

Benjamin W. Dreyfus

Department of Physics & Astronomy / STEM Accelerator Program
George Mason University
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EDUCATION

Ph.D., Physics, 2014

University of Maryland, College Park, MD. Advisor: Dr. Edward F. Redish

Dissertation: Interdisciplinary Reasoning about Energy in an Introductory Physics Course for the Life Sciences

M.A. with honors, Science Education, 2004

The City College of New York, New York, NY

Permanent New York state teaching certificate in physics

A.B. *summa cum laude*, Physics, 2001

Harvard University, Cambridge, MA

Language citation in Modern Hebrew

PROFESSIONAL EXPERIENCE

Term Associate Professor (2016–present), Department of Physics and Astronomy / STEM Accelerator Program, George Mason University

Taught introductory algebra-based physics lecture and lab courses. Introduced research-based teaching methods including tutorials and Peer Instruction. Developed a new flipped version of the course for a SCALE-UP classroom. Coordinated Learning Assistant (LA) program for the physics/astronomy department, and taught pedagogy seminar for LAs across 8 STEM disciplines. Mentored undergraduates in independent research projects in PER. Ongoing research on impact of LA program on LAs and on students.

Postdoctoral Research Associate (2014–16), Physics Education Research Group, University of Maryland College Park

Analyzed engineering students' understanding of quantum phenomena, including students' ontological conceptions. Developed curricular modules to address fundamental concepts in quantum mechanics and modern applications, and instructor guides to assist other educators in adapting the materials.

Lecturer (2014–16), Department of Physics, University of Maryland College Park

Taught a reformed large-enrollment introductory physics course for life science majors emphasizing interdisciplinary coherence. Used research-based instructional strategies including Peer Instruction and Just In Time Teaching.

Research Assistant / NSF Graduate Research Fellow (2010–14), Physics Education Research Group, University of Maryland College Park

Worked on the design, implementation, and evaluation of a biologically authentic physics curriculum for life sciences students. Researched student understanding of energy and thermodynamics across biology, chemistry, and physics.

Teaching Assistant (2009–11, 2013–14), Department of Physics, University of Maryland College Park

Taught tutorial and lab sections for a reformed algebra-based introductory physics course, and taught discussion sections for a calculus-based introductory physics. Ran weekly training sessions for TAs and undergraduate Learning Assistants to implement group active-learning activities for an introductory physics course for life science students. Assisted with scaling up a new reformed course to large lecture format.

Physics Teacher (2003–09), Stuyvesant High School, New York, NY

Taught Regents physics for 9th and 11th graders, AP Physics B, AP Physics C, astronomy, and physics of music, at a selective public high school specializing in math and science. Developed the curriculum for a new physics of music elective. Advised students submitting original research projects to the Intel Science Talent Search. Faculty advisor for student-run physics publication.

Physics Teacher (2002–03), Frederick Douglass Academy, New York, NY

Taught Regents physics and 8th-grade math at a rigorous urban public school. Developed a physics lab curriculum from scratch.

Application Scientist (2001–02), Nanonics Imaging, Ltd., Jerusalem, Israel

Developed and tested new software for a pioneering near-field scanning optical microscopy (NSOM) system for high-resolution imaging. Conducted on-site hardware installation and training for international users. Edited company website and promotional literature.

Course Assistant (2000), Department of Mathematics, Harvard University

Taught a discussion section for an introductory course on calculus and differential equations, and worked with individual students.

Research Aide (1996–97), Chemistry Division, Argonne National Laboratory

Research on the radiation chemistry of nuclear waste.

FELLOWSHIPS AND AWARDS

GMU College of Science Excellence in Mentoring Award Nomination, 2019

GMU Stearns Center for Teaching and Learning Thank-a-Teacher Program, 2017, 2018

NSF Graduate Research Fellowship, 2011–2014

AAMC MedEd Portal Curriculum Award, Top submission in biochemistry for “Chemical Energy Instructional Thread for an Introductory Physics for the Life Sciences Class,” 2013

Jacob K. Goldhaber Travel Grant, University of Maryland (to present at the AAPT Summer Meeting and PERC), 2013

Richard and Anna Iskraut Scholarship, University of Maryland (awarded for the highest score on the classical physics qualifying exam), 2011

John Harvard Scholarship, Harvard University, 1997–2001 (every semester)

PROFESSIONAL ACTIVITIES

American Physical Society, Forum on Education, Executive Committee, Member-at-Large, 2019–present

American Physical Society, Jonathan F. Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction, Selection Committee, 2019

George Mason University, College of Science, Nominations Committee, 2018–present

George Mason University, Department of Physics and Astronomy, Recruitment and Engagement Committee, 2017–present

Judge, GMU College of Science Undergraduate Research Colloquium, 2017, 2018, 2019

Science Reviewer (Judge), The Loudoun County Public Schools Celebration of Independent Science Research at Mason (LCPS-ISR @ Mason), 2017, 2018

Reviewer, Physical Review PER, 2013–present

Reviewer, The Physics Teacher, 2014–present

Reviewer, American Journal of Physics, 2016–present

Reviewer, Cognition and Instruction, 2017–present

Reviewer, International Journal of Physics and Chemistry Education, 2017–present

Reviewer, Journal of Engineering Education, 2017–present

Reviewer, Physics Education Research Conference Proceedings, 2011–present

Organizer, PERG/Science Education Research Meeting, University of Maryland, 2012–2014

Judge, Graduate Research Interaction Day, University of Maryland, 2014

Workshop Leader, New TA Orientation, Department of Physics, University of Maryland, 2011, 2013, 2014, 2015

Session Chair, APS April Meeting, 2015, 2019

Presider, AAPT Summer Meeting, 2018

PROFESSIONAL AFFILIATIONS

American Association of Physics Teachers

American Physical Society

Learning Assistant Alliance

PUBLICATIONS

Refereed Journal Articles:

B.W. Dreyfus*, J.R. Hoehn*, A. Elby, N.D. Finkelstein, A. Gupta, “Splits in students’ attitudes toward classical and quantum physics,” *under review*. *Authors contributed equally.

B.W. Dreyfus*, A. Elby*, A. Gupta, E.R. Sohr, “Mathematical sense-making in quantum mechanics: An initial peek,” *Phys. Rev. PER*, **13**, 020141 (2017). *Authors contributed equally.

B.W. Dreyfus*, A. Gupta*, E.F. Redish, “Applying conceptual blending to model coordinated use of multiple ontological metaphors,” *Int. J. Sci. Ed.*, **37**(5–6), 812–838 (2015). *Authors contributed equally.

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

B.W. Dreyfus, J. Gouvea, B.D. Geller, V. Sawtelle, C. Turpen, E.F. Redish, “Chemical energy in an introductory physics course for the life sciences,” *Am. J. Phys.*, **82**(5), 403–411 (2014).

B.W. Dreyfus, V. Sawtelle, C. Turpen, J. Gouvea, E.F. Redish, “Students’ reasoning about ‘high-energy bonds’ and ATP: A vision of interdisciplinary education,” *Phys. Rev. ST–Phys. Educ. Res.*, **10**, 010115 (2014).

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

B.D. Geller, **B.W. Dreyfus**, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “Entropy and spontaneity in an introductory physics course for the life sciences,” *Am. J. Phys.*, **82**(5), 394–402 (2014).

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, K.V. Thompson, C. Turpen, R.K.P. Zia, “NEXUS/Physics: An interdisciplinary repurposing of physics for biologists,” *Am. J. Phys.*, **82**(5), 368–377 (2014).

A.R. Cook, N. Dimitrijevic, **B.W. Dreyfus**, D. Meisel, L.A. Curtiss, D.M. Camaioni, “Reducing radicals in nitrate solutions. The NO_3^{2-} system revisited,” *J. Phys. Chem. A* **105**(14), 3658–3666 (2001).

Papers in Peer-Reviewed Conference Proceedings:

W. Faries, R. Gordon, B.W. Dreyfus, “Student experiences in traditional and active-learning classrooms in introductory physics courses,” Proceedings of the 2018 Physics Education Research Conference (2018).

E.R. Sohr, A. Gupta, A. Elby, **B.W. Dreyfus**, “Sense-making with inscriptions in quantum mechanics,” Proceedings of the 2016 Physics Education Research Conference, 324–327 (2016).

B.W. Dreyfus, E.R. Sohr, A. Gupta, A. Elby, “‘Classical-ish’: Negotiating the boundary between classical and quantum particles,” Proceedings of the 2015 Physics Education Research Conference, 111–114 (2015).

E.R. Sohr, **B.W. Dreyfus**, A. Gupta, A. Elby, “‘Because math’: Epistemological stance or defusing social tension in QM?,” Proceedings of the 2015 Physics Education Research Conference, 319–322 (2015).

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

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

B.W. Dreyfus, B.D. Geller, V. Sawtelle, J. Svoboda, C. Turpen, E. F. Redish, “Students’ interdisciplinary reasoning about ‘high-energy bonds’ and ATP,” Proceedings of the 2012 Physics Education Research Conference, AIP Conf. Proc. **1513**, 122–125 (2013).

B.D. Geller, **B.W. Dreyfus**, V. Sawtelle, J. Svoboda, C. Turpen, E. F. Redish, “Students’ reasoning about interdisciplinarity,” Proceedings of the 2012 Physics Education Research Conference, AIP Conf. Proc. **1513**, 146–149 (2013).

B.W. Dreyfus, E.F. Redish, J. Watkins, “Students' views of macroscopic and microscopic energy in physics and biology,” Proceedings of the 2011 Physics Education Research Conference, AIP Conf. Proc. **1413**, 179–182 (2012).

Invited Presentations:

B.W. Dreyfus, “Is energy a substance, a location, or a blend of both? Ontological metaphors for energy in physics,” Invited talk, American Physical Society, 2019 April Meeting, Denver, CO, April 2019.

B.W. Dreyfus, “What is energy? Blending scientific disciplines and blending metaphors,” Invited colloquium talk, Department of Physics, Georgetown University, Washington, DC, February 2019.

B.W. Dreyfus, “Is energy a substance, a location, or a blend of both? Ontological metaphors for energy in physics and interdisciplinary thermodynamics,” Invited plenary talk, Gordon Research Conference on Physics Research and Education, Smithfield, RI, June 2018.

B.W. Dreyfus, “Students' ideas about physics: Insights from physics education research,” Invited workshop, National Science Teachers Association, Area Conference, Baltimore, MD, October 2017.

B.W. Dreyfus, “Differential amplifiers' in PER: How does the content of physics interact with everything else we're researching?”, Invited plenary talk, Foundations and Frontiers of Physics Education Research, Bar Harbor, ME, June 2017.

B.W. Dreyfus, “Playing dice with the universe: Quantum mechanics, Talmud, and indeterminacy,” Invited talk, Hebrew College, Newton, MA, January 2017.

B.W. Dreyfus, A. Gupta, E.R. Sohr, J. Hoy, “Conceptual blending as a framework for modeling the coordinated use of ontological metaphors,” Invited symposium talk, Physics Education Research Conference, Sacramento, CA, July 2016.

B.W. Dreyfus, E.R. Sohr, A. Gupta, J. Hoy, N.D. Finkelstein, “Ontologies in quantum mechanics as a research and instructional lens,” Invited talk, American Association of Physics Teachers, 2016 Summer Meeting, Sacramento, CA, July 2016.

B.W. Dreyfus, “Developing an IPLS course around interdisciplinary reconciliation and coherence,” Invited talk, National Society of Black Physicists conference, Baltimore, MD, February 2015.

B.W. Dreyfus, “Connecting physics and biology through energy,” Invited talk, Department of Science Teaching, Weizmann Institute of Science, Rehovot, Israel, June 2014.

B.W. Dreyfus, “The challenges and successes of an interdisciplinary approach to energy in physics and biology,” Invited talk, Department of Physics and Astronomy, Rutgers University, Piscataway, NJ, March 2013.

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

B.W. Dreyfus, B.D. Geller, V. Sawtelle, J. Svoboda, C. Turpen, E.F. Redish, “Students’ interdisciplinary reasoning about ‘high-energy bonds’ and ATP,” Invited poster, Physics Education Research Conference, Philadelphia, PA, July 2012.

Contributed Presentations (Posters and Talks):

J. Rosenberg, M.A. Nelson, **B.W. Dreyfus**, R.M. Jones, “Innovative ways to engage students in active learning,” Contributed workshop, Innovations in Teaching and Learning Conference, George Mason University, Fairfax, VA, September 2018.

R. Gordon, **B.W. Dreyfus**, J. Nissen, *W. Faries*, “Student attitudes in introductory physics: Quantitative trends across courses,” Contributed poster, Physics Education Research Conference, Washington, DC, July 2018.

W. Faries, *R. Gordon*, **B.W. Dreyfus**, “Student attitudes in introductory physics: How students experience physics courses,” Contributed poster, Physics Education Research Conference, Washington, DC, July 2018.

B.W. Dreyfus, W. Christian, H. Edri, E. Yerushalmi, “Introducing computational models for diffusion into IPLS,” Contributed talk, American Association of Physics Teachers, 2018 Summer Meeting, Washington, DC, July 2018.

W. Christian, H. Edri, **B.W. Dreyfus**, “Adapting Weizmann Institute material for use in the United States,” Contributed talk, American Association of Physics Teachers, 2018 Summer Meeting, Washington, DC, July 2018.

R. Gordon, **B.W. Dreyfus**, J. Nissen, *W. Faries*, “Student attitudes in introductory physics: Quantitative trends across courses,” Contributed poster, American Association of Physics Teachers, 2018 Summer Meeting, Washington, DC, July 2018.

W. Faries, *R. Gordon*, **B.W. Dreyfus**, “Student attitudes in introductory physics: How students experience physics courses,” Contributed poster, American Association of Physics Teachers, 2018 Summer Meeting, Washington, DC, July 2018.

J. Rosenberg, **B.W. Dreyfus**, “Driving change in physics through multi-disciplinary science programs,” Contributed talk, American Association of Physics Teachers, 2018 Summer Meeting, Washington, DC, July 2018.

W. Faries, **B.W. Dreyfus**, “Patterns of interest and commitment in introductory physics courses,” Contributed poster, George Mason University College of Science Undergraduate Research Colloquium, Fairfax, VA, April 2018.

B.W. Dreyfus, C.P. Davis, R.M. Jones, K.L. Knight, M.A. Nelson, J.A. Nord, J.L. Rosenberg, J.R. Schwebach, “An LA program within a larger STEM program: George Mason University’s STEM Accelerator,” Contributed poster, International Learning Assistant Conference, Boulder, CO, November 2017.

B.W. Dreyfus, M. Ewell, K. Moore, “Curricular adaptations in introductory physics labs,” Contributed talk, American Physical Society, 2017 April Meeting, Washington, DC, January 2017.

E.R. Sohr, **B.W. Dreyfus**, A. Gupta, A. Elby, “Sense-making with inscriptions in quantum mechanics,” Contributed poster, Physics Education Research Conference, Sacramento, CA, July 2016.

B.W. Dreyfus, J. Hoy, E.R. Sohr, A. Gupta, A. Elby, “Splits in students’ attitudes toward classical and quantum physics,” Contributed talk and poster, American Association of Physics Teachers, 2016 Summer Meeting, Sacramento, CA, July 2016.

E.R. Sohr, **B.W. Dreyfus**, A. Gupta, A. Elby, “Sense-making with inscriptions in quantum mechanics,” Contributed talk and poster, American Association of Physics Teachers, 2016 Summer Meeting, Sacramento, CA, July 2016.

E.R. Sohr, J. Hoy, **B.W. Dreyfus**, K. Hinko, N.D. Finkelstein, “Tutorials on thinking about quantum entities,” Contributed poster, American Association of Physics Teachers, 2016 Summer Meeting, Sacramento, CA, July 2016.

B.W. Dreyfus, E.R. Sohr, A. Gupta, A. Elby, “Classical-ish’: Negotiating the boundary between classical and quantum particles,” Contributed poster, Physics Education Research Conference, College Park, MD, July 2015.

E.R. Sohr, **B.W. Dreyfus**, A. Gupta, A. Elby, “Because math’: Epistemological stance or defusing social tension in quantum mechanics?,” Contributed poster, Physics Education Research Conference, College Park, MD, July 2015.

B.W. Dreyfus, E.R. Sohr, A. Gupta, A. Elby, “Classical-ish’: Negotiating the boundary between classical and quantum particles,” Contributed talk and poster, American Association of Physics Teachers, 2015 Summer Meeting, College Park, MD, July 2015.

E.R. Sohr, **B.W. Dreyfus**, A. Gupta, A. Elby, “Because math’: Epistemological stance or defusing social tension in QM?,” Contributed talk and poster, American Association of Physics Teachers, 2015 Summer Meeting, College Park, MD, July 2015.

B.W. Dreyfus, E.R. Sohr, A. Gupta, A. Elby, “Classical-ish’: Negotiating the boundary between classical and quantum particles,” Contributed poster, Foundations and Frontiers of Physics Education Research, Bar Harbor, ME, June 2015.

B.W. Dreyfus, A. Elby, A. Gupta, “Dynamics of how students conceptualize the particle in a box,” Contributed talk, American Physical Society, 2015 April Meeting, Baltimore, MD, April 2015.

V. Sawtelle, **B.W. Dreyfus**, B.D. Geller, E.F. Redish, J.S. Gouvea, C. Turpen, “Designing and refining physics for biologists: The scaling up process,” Contributed poster, Physics Education Research Conference, Minneapolis, MN, July 2014.

B.W. Dreyfus, A. Gupta, E.F. Redish, “Identifying blended ontologies for energy,” Contributed poster, Physics Education Research Conference, Minneapolis, MN, July 2014.

A. Gupta, **B.W. Dreyfus**, E.F. Redish, “Exploring blended ontologies via gestures,” Contributed talk, American Association of Physics Teachers, 2014 Summer Meeting, Minneapolis, MN, July 2014.

B.W. Dreyfus, A. Gupta, E.F. Redish, “Identifying blended ontologies for energy,” Contributed talk and poster, American Association of Physics Teachers, 2014 Summer Meeting, Minneapolis, MN, July 2014.

B.W. Dreyfus, B.D. Geller, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “Chemical energy in introductory physics for the life sciences,” Contributed poster, American Association of Physics Teachers, 2014 Summer Meeting, Minneapolis, MN, July 2014.

B.D. Geller, **B.W. Dreyfus**, J.S. Gouvea, V. Sawtelle, C. Turpen, “Explanatory coherence in an introductory physics for life scientists course,” Contributed poster, Physics Education Research Conference, Minneapolis, MN, July 2014.

B.D. Geller, **B.W. Dreyfus**, J.S. Gouvea, V. Sawtelle, C. Turpen, “Explanatory coherence in an introductory physics for life scientists course,” Contributed talk and poster, American Association of Physics Teachers, 2014 Summer Meeting, Minneapolis, MN, July 2014.

C. Turpen, V. Sawtelle, **B.W. Dreyfus**, B.D. Geller, J.S. Gouvea, “Heuristics for designing interdisciplinary learning environments,” Contributed talk, American Association of Physics Teachers, 2014 Summer Meeting, Minneapolis, MN, July 2014.

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

E.F. Redish, C. Bauer, K. Carleton, T. Cooke, M. Cooper, C. Crouch, **B.W. Dreyfus**, B.D. Geller, J. Giannini, J. Svoboda Gouvea, M. Klymkowsky, W. Losert, K. Moore, J. Presson, V. Sawtelle, C. Turpen, K. Thompson, “NEXUS/Physics: Rethinking physics for biology and premed students,” Contributed poster, Mid-Atlantic Regional Learning Assistant Workshop, College Park, MD, February 2014.

B.W. Dreyfus, B.D. Geller, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “Negative energy: Why interdisciplinary physics requires multiple ontologies,” Contributed poster, Bioscience Day, University of Maryland, College Park, MD, November 2013.

B.D. Geller, **B.W. Dreyfus**, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “‘Like dissolves like’: Unpacking student reasoning about thermodynamic heuristics,” Contributed poster, Bioscience Day, University of Maryland, College Park, MD, November 2013.

B.W. Dreyfus, B.D. Geller, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “Negative energy: Why interdisciplinary physics requires multiple ontologies,” Contributed poster, Physics Education Research Conference, Portland, OR, July 2013.

B.W. Dreyfus, B.D. Geller, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “Negative energy: Why interdisciplinary physics requires multiple ontologies,” Contributed talk and poster, American Association of Physics Teachers, 2013 Summer Meeting, Portland, OR, July 2013.

B.D. Geller, **B.W. Dreyfus**, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “‘Like dissolves like’: Unpacking student reasoning about thermodynamic heuristics,” Contributed poster, Physics Education Research Conference, Portland, OR, July 2013.

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J. Gouvea, **B.W. Dreyfus**, B.D. Geller, V. Sawtelle, C. Turpen, E.F. Redish, “Mathematical reasoning across the sciences: The case of IPLS,” Contributed poster, Physics Education Research Conference, Portland, OR, July 2013.

J. Gouvea, **B.W. Dreyfus**, B.D. Geller, V. Sawtelle, C. Turpen, E.F. Redish, “Mathematical reasoning across the sciences: The case of IPLS,” Contributed poster, American Association of Physics Teachers, 2013 Summer Meeting, Portland, OR, July 2013.

E.F. Redish, C. Bauer, K. Carleton, T. Cooke, M. Cooper, C. Crouch, **B.W. Dreyfus**, B.D. Geller, J. Giannini, J. Svoboda Gouvea, M. Klymkowsky, W. Losert, K. Moore, J. Presson, V. Sawtelle, C. Turpen, K. Thompson, “NEXUS/Physics: Rethinking physics for biology and premed students,” Contributed poster, American Association of Physics Teachers, 2013 Summer Meeting, Portland, OR, July 2013.

V. Sawtelle, C. Turpen, J. Gouvea, **B.W. Dreyfus**, B.D. Geller, “A case study in leveraging biology experiences in physics,” Contributed poster, Physics Education Research Conference, Portland, OR, July 2013.

V. Sawtelle, C. Turpen, J. Gouvea, **B.W. Dreyfus**, B.D. Geller, “A case study in leveraging biology experiences in physics,” Contributed talk and poster, American Association of Physics Teachers, 2013 Summer Meeting, Portland, OR, July 2013.

B.W. Dreyfus, B.D. Geller, J. Gouvea, V. Sawtelle, C. Turpen, E.F. Redish, “Negative energy: Why interdisciplinary physics requires multiple ontologies,” Contributed talk and poster, Foundations and Frontiers of Physics Education Research, Bar Harbor, ME, June 2013.

E.F. Redish, **B.W. Dreyfus**, B.D. Geller, V. Sawtelle, J. Svoboda, C. Turpen, “Creating a common thermodynamics,” Contributed poster, NSF TUES PI Meeting, Washington, DC, January 2013.

C. Turpen, **B.W. Dreyfus**, V. Sawtelle, “Physics energy is not chemistry energy is not biology energy,” Contributed poster, American Association of Physics Teachers, 2013 Winter Meeting, New Orleans, LA, January 2013.

B.W. Dreyfus, B.D. Geller, V. Sawtelle, J. Svoboda, C. Turpen, E.F. Redish, “Students’ interdisciplinary reasoning about ‘high-energy bonds’ and ATP,” Contributed poster, Bioscience Day, University of Maryland, College Park, MD, November 2012.

B.D. Geller, **B.W. Dreyfus**, V. Sawtelle, C. Turpen, E.F. Redish, “Research on students’ reasoning about interdisciplinarity,” Contributed poster, Bioscience Day, University of Maryland, College Park, MD, November 2012.

B.W. Dreyfus, B.D. Geller, V. Sawtelle, J. Svoboda, C. Turpen, E.F. Redish, “Students’ interdisciplinary reasoning about ‘high-energy bonds’ and ATP,” Contributed talk and poster, American Association of Physics Teachers, 2012 Summer Meeting, Philadelphia, PA, July 2012.

E.F. Redish, **B.W. Dreyfus**, B.D. Geller, V. Sawtelle, J. Svoboda, C. Turpen, “Developing a research-based interdisciplinary physics course for biologists,” Contributed poster, American Association of Physics Teachers, 2012 Summer Meeting, Philadelphia, PA, July 2012.

B.D. Geller, **B.W. Dreyfus**, V. Sawtelle, C. Turpen, E.F. Redish, “Research on students’ reasoning about interdisciplinarity,” Contributed talk and poster, American Association of Physics Teachers, 2012 Summer Meeting, Philadelphia, PA, July 2012.

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

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

C. Turpen, V. Sawtelle, J. Svoboda, **B.W. Dreyfus**, E.F. Redish, “Conceptualizing ‘disciplinary’ in research and design of interdisciplinary learning contexts,” June 2012, Contributed poster, Conference on Transforming Research in Undergraduate STEM Education (TRUSE), St. Paul, MN, June 2012.

B.W. Dreyfus, E.F. Redish, J. Watkins, “Student views of macroscopic and microscopic energy in physics and biology,” Contributed poster, Physics Education Research Conference, Omaha, NE, August 2011.

B.W. Dreyfus, E.F. Redish, J. Watkins, “Student views of macroscopic and microscopic energy in physics and biology,” Contributed talk, American Association of Physics Teachers, Omaha, NE, August 2011.