physics for biologists course,” Contributed poster, Beyond-First-Year Laboratory Conference, Philadelphia, PA, August 2012.

Dreyfus, B.W., **Geller, B.D.**, Sawtelle, V., Svoboda, J., Turpen, C., Redish, E.F., “Students' interdisciplinary reasoning about 'high energy bonds' and ATP,” Contributed poster, AAPT/PERC, 2012 National Meeting, Philadelphia, PA, August 2012.

Redish, E.F., Dreyfus, B.W., **Geller, B.D.**, Sawtelle, V., Svoboda, J., Turpen, C., “Developing a research-based interdisciplinary physics course for biologists,” Contributed poster, AAPT/PERC, 2012 National Meeting, Philadelphia, PA, August 2012.

Geller, B.D., Dreyfus, B.W., Sawtelle, V., Turpen, C., and Redish, E.F. “Research on students' reasoning about interdisciplinarity,” Contributed poster, Transforming Undergraduate Science Education (TRUSE) Conference, St. Paul, MN, June 2012.

Dreyfus, B.W., **Geller, B.D.**, Sawtelle, V., Svoboda, J., Turpen, C. and Redish, E.F. “Students' interdisciplinary reasoning about 'high-energy bonds' and ATP,” Contributed poster, Society for the Advancement of Biology Education Research (SABER) National Meeting, SABER National Meeting, Minneapolis, MN, July 2012.