Rachel E. Pepper

William D. and Flora McCormick Chair in Biophysics
University of Puget Sound, Department of Physics
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ACADEMIC EMPLOYMENT

University of Puget Sound, July 2017 – Present
Associate Professor, Department of Physics, William D. and Flora McCormick Chair in Biophysics

University of Puget Sound, August 2014 – June 2017
Assistant Professor, Department of Physics, William D. and Flora McCormick Chair in Biophysics

Miller Institute, University of California Berkeley, 2011 – 2014
Postdoctoral Fellow

University of Colorado Boulder, 2009 – 2011
Postdoctoral Fellow

EDUCATION

Harvard University (Cambridge, MA)
Ph.D., Physics, November 2009
Thesis: Splashing, Feeding, Contracting: Drop impact and fluid dynamics of *Vorticella*
Advisor: Howard A. Stone

Cambridge University (Cambridge, UK)
Marshall Scholarship; B.A., Physics, with Honors, 2004

Brown University (Providence, RI)
Sc.B., Biophysics, *Magna Cum Laude*, with Honors, 2002
Phi Beta Kappa, Sigma Xi

AWARDS, FELLOWSHIPS, AND EXTERNAL GRANTS

NSF: BIO IOS Grant: RUI, Collaborative Research. Do nearby surfaces limit the food uptake of microscopic sessile suspension feeders?: 3D feeding flow measurements [$363,570] (Co-PI). 2018-2021

Miller Institute for Basic Research in Science Fellowship, 2011-2014

Life Sciences Research Foundation Postdoctoral Fellowship, 2011-2014 (declined)

University of California President's Postdoctoral Fellowship Finalist, 2011

Association for Women in Mathematics/NSF Travel Grant, 2010

NSF Interdisciplinary Graduate Education and Research Training Fellowship, Harvard University 2007-2009

NSF Graduate Research Fellowship, 2004-2007

Harold T. White Prize for Excellence in the Teaching of Physics, Harvard University 2007

Certificate of Distinction in Teaching, Harvard University 2006

Marshall Scholarship, 2002-2004

Barry M. Goldwater Scholarship, 2001

TEACHING EXPERIENCE

University of Puget Sound
General College Physics; Phys 111 (Fa 2014, Fa 2015, Fa 2016, Fa 2018)
Electromagnetic Theory 1; Phys 351 (Fa 2014, Fa 2015, Fa 2016, Fa 2018)
Electromagnetic Theory 2; Phys 352 (Sp 2015, Sp 2016, Sp 2017, Sp. 2019)
Biophysics; Biol/Phys 363 (Sp 2015, Sp 2016, Sp 2017, Sp 2019)
Physics 111 Lab (Fa 2015, Fa 2016, Fa 2018)
Physics 121 Lab (Fa 2015)
Independent Study in Fluid Mechanics; Phys 495 (Sp 2018)
Directed Research; Phys 390, Biol 490 (Fa 2014, Fa 2015, Sp 2016, Fa 2016, Fa 2018)
Senior Thesis; Phys 491, Phys 492 (Sp 2016, Fa 2016, Sp 2017)

Other Institutions
Teaching Fellow: Classical Mechanics/Math Methods, *University of Colorado Boulder* (Sp 2010, Fa 2011, Sp 2011)
Teaching Fellow: Electricity and Magnetism, *University of Colorado Boulder* (Fa 2009)
Teaching Fellow: Reality Physics*, Harvard University* **(**Sp 2006)
Teaching Assistant: Genetics*, Brown University* **(**Fa 2000)

DEPARTMENT/UNIVERSITY SERVICE

Vice President of Phi Beta Kappa, Spring 2018 – Present
Member of Summer Science Working Group, Spring 2019 – Summer 2019
Member of Committee on Diversity, Fall 2018 – Spring 2019
RISE e-portfolio evaluator, Summer 2018
NSF SSTEM grant proposal co-PI, Spring 2018
Member of University Enrichment Committee, Fall 2015 – Spring 2017
Organizer for the McCormick Biophysics Day, May 2016
HHMI pre-proposal core team member, 2015 – 2016
Reviewer for math and science summer research grants, Spring 2016, 2017, 2019
Member of Faculty Search Committee for Exercise Science, 2015 – 2016
University of Puget Sound Rhodes and Marshall Mock Interview Panel, Fall 2014

OUTREACH AND PROFESSIONAL SERVICE

Member of the Local Organizing Committee for the APS Division of Fluid Dynamics (DFD) 72nd Annual Meeting, Seattle, WA, 2018 – Present
Tech Trek Professional Women's Night, Tacoma, WA, 2017 – Present
Science On Tap (Ravenna Science Café) Speaker, Seattle, WA, 2017
Public Science Talk for Mensa of Western Washington, Seattle, WA, 2017
Reviewer for Physical Review Journals, 2014 – Present
Reviewer for National Science Foundation, electronic proposal reviews 2014 – Present
Member of the APS DFD Committee on Educational and Career Outreach, 2013 – 2014

Organizer for the Fluids Education Lunch Workshop at the annual APS DFD meeting, Pittsburgh, PA, 2013; San Francisco, CA 2014

Techbridge Girls, Oakland, CA, 2013 – 2014

Dinner with a Scientist, Oakland, CA, 2012 – 2014

Science Club for Girls, Cambridge, MA, 2004 – 2008

STUDENT PRESENTATIONS AT EXTERNAL CONFERENCES (* = AWARDED POSTER PRIZE)

I. Mejia Natividad, R.E. Pepper. *Determining the Effect of Raindrop Impact Location on Seed Dispersal Of Splash-Cup Plants.* November 2018 – 71th APS Meeting of the Division of Fluid Dynamics, Atlanta, GA, poster presentation.

A. Schumann, R.E. Pepper. *Flow Field of a Point Vortex Inside an Elliptical Boundary.* November 2018 – 71th APS Meeting of the Division of Fluid Dynamics, Atlanta, GA, poster presentation.

P. Wigger*, R.E. Pepper. *Effect of Seed Density on Splash Cup Seed Dispersal.* May 2018 – 19th APS Meeting of the Northwest Section, Tacoma, WA, poster presentation.

C.A. Baxter, R.E. Pepper. *Single Versus Group Feeding Patterns in* Vorticella convalleria*.* January 2018 – Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, poster presentation.

P. Wigger, R.E. Pepper. *Effect of Seed Density on Splash Cup Seed Dispersal.* November 2017 – 70th APS Meeting of the Division of Fluid Dynamics, Denver, CO poster presentation.

S.J. Boos*, R.E. Pepper. *How does the micro-splashing threshold change with drop size?* November 2016 – 69th APS Meeting of the Division of Fluid Dynamics, Portland, OR, poster presentation.

J.F. Eklof, R.E. Pepper. *The Importance of Seed Characteristics in the Dispersal of Splash Cup Plants.* November 2016 – 69th APS Meeting of the Division of Fluid Dynamics, Portland, OR, oral presentation.

A.T. Lutton, R.E. Pepper. *Is the stokeslet model sufficient for finding nutrient uptake of microscopic suspension feeders?* November 2016 – 69th APS Meeting of the Division of Fluid Dynamics, Portland, OR, poster presentation.

M.C. Specht, R.E. Pepper. *Determining the benefits of Vorticella cell body motion.* November 2016 – 69th APS Meeting of the Division of Fluid Dynamics, Portland, OR, poster presentation.

J.F. Eklof, R.E. Pepper. *The Importance of Seed Characteristics in the Dispersal of Splash Cup Plants.* January 2016 – Society for Integrative and Comparative Biology Annual Meeting, Portland, OR, poster presentation.

J.F. Eklof, R.E. Pepper. *The Importance of Seed Characteristics in the Dispersal of Splash Cup Plants.* November 2015 – 24th Annual Murdock College Science Research Conference, Vancouver, WA, oral presentation.

PUBLICATIONS

M. D. Caballero, L. Doughty, A. M. Turnbull, **R. E. Pepper**, S. J. Pollock. *Assessing Learning Outcomes in Middle-Division Classical Mechanics: The Colorado Classical Mechanics/Math Methods Instrument.* Phys. Rev. Phys. Educ. Res. 13, 010118 (2017).

S. Ryu, **R. E. Pepper**, M. Nagai, and D. C. France. *Vorticella: A Protozoan for Bio-Inspired Engineering*. Micromachines **8**, 4 (2016).

R.E. Pepper, J.S. Jaffe, E. Variano, M.A.R. Koehl. *Zooplankton in flowing water near benthic communities encounter rapidly fluctuating velocity gradients and accelerations.* Mar. Biol. **162**, 1939 (2015).

R.E. Pepper, M. Roper, S. Ryu, N. Matsumoto, M. Nagai, and H.A. Stone. *A new angle on microscopic suspension feeders near boundaries.* Biophys. J. **105**, 1796 (2013).

M. Roper, M. Dayel, **R.E. Pepper**, N. King and M. Koehl. *Cooperatively Generated Stresslet Flows Supply Fresh Fluid to Multicellular Choanoflagellate Colonies*. Phys. Rev. Lett. **110**, 228104 (2013).

R.E. Pepper, S.V. Chasteen, S.J. Pollock, and K.K. Perkins. *Observations on student difficulties with mathematics in upper-division Electricity and Magnetism.* Phys. Rev. ST Physics Ed. Research **8**, 010111 (2012).

S.V. Chasteen, **R.E. Pepper**, M.D. Caballero, S.J. Pollock, K.K. Perkins. *Colorado Upper-Division Electrostatics Diagnostic: A conceptual assessment for the junior level*. Phys. Rev. ST Physics Ed. Research **8**, 020108 (2012).

S.V. Chasteen, S.J. Pollock, **R.E. Pepper**, and K.K. Perkins. *"Thinking Like a Physicist": A Multi-Semester Case Study of Junior-level Electricity & Magnetism.* AJP **80**, 923 (2012).

S.V. Chasteen, S.J. Pollock, **R.E. Pepper**, K.K. Perkins. *Transforming the junior level: Outcomes from instruction and research in E&M*. Phys. Rev. ST Physics Ed. Research **8**, 020107 (2012).

R.E. Pepper, M. Roper, S. Ryu, P. Matsuidara, and H.A. Stone. *Nearby boundaries create eddies near microscopic filter feeders*. J. R. Soc. Interface **7**, 851-862 (2010).

J. de Ruiter, **R.E. Pepper**, and H.A. Stone. *Thickness of an expanding lamella near the splash threshold*. Phys. Fluids **22**, 022104 (2010).

M. Roper, **R.E. Pepper**, M. Brenner, A. Pringle. *Explosively launched spores of ascomycete fungi have drag minimizing shapes*. PNAS **105**, 20583 (2008).

R.E. Pepper, L. Courbin, and H. A. Stone. *Splashing on elastic membranes: the importance of early-time dynamics*. Phys. Fluids **20**, 082103 (2008).

PEER REVIEWED CONFERENCE PROCEEDINGS

M.D. Caballero, B.R. Wilcox, **R.E. Pepper,** S.J. Pollock. *ACER: A Framework on the Use of Mathematics in Upper-division Physics.* PERC Proceedings 2012, AIP Press (2013).

B.R. Wilcox, M.D. Caballero, **R.E. Pepper,** S.J. Pollock. *Upper-division Student Understanding of Coulomb's Law: Difficulties with Continuous Charge Distributions.* PERC Proceedings 2012, AIP Press (2013).

R.E. Pepper, S.V. Chasteen, S.J. Pollock, and K.K. Perkins. *Facilitating Faculty Conversations: Development of Consensus Learning Goals.* PERC Proceedings 2011, AIP Press (2012).

S.J. Pollock, **R.E. Pepper**, and A.D. Marino. *Issues and progress in transforming a middle-division Classical Mechanics/Math Methods course.* PERC Proceedings 2011, AIP Press (2012).

S.J. Pollock**, R.E. Pepper**, S.V. Chasteen, and K.K. Perkins. *Multiple Roles of Assessment In Upper-Division Physics Course Reforms.* PERC Proceedings 2011, AIP Press (2012).

S.V. Chasteen, **R.E. Pepper**, S.J. Pollock, K.K. Perkins. *But Does It Last? Sustaining a Research-Based Curriculum in Upper-Division Electricity & Magnetism*. PERC Proceedings 2011, AIP Press (2012).

R.E. Pepper, S.V. Chasteen, S.J. Pollock, and K.K. Perkins. *Our best juniors still struggle with Gauss's Law: Characterizing their difficulties.* PERC Proceedings 2010, AIP Press (2010).

SEMINAR PRESENTATIONS ON CAMPUS

The effects of external flow on the feeding currents of sessile microorganisms. January, 2019 – University of Puget Sound, Thompson Hall Science & Mathematics Seminar.

Dispersal of seeds from splash cup plants. November, 2018 – University of Puget Sound, Department of Physics Seminar.

Fluid mechanics of microorganisms: Microscopic suspension feeders near boundaries. May 2016 – University of Puget Sound, McCormick Biophysics Seminar.

Fluid mechanics of microorganisms: Microscopic suspension feeders near boundaries. December 2015 – University of Puget Sound, Physics Department Seminar.

INVITED PRESENTATIONS

Dispersal of seeds from splash cup plants. October, 2018 – Reed College, Department of Physics Seminar.

Dispersal of seeds from splash cup plants. June, 2018 – Danish Technical University, Fluids Group Seminar.

Microscopic suspension feeders near boundaries: feeding restrictions and strategies due to eddies. March 2018 – University of San Diego Departments of Physics and Earth and Ocean Sciences joint seminar.

Applying the results of education research to help students learn more. February, 2018 – Haverford College, Distinguished Visitors Program Seminar.

Microscopic suspension feeders near boundaries: feeding restrictions and strategies due to eddies. February, 2018 – Haverford College, Distinguished Visitors Program Seminar.

Dispersal of seeds from splash cup plants. October, 2017 – Princeton University, Complex Fluids Group Seminar.

Microscopic filter feeders near boundaries: feeding challenges and strategies due to eddies. May, 2017 – Oregon Institute of Marine Biology Seminar.

Applying the results of education research to help students learn more. January 2015 – Society for Integrative and Comparative Biology Annual Meeting, West Palm Beach, FL, oral presentation.

Microscopic filter feeders near boundaries: feeding challenges and strategies due to eddies. November, 2013 – Pomona College, Physics Department Colloquium.

Applying the results of education research to help students learn more. November, 2013 – Pomona College, Teaching and Learning Center lunchtime discussion.

Microscopic filter feeders near boundaries: feeding challenges and strategies due to eddies. November, 2013 – California Institute of Technology, GALCIT Seminar Series.

Microscopic filter feeders near boundaries: feeding challenges and strategies due to eddies. October, 2012 – University of California Berkeley, Fluid Seminar Series.

Microscopic filter feeders near boundaries: feeding restrictions and strategies due to eddies. April, 2012 – Brown University Division of Applied Mathematics, Fluid Dynamics Seminar Series.

A research-based approach to transforming upper-division physics courses. April, 2012 – Brown University Department of Physics, Colloquium.

Microscopic filter feeders near boundaries: feeding challenges and strategies. February, 2011 – Mt. Holyoke Department of Physics, Seminar Series.

R.E. Pepper, S.V. Chasteen, S.J. Pollock, and K.K. Perkins. *Upper-Division Electricity and Magnetism: Students' Ideas and Difficulties.* July, 2010 – American Association of Physics Teachers Summer Meeting, Portland, OR.

Microscopic filter feeders near boundaries: feeding restrictions and strategies. December 2009 – University of Western Australia.

CONTRIBUTED PRESENTATIONS

Rachel Pepper, Matthieu Baron, Emily Riley, Lasse Nielsen, Thomas Kiørboe, Anders Andersen. *The effects of external flow on the feeding currents of sessile microorganisms.* January 2019 – Microscale Ocean Biophysics, Whistler, BC, Canada, poster and oral presentation.

Rachel Pepper, Matthieu Baron, Emily Riley, Lasse Nielsen, Thomas Kiørboe, Anders Andersen. *The effects of external flow on the feeding currents of sessile microorganisms*. November 2018 – 71th APS Meeting of the Division of Fluid Dynamics, Atlanta, GA, oral presentation.

R. E. Pepper, M.A.R. Koehl. *Microscopic suspension feeders near boundaries: Effects of external water flow*. February 2018 – Ocean Science Meeting, Portland, OR, oral presentation.

R.E. Pepper. *Dispersal of seeds from splash cup plants*. January 2018 – Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, oral presentation.

R.E. Pepper. *Motivating students to read the textbook before class*. January 2018 – Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, oral presentation.

R.E. Pepper. *Dispersal of seeds from splash cup plants*. November 2017 – 70th APS Meeting of the Division of Fluid Dynamics, Denver, CO oral presentation.

R.E. Pepper. *Motivating students to read the textbook before class*. November 2016 – 69th APS Meeting of the Division of Fluid Dynamics, Portland, OR, oral presentation.

R.E. Pepper, M. A. R. Koehl. *Microscopic suspension feeders near boundaries: Effects of external water flow*. November 2015 – 68th APS Meeting of the Division of Fluid Dynamics, Boston, oral presentation.

R.E. Pepper, S.J. Chasteen, K.K. Perkins, S.J. Pollock. *Applying the results of education research to help students learn more: peer instruction and clicker questions in upper-division courses*. November 2014 – 67th APS Meeting of the Division of Fluid Dynamics, San Francicso, oral presentation.

R. E. Pepper, E. Variano, M.A.R. Koehl. *Turbulent flow from a larva's perspective: What does it feel like to be tiny in the ocean?* February 2014 – Ocean Science Meeting, Honolulu, poster presentation.

R. E. Pepper, E. Variano, M.A.R. Koehl. *Turbulent flow from a microscopic organism's perspective: What does it feel like to be tiny in the ocean?* November 2013 – 66th APS Meeting of the Division of Fluid Dynamics, Pittsburgh, oral presentation.

R.E. Pepper, S.J. Chasteen, K.K. Perkins, S.J. Pollock. *Applying the results of education research to help students learn more: peer instruction and clicker questions in upper-division courses*. November 2013 – 66th APS Meeting of the Division of Fluid Dynamics, Pittsburgh, PA, oral presentation.

N. Thomas, **R.E. Pepper**, D. Liepmann, M.A.R. Koehl. *A simple microfluidic-inspired extensional flow device for observation of small aquatic organisms: design and implementation.* November 2013 – 66th APS Meeting of the Division of Fluid Dynamics, Pittsburgh, PA, poster presentation.

R.E. Pepper, E. Variano, M.A.R. Koehl. *Turbulence from a microorganism's perspective.* March 2013 – Microscale Interactions in Aquatic Environments, Les Houches, France, oral presentation.

R.E. Pepper, E. Variano, M.A.R. Koehl. *Turbulence from a microorganism's perspective: Does the open ocean feel different than a coral reef?* January 2013 – Society for Integrative and Comparative Biology Annual Meeting, San Francisco, CA, oral presentation.

R.E. Pepper, E. Variano, M.A.R. Koehl. *Turbulence from a microorganism's perspective: Does the open ocean feel different than a coral reef* ? November 2012 – 65th APS Meeting of the Division of Fluid Dynamics, San Diego, CA, oral presentation.

R.E. Pepper, C. Baily, M.D. Caballero, S.J. Chasteen, B. Wilcox, K.K. Perkins, S.J. Pollock. *Applying the results of education research to help students learn more: an update*. November 2012 – 65th APS Meeting of the Division of Fluid Dynamics, San Diego, CA, oral presentation.

R.E. Pepper, M. Roper, S. Ryu, P. Matsudaira, N. Matsumoto, M. Nagai, H.A. Stone. *Microscopic filter feeders near boundaries: feeding restrictions and strategies due to eddies.* November 2012 – Fluid & Elasticity 2012, La Jolla, CA, oral and poster presentations.

R.E. Pepper, M. Roper, S. Ryu, P. Matsuidara, N. Matsumoto, M. Nagai, and H.A. Stone. *Microscopic filter feeders near boundaries: feeding restrictions and strategies due to eddies*. January 2012 – Society for Integrative and Comparative Biology Annual Meeting, Charleston, SC, oral presentation.

R.E. Pepper, S.V. Chasteen, M. Dubson, K.K. Perkins, and S.J. Pollock. *Applying the results of education research to help students learn more*. November 2011 – 64th APS Meeting of the Division of Fluid Dynamics, Baltimore, MD, oral presentation.

R.E. Pepper. *Microscopic filter feeders at an angle to nearby boundaries: Feeding restrictions and strategies*. January 2011 – Aspen Ocean Symposium: Microenvironments modulating biological interactions in the ocean, Aspen, CO, poster presentation.

R.E. Pepper, M. Roper, S. Ryu, P. Matsuidara, and H.A. Stone. *Microscopic filter feeders at an angle to nearby boundaries: Feeding restrictions and strategies*. November 2010 – 63th APS Meeting of the Division of Fluid Dynamics, Long Beach, CA, oral presentation.

R.E. Pepper, S.V. Chasteen, S.J. Pollock, M. Dubson, P. Beale, and K.K. Perkins. *New Ways of Teaching Upper-division courses: Descriptions and Results*. November 2010 – 63th APS Meeting of the Division of Fluid Dynamics, Long Beach, CA, oral presentation.

R.E. Pepper, S.V. Chasteen, S.J. Pollock, and K.K. Perkins. *Our best juniors still struggle with Gauss's Law: Characterizing their difficulties.* August 2010 – Upper Division Physics Education Research Workshop 2010, Crawfordsville, IN, poster presentation.

R.E. Pepper, S.V. Chasteen, S.J. Pollock, and K.K. Perkins. *Our best juniors still struggle with Gauss's Law: Characterizing their difficulties.* July 2010 – Physics Education Research Conference 2010, Portland, OR, poster presentation.

K.K. Perkins, S. Pollock, S. Chasteen, S. Goldhaber, **R.E. Pepper**, M. Dubson, and P. Beale. *Colorado's Transformed Upper-Division E&M and QM courses: Description and Results.* July, 2010 – American Association of Physics Teachers Summer Meeting, Portland, OR, oral presentation.

R.E. Pepper, M. Roper, S. Ryu, P. Matsuidara, and H.A. Stone. *Microscopic filter feeders near boundaries*. November 2009 – 62th APS Meeting of the Division of Fluid Dynamics, Minneapolis, MN, oral presentation.

R.E. Pepper, L. Courbin, and H.A. Stone, *Splashing on elastic membranes: the importance of early time dynamics.* June 2009 – Fluid & Elasticity 2009, Carry-le-Rouet, France, oral presentation.

R.E. Pepper, M. Roper, and H.A. Stone. *Flow field around* Vorticella*: Mixing with a reciprocal stroke*. November 2008 – 61th APS Meeting of the Division of Fluid Dynamics, San Antonio, TX, oral presentation.

R.E. Pepper, L. Courbin, and H.A. Stone, *Splashing on elastic membranes: the importance of early time dynamics.* November 2007 – 60th APS Meeting of the Division of Fluid Dynamics, Salt Lake City, UT, oral presentation.

R.E. Pepper, L. Courbin, and H.A. Stone. *Tuning of a splash on elastic membranes.* July 2007– Boulder School for Condensed Matter and Material Physics, University of Colorado, Boulder, CO, poster presentation.

R.E. Pepper, L. Courbin, and H.A. Stone. *Tuning of a splash on elastic membranes.* November 2006 – 59th APS Meeting of the Division of Fluid Dynamics, Tampa, FL, oral presentation.