

**PATRICIA A. HOLDEN, Ph.D., P.E.**  
**Professor, Environmental Microbiology**  
**Director, UCSB Natural Reserve System**  
Bren School of Environmental Science & Management  
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## ACADEMIC POSITIONS

**Director, UCSB Natural Reserve System**, University of California, Santa Barbara (July 2011 to present), 50% teaching release, overseeing 7 (ca. \$1.3M operating budget) of 39 total UC Natural Reserves (mission: university teaching, research, and public service. <http://www.nrs.ucsb.edu/>)

**Professor**, University of California, Santa Barbara (July 2007-present; Associate Professor July 2003 – June 2007; Assistant Professor July 1997-June 2003). Environmental Microbiology. Jointly appointed in the Bren School (100%) and (0%) in the Departments of Mechanical Engineering, Earth Science, and Ecology, Evolutionary and Marine Biology (EEMB). Participating faculty member: Interdepartmental Graduate Program in Marine Science (IGPMS).

*Research:* Origins and fates of microbiological and chemical pollution. Current projects include: the urban water environment (UWE), integrating spatial relationships between urban infrastructure and subsurface contamination for diagnosing and addressing shallow groundwater micro- and conventional pollutants; origins and fates of microbiological contamination in coastal watersheds; distribution and function of bacteria in subsurface soils, including controls on carbon availability and processing; microbial interactions with engineered nanomaterials in terrestrial ecosystems, towards safe-by-design nanomaterial engineering for environmental hazard avoidance.

**Postdoctoral Researcher**, University of California, Berkeley (November 1995-June 1997).

## UNIVERSITY EDUCATION

**Ph.D. in Soil Microbiology**, University of California, Berkeley. 1995  
Major Adviser: Dr. Mary Firestone. Dissertation: The effects of water potential on the biodegradation of a volatile hydrocarbon.

**M. Eng. in Civil Engineering**, University of California, Berkeley. 1992  
Major Adviser: Dr. Jim Hunt. Special Project: The effects of water potential on gas-phase VOC biodegradation: a model and review of the literature.

**M.S. in Civil Engineering**, Purdue University, West Lafayette. 1983  
Major Adviser: Dr. Edwin Kirsch. Thesis: The fate of *p*-chloro-*m*-cresol and 4,6-dinitro-*o*-cresol in anaerobic digestion.

**B.S. in Civil Engineering**, University of Tennessee, Knoxville. 1981

## OTHER

Gray Freshwater Biological Institute. 1992 Summer course: The application of techniques of molecular biology to studies in microbial ecology.

## OTHER PROFESSIONAL POSITIONS

**EMCS Design Group**, Milwaukee, Wisconsin. Environmental Engineer, 1988-1990.  
Designed wastewater treatment facilities and developed plant hydraulics for 100 MGD Green Bay, WI plant expansion. Authored \$1 million O&M and Training documents for Milorganite fertilizer storage/handling facility and trained facility operators.

**City of Albany**, Oregon. Civil/Environmental Engineer, 1985-1988. Designed public facilities, supervised projects including reservoir resurfacing with cathodic protection. Supervised and managed city-wide industrial pretreatment program.

**CH2M Hill**, Gainesville, Florida. Environmental Engineer, 1983-1984. Designed municipal wastewater treatment facilities and developed plant hydraulics for Fayetteville, AR, Louisville, KY and Charlotte, NC wastewater treatment plant expansions.

## **PROFESSIONAL REGISTRATION**

### **Professional Engineer**

Oregon (Civil and Environmental Branches, No. 13910PE)

## **UNIVERSITY COURSES**

### **Instruction at UCSB**

ESM 120, Microbiology for Engineers (2000, 2002); ESM 213, Ecological Effects of Pollutants. (Spring 1998); ESM 218, Environmental Biotechnology: Science & Law. (Winter 2002; with Professor Holly Doremus, UC Davis faculty of Law); ESM 202, Environmental Biogeochemistry (core course in the Bren MESM program; since 2008); ESM 219 / 219L, Environmental Microbiology Lecture and Lab. (lecture since 1998; lab since 2004; biannually or periodically); ESM 214 / 214L, Principles of Biological Mitigation and Remediation Lecture and Lab (lecture since 1998, lab since 2005; biannually or periodically); ESM 250, Analytical Methods. (calculus for ESM Master's students, since Fall 2000 - 2005).; ESM 595JJ, Ph.D. Seminar in Environmental Microbiology (annually since 1998); ESM 595PP, Ph.D. Seminar in Writing for Publication. Winter 2005 (with Professor Magali Delmas); GS 270, Graduate Seminar in Microbe-Mineral Interactions. (Winter 2002; with Professor Haymon in Geological Sciences); Initiated / Led Environmental Microbiology / Microbial Ecology Speaker Series (9 guests W'07; 5 guests in '08-'09); ESM595J, MESM Seminar in Ecotoxicology (Fall 2010); ESM595J, MESM Seminar in Bioenergy and Biofuels (Fall 2009)

### **Classroom Guest Lectures and Other Teaching**

Guest lecture in ESM254 (Coastal Marine Ecosystem Processes), Bren School, June 3, 2013; Guest lecture ESM437 (Writing Skills), UCSB Bren School, November 26, 2012; Guest lectures in ESM202 (Environmental Biogeochemistry), UCSB Bren School, ongoing since 2000; Bren School Faculty Chat (Ph.D. seminar in research; November 15, 2010); Guest lecture in the UCLA Nanotoxicology Capstone Course ENV HLT 280 (co-listed with UCSB, F07 & F08) Guest lectures at UCSB: Mechanical & Environmental Engineering 126 (1999,2000), 225AE (1998-99); EEMB 145AL (1998); Geology 270 (Winter 2000); Biology 4C (Spring 2000); Mechanical & Environmental Engineering 126 (Spring 2000); Geography 158 (California Currents, 2003), numerous in the Bren School (ESM 202, ESM595 Seminars, ESM 210, ESM 288). Guest lecture at UC Davis School of Law: Biotechnology Law and Policy, Law 289A, (09/05/01) Guest Lecture, Soil Physics Laboratory, University of California, Berkeley, 1996. Topic: Measuring Soil Specific Surface By Positive Adsorption of Water Vapor.; Guest Lecture, Soil Physics Laboratory, University of California, Berkeley, 1995. Topic: Use of the Thermocouple Psychrometer and Pressure Plate Apparatus.; Guest Lecture, Soil Chemistry Laboratory, University of California, Berkeley, 1995. Topic: Soil C/N Ratio: A Microbial Perspective. Graduate Student Instructor, Soil Microbiology Laboratory, University of California, Berkeley, 1994. Instructed students: updated and delivered lectures and exams, graded lab reports and exams for two sections of combined undergraduate and graduate students.

## GRADUATE AND POSTDOCTORAL ADVISING

### Ph.D. Committees (in the Bren School / UCSB, unless in parentheses)

<u>Name</u>	<u>Date Completed</u>	<u>Role</u>
Dr. Rachel E. Steinberger	2005	chair
Dr. Yiping Cao	2006	chair
Dr. Victoria Orphan (EEMB)	2002	member
Dr. Mina Mitani (Bren School)	2002	member
Dr. Noah Fierer (EEMB)	2003	member
Dr. Sanya Sirivithayapakorn	2003	member
Dr. Gloria Luo (Mechanical Engineering)	2005	member
Dr. Todd Ostomel (Chemistry)	2006	member
Dr. Victoria Broje	2006	member
Dr. Chris Erhardt (Geology)	2006	member
Dr. Peng Wang	2007	member
Dr. Brandon Swan (IGPMS)	2009	member
Dr. Molly Redmond (IGPMS)	2010	member
Dr. Kristin Clark	2011	member
Dr. Priya Verma	2011	member
Sam Bennett	In progress	member
Dr. Rebecca Werlin (MCDB)	2011	member
Aubrey Cano (IGPMS)	In progress	member
Dr. Dongxu Zhou	2012	member
Dr. Allison Horst	2012	chair
Randy Mielke	2014	chair
Dr. Blair Paul (Earth Science)	2013	member
Zoe Welch (IGPMS)	In progress	chair
Junyeol Kim	In progress	chair
Marina Feraud	In progress	chair
Louise Stevenson (EEMB)	In progress	member
Blair Goodridge	In progress	member
Jon Conway	In progress	member
Adeyemi Adeleye	In progress	member
Yuxiong Huang	In progress	member
Tyronne Martin	In progress	member
Francy Helena Avila Arias (Purdue University)	In progress	member
Ying Wang	In progress	chair

### M.S. Committees (in Mechanical Engineering / UCSB, unless noted otherwise)

<u>Name</u>	<u>Date Completed</u>	<u>Role</u>
Brandon Steets	2000	Chair
Karen Hurley (Geology)	2003	member
John Priester	2004	Chair
Dan Brooks	2005	Chair
Allison Horst	2007	Chair
Jim Rumbley	2007	Member
Courtney Ewart (Marine Science)	2007	Member
Tristan Winneker (Marine Science)	2010	Chair

### Master's Group Projects Supervised (Bren School / UCSB)

<u>Name(s)</u>	<u>Project Title</u>	<u>Dates</u>	<u>Co-Advisor</u>
Claire Eustace, Jack Kerns, Jennifer Newman, Ryan Pingree, Nathan Vaziri, Cindy Wu	An integrative approach to managing coastal bacterial pollution	1998-1999	Prof. David Siegel
Effie Milionis, Doug Tallman, Linda Zwick	Environmental decision- making in Goleta old town brownfields	1999-2000	Prof. James Frew
Ian Adam, Michael Asakawa, Ryan Edwards, Shawn Kelly, Sandrine King	Assessment of an artificial breach of an impounded coastal water body: a case study of Goleta slough	2000-2001	Prof. David Siegel
Emily Bosanquet, Todd Cooper, Ann Hayden, Vicky Krikelas, Michelle Torrent	Wetland mitigation alternatives for the Casmalia resources disposal site, Santa Barbara, California	2001-2002	Dr. Michael McGinnis
Alicia DeToro, Jennifer Hershberger, Helene Marsh, Priya Verma, Dale Zurawski	A feasibility study for commercial food scrap diversion for the City of Santa Barbara	2003-2004	(none)
Christine Fernandez, Kapil Kulkarni, Sara Polgar, Matt Schneider, Stu Webster	Greenhouse gas mitigation planning: a guide for small municipal utilities	2004-2005	(none)
Sean Kilgore, Erin Nuccio, Pauling Sun, Niki Wilson	Microbiological water quality investigation for Las Palmas Creek, Hope Ranch, Santa Barbara, California	2005-2006	(none)
Gina Gerritzen, Leia Huang, Keith Killpack, Maria Mircheva, Joe Conti (Ph.D. candidate in Sociology)	An inventory and evaluation of environmental health and safety practices in the nanotechnology industry	2006-2007	Prof. Magali Delmas, Dr. Herr Harthorn, Prof. Rich Applebaum
Kyle Albers, Peter Canepa, Jennifer Miller	Analyzing the Environmental Impacts of Simple Shoes – A Life Cycle Assessment of the Supply Chain and Evaluation of End-of-Life Management Options	2007-2008	Prof. John Melack

<u>Name(s)</u>	<u>Project Title</u>	<u>Dates</u>	<u>Co-Advisor</u>
Lynn Baumgartner, Benjamin Carr, Allison Fish, John Meyerhofer	Current Practices and Perceived Risks Related to Environmental Health, Safety & Product Stewardship in Nanomaterials Industry	2009-2010	Prof. Barbara Herr- Harthorn
Adeyemi Adeleye, Daniel Huang, Zoe Layton, Sudhir Paladugu, Jessica Twining	Consolidating Nanomaterials EH&S Guidance and Evaluating their Economic Implications	2010-2011	Prof. Hilary Godwin
Andrew E. Riley, Carlo Bencomo-Jasso, Sougandhica Hoysal	Evaluating Viable Models for Community Solar Projects in the State of California	2011-2012	Prof. Jeff Dozier
Advisor on Eco-Entrepreneurship Projects including “Baby Love” and “Green Soil”		2012-2013	(w/ Emily Cotter, Eco-E Program Advisor)
Advisor on Eco-Entrepreneurship Project “Charborn”		2013-2014	(w/ Emily Cotter, Eco-E Program Advisor)
Lyandra Dias, Casey Garrett, Kathy Tejano, Grace Kao, Aarushi Jha,	Evaluation of Water Stress Impacts on Insulin Production, Eli Lilly and Kaiser Permanente	2014-	(none)

### Postdoctoral Researchers Supervised

Dr. Alicia Wilson (2000-01; Professor, University of South Carolina); Dr. Michael G. LaMontagne (1999-2003; formerly Agricen Sciences); Dr. Noah Fierer (Professor, University of Colorado); Dr. Peter Stoimenov (2004-05; currently Gas Reaction Technologies); Dr. Shurong Xiang (2005-06); Dr. Bram Sercu (2006- 10, County of Ventura); Dr. Dad Roux-Michollet (2007-10); Dr. Andrea Neal (2007-08); Dr. Raja Vukanti (2009-11); Dr. Yuan Ge (2009- ); Dr. Jared Ervin (2011-); Dr. Do Gyun Lee (2012- ); Dr. Monika Mortimer (2014 - )

### UNDERGRADUATE RESEARCH and MENTORING

<u>Name (Department)</u>	<u>Project</u>	<u>Role</u>	<u>Year.</u>
Ilene Auerbach (Molecular, Cellular and Developmental Biology)	Atomic force microscopy of <i>Pseudomonas putida</i> biofilms	co-advisor	1999
Alexa Bruce (Molecular, Cellular and Developmental Biology)	Isolation and expression of a gene involved in biosurfactant synthesis in <i>Pseudomonas aeruginosa</i>	advisor	2001

Ellen Salvador (Environmental Studies Program)	Relating bacterial communities by T-RFLP to development in Santa Barbara watersheds	advisor	2002
Erica Giovannetti (Molecular, Cellular and Developmental Biology)	Bacterial diversity and abundance in saltwater marshes	advisor	2003
Scott Olson (Mechanical & Environmental Engineering)	Quantification of DNA content in unsaturated <i>P.putida</i> mt-2 biofilm cells.	advisor	2005-06
Allison Horst (ChemE)	Cultivation of estuarine and sand bacterial biofilms for ESEM imaging and analysis	advisor	2005
Josh Bettner (Biology)	Elastase production by <i>Pseudomonas aeruginosa</i>	advisor	2007
Kathleen Pacpaco (Chemistry)	Delineation of exposure levels in nanotoxicological research	supervisor	2013
Briana Gray, Cindy Au (assistants to Associate Researcher Patrick Roehrdanz)	Research in Urban Water Environment	PI	2013

### Other mentoring

Hosted / mentored high school interns (3) in the Research Mentorship Program (Summers of 2009, 2010, 2011); Hosted high school graduate (intern) for summer research, 2011 (Jeremy Hutton); Hosted intern Corrine Dorais (Juniata College) for summer research, 2011 and 2012; hired for post-baccalaureate research year (2013 – 2014) prior to graduate school; Hosted summer intern (MS level) from AgroParisTech (France; Olivier Brun) for research (2011); Hosted summer intern (undergraduate) from UCLA (Kilty Inafuku) for research (2011)

### HONORS AND AWARDS

2012 Recipient of \$1.25M fund from private donor, unrestricted research in urban water quality  
 2010 Excellence in Review Award, Environmental Science & Technology (American Chemical Society)

2004-05 Teaching Award in the Bren School (UCSB)

Fellow, Association of Pacific Rim Universities, 2000

UCSB Faculty Career Development Award, 1998

Outstanding Graduate Student Instructor Award, U. C. Berkeley 1995

Co-author EPA Agreement: "Microbial Degradation of Petroleum Hydrocarbons in Unsaturated Soils: The Mechanistic Importance of Water Potential and the Exopolymer Matrix" (\$360,000) 1994-1997

Graduate Research Assistantship from Los Alamos National Lab 1992-1994

Switzer Environmental Fellow 1992

University of California Graduate Mentorship Award 1990-1992

Rotary International Group Study Exchange to Nigeria 1988

Armour T. Grainger Memorial Scholarship, University of Tennessee 1980-1981

Outstanding Environmental Engineering Student, University of Tennessee 1981

Tau Beta Pi and Chi Epsilon Engineering Honor Societies

## PUBLICATIONS

### In Review or Revision (4 articles, 1 edited book chapter)

Lee, D. G., Roehrdanz, P. R., Feraud, M., Ervin, J., Anumol, T., Jia, A., Park, M., Tamez, C., Morelius, E. W., Gardea-Torresdey, J. L., Izbicki, J., Means, J. C., Snyder, S. A., Holden, P. A. 2014 (in review). A framework for predicting and assessing urban shallow groundwater contamination by sanitary sewer exfiltration.

Kaweeteerawat, C., Ivask, A., Liu, R., Zhang, H., Chan, C. H., Lowkam, C., Fischer, H., Ji, Z., Pokhrel, S., Cohen, Y., Zink, J., Mädler, L., Holden P., Nel, A., Godwin, H. 2014. (in review). Toxicity of metal oxide nanoparticles in bacteria correlates with conduction band energy and hydration energy.

Ge, Y., Priester, J. H., Van De Werfhorst, L. C., Walker, S. L., Nisbet, R. M., An, Y.-J., Schimel, J. P., Gardea-Torresdey, J. L., Holden, P. A. 2014 (in revision). Soybean plants modify metal oxide nanoparticle effects on soil bacterial communities.

Priester, J. H., Van De Werfhorst, L. C., Ge, Y., Adeleye, A., Tomar, S., Tom, L. M., Piceno, Y. M., Andersen, G. L., Holden, P. A. 2014 (in review). Effects of TiO<sub>2</sub> and Ag nanoparticles on polyhydroxybutyrate biosynthesis by activated sludge bacteria.

Ge, Y.; Horst, A. M.; Kim, J.; Priester, J. H.; Welch, Z. S.; Holden, P. A.. (in revision from 2014 review). Toxicity of Manufactured Nanomaterials to Microorganisms. In *Engineered Nanoparticles and the Environment: Biophysicochemical Processes and Biototoxicity*, Xing, B.; Vecitis, C. D.; Senesi, N., Eds. Wiley: Vol. 4.

### Published (98 as of October 2014: 89 articles, 6 edited book chapters, 3 proceedings)

Holden, P.A., Klaessig, F., Turco, R. F., Priester, J. H., Rico, C. M., Arias, H. A., Mortimer, M., Pacpaco, K., Gardea-Torresdey, J. L. 2014. Evaluation of exposure concentrations used in assessing manufactured nanomaterial environmental hazards: are they relevant? *Environmental Science & Technology*. 48(16):10541-10551.

Ervin, J. S., Van De Werfhorst, L. C., Murray, J. L. S., Holden, P. A. 2014. Microbial source tracking in a coastal California watershed reveals canines as controllable sources of fecal contamination. *Environmental Science & Technology*. 48:9043-9052.

Van De Werfhorst, L. C.; Murray, J. L. S.; Reynolds, S.; Reynolds, K.; Holden, P. A. 2014. Canine scent detection and microbial source tracking of human waste contamination in storm drains. *Water Environment Research*. 86 (6): 550-558.

Ge, Y.; Schimel, J. P.; Holden, P. A. 2014. Analysis of run-to-run variation of bar-coded pyrosequencing for evaluating bacterial community shifts and individual taxa dynamics. *Plos ONE*. 9 (6). e99414

Riedel, T. E.; Zimmer-Faust, A. G.; Thulsiraj, V.; Madi, T.; Hanley, K. T.; Ebentier, D. L.; Byappanahalli, M.; Layton, B.; Raith, M.; Boehm, A. B.; Griffith, J. F.; Holden, P. A.; Shanks, O. C.; Weisberg, S. B.; Jay, J. A. 2014. Detection limits and cost comparisons of human- and gull-

associated conventional and quantitative PCR assays in artificial and environmental waters. *J. Environ. Management.* 136: 112-120.

Priester, J. H.; Singhal, A.; Wu, B.; Stucky, G. D.; Holden, P. A. 2014. Integrated approach to evaluating the toxicity of novel cysteine-capped silver nanoparticles to *Escherichia coli* and *Pseudomonas aeruginosa*. *Analyst.* 139: 954-963.

Peralta-Videa, J. R.; Hernandez-Viezcas, J. A.; Zhao, L.; Diaz, B. C.; Ge, Y.; Priester, J. H. 2014. Holden, P. A.; Gardea-Torresdey, J. L., Cerium dioxide and zinc oxide nanoparticles alter the nutritional value of soil cultivated soybean plants. *Plant Physiol. Biochem.* 80: 128-135.

Ivask, A.; El Badawy, A.; Kaweeteerawat, C.; Boren, D.; Fischer, H.; Ji, Z. X.; Chang, C. H.; Liu, R.; Tolaymat, T.; Telesca, D.; Zink, J. I.; Cohen, Y.; Holden, P. A.; Godwin, H. A. 2014. Toxicity mechanisms in *Escherichia coli* vary for silver nanoparticles and differ from ionic silver. *ACS Nano.* 8: 374-386.

Holden, P. A.; Schimel, J. P.; Godwin, H. A. 2014. Five reasons to use bacteria when assessing manufactured nanomaterial environmental hazards and fates. *Curr. Opin. Biotechnol.* 27: 73-78.

Yoon, S.-J., Kwak, J. I., Lee, W.-M., Holden, P. A., An, Y. J. 2014. Zinc oxide nanoparticles delay soybean development: a standard soil microcosm study. *Ecotoxicology and Environmental Safety.* 100:131-137.

Wang, H. H.; Wu, F. C.; Meng, W.; White, J. C.; Holden, P. A.; Xing, B. S. 2013. Engineered nanoparticles may induce genotoxicity. *Environ. Sci. Technol.* 47: 13212-13214.

Ge, Y.; Priester, J. H.; De Werfhorst, L. C. V.; Schimel, J. P.; Holden, P. A. 2013. Potential mechanisms and environmental controls of TiO<sub>2</sub> nanoparticle effects on soil bacterial communities. *Environ. Sci. Technol.* 47: 14411-14417.

Priester, J.H., Ge, Y., Chang, V., Stoimenov, P. K., Schimel, J. P., Stucky, G.D., Holden, P. A. 2013. Assessing interactions of hydrophilic nanoscale TiO<sub>2</sub> with soil water. *Journal of Nanoparticle Research.* 15:1-13.

Mielke, R. E., Priester, J. H., Werlin, R. A., Gelb, J., Horst, A. M., Orias, E., Holden, P. A. 2013. Differential growth of and nanoscale TiO<sub>2</sub> accumulation in *Tetrahymena thermophila* by direct feeding versus trophic transfer from *Pseudomonas aeruginosa*. *Applied & Environmental Microbiology.* 79:5616.

Xia T, Malasarn D, Lin SJ, Ji ZX, Zhang HY, Miller RJ, Keller AA, Nisbet RM, Harthorn BH, Godwin HA, Lenihan, H. S., Liu, R., Gardea-Torresdey, J., Cohen, Y., Madler, L., Holden, P. A., Zink, J. I., Nel, A. E. 2013. Implementation of a multidisciplinary approach to solve complex nano EHS problems by the UC Center for the Environmental Implications of Nanotechnology. *Small* 2013, 9:1428-1443.

Layton, B. A., Cao, Y., Ebentier, D. L, Hanley, K., Van De Werfhorst, L. C., Wang, D., Tania Madi, T., Whitman, R., Byappanahalli, ; Muruleedhara, Ballesté, E., Meijer, W. G., Schriewer, A., Wuertz, S., Converse, R., Noble, R., Srinivasan, S., Rose, J. B., Lee, C. S., Lee, J., Gentry-Shields, J., Stewart, J., Reischer, G. H., Farnleitner, A. H., Gidley, M. L., Sinigalliano, C., ; Brandão, J., Rodrigues, R., Lozach, S., Gourmelon, M., Peed, L., Jay, J. A., Holden, P. A., Boehm, A. B.,

Shanks, O. C., Griffith, J. F. 2013. Performance of human fecal anaerobe-associated PCR-based assays in a multi-laboratory method evaluation study. *Water Research*. 47: 6897-6908.

Raith, M.R., Kelty, C. A., Griffith, J. F., Schriewer, A., Wuertz, S., Mieszkin, S., Gourmelon, M., Reischer, G. H., Farnleitner, A. H., Ervin, J. S., Holden, P. A., Ebentier, D. L., Jay, J. A., Wang, D., Boehm, A. B., Aw, T. G., Rose, J. B., Balleste, E., Meijer, W. G., Sivaganesan, M., Shanks, O. 2013. Comparison of PCR and quantitative real-time PCR methods for the characterization of ruminant and cattle fecal pollution sources. *Water Research*. 47:6921-6928

Schriewer, A., Goodwin, K. D., Sinigalliano, C. D., Cox, A., Wanless, D., Bartkowiak, J., Ebentier, D. L., Hanley, K. T., Ervin, J., Deering, L. A., Shanks, O. C., Peed, L. A., Meijer, W. G., Griffith, J. F., SantoDomingo, J., Jay, J. A., Holden, P. A., Wuertz, S. 2013. Performance evaluation of canine-associated Bacteroidales assays in a multi-laboratory comparison study. *Water Research*. 47:6909-6920.

Cao, Y., Van De Werfhorst, L. C., Scott, E. A., Raith, M. R., Holden, P. A., Griffith, J. F. 2013. Bacteroidales terminal restriction fragment length polymorphism (TRFLP) for fecal source differentiation in comparison to and in combination with universal bacteria TRFLP. *Water Research*. 47: 6944-6955.

Engeman, C.D., Baumgartner, L., Carr, B.M., Fish, A.M., Meyerhofer, J.D., Satterfield, T.A., Holden, P.A., Harthorn, B.H. 2013. The hierarchy of environmental health and safety practices in the U.S. nanotechnology workplace. *Journal of Occupational & Environmental Hygiene*. 10:487-495.

Hernandez-Viezcas, J. A., Castillo-Michel, H., Andrews, J. C., Cotte, M., Rico, C., Peralta-Videa, J. R., Ge, Y., Priester, J. H., Holden, P. A., Gardea-Torresdey, J. L. 2013. In situ synchrotron X-ray fluorescence mapping and speciation of CeO<sub>2</sub> and ZnO nanoparticles in soil cultivated soybean (*Glycine max*). *ACS Nano*. 7:1415-1423.

Sinigalliano, C. D., Ervin, J., Van De Werfhorst, L. C., Badgley, B., Ballesté, E., Bartkowiak, J., Boehm, A. B., Byappanahalli, M., Goodwin, K. D., Gourmelon, M., Griffith, J., Holden P. A., Jay, J., Layton, B., Lee, C., Lee, J., Meijer, W. G., Noble, R., Raith, M., Ryu, H., Sadowsky, M. J., Schriewer, A., Wang, D., Wanless, D., Whitman, R., Wuertz, S., Santo Domingo, J. W. 2013. Multi-laboratory evaluations of the performance of *Catellibacoccus marimammali* PCR assays developed to target gull fecal sources. *Water Research*. 47:6883-6896.

Ervin, J. S., Russell, T. L., Layton, B. A., Yamahara, K. M., Wang, D., Sassoubre, L. M., Cao, Y., Kelty, C. A., Sivaganesan, M., Boehm, A. B., Holden, P. A., Weisberg, S. B., Shanks, O. 2013. Characterization of fecal concentrations in human and other animal sources by physical, culture-based, and quantitative real-time PCR methods. *Water Research*. 47:6873-6882.

Cao, Y., Van De Werfhorst, L. C., Dubinsky, E. A., Badgley, B. D., Sadowsky, M. J., Andersen, G. L., Griffith, J. G., Holden, P. A. 2013. Evaluation of molecular community analysis methods for discerning fecal sources and human waste. *Water Research*. 47:6862-6872.

Ebentier, D. L., Hanley, K. T., Cao, Y., Badgley, B. D., Boehm, A. B., Ervin, J. S., Goodwin, K. D., Gourmelon, M., Griffith, J. F., Holden, P. A., Kelty, C. A., Lozach, S., McGee, C., Peed, L. A., Raith, M., Ryu, H., Sadowsky, M. J., Scott, E. A., Domingo, J. S., Schriewer, A., Sinigalliano, C.

- D., Shanks, O. C., Van De Werfhorst, L. C., Wang, D., Wuertz, S., Jay, J. A. 2013. Evaluation of the repeatability and reproducibility of a suite of qPCR-based microbial source tracking methods. *Water Research*. 47: 6839-6848.
- Klanjscek, T., Nisbet, R.M., Priester, J.H., Holden, P.A. 2013. Dynamic energy budget approach to modeling mechanisms of CdSe quantum dot toxicity. *Ecotoxicology*. 22:319-330.
- Boehm, Alexandria B., Laurie C. Van De Werfhorst, John F. Griffith, Patricia A. Holden, Jenny A. Jay, Orin C. Shanks, Dan Wang, Stephen B. Weisberg 2013. Performance of forty-three microbial source tracking methods: a twenty-seven lab evaluation study. *Water Research*. 47: 6812-6828.
- Holden, Patricia A., Roger M. Nisbet, Hunter S. Lenihan, Robert J. Miller, Gary N. Cherr, Joshua P. Schimel, Jorge L. Gardea-Torresdey. 2013. Ecological nanotoxicology: integrating nanomaterial hazard considerations across the subcellular, population, community, and ecosystems levels. *Accounts of Chemical Research*. 46:813-822.
- Horst, Allison M., Raja Vukanti, John H. Priester, P. A. Holden. 2013. An assessment of fluorescence- and absorbance-based assays to study nanoparticle ROS production and effects on bacterial membranes. *Small*. 9:1753-1764.
- Xia, Tian, Malasarn, Davin, Lin, Sijie, Ji, Zhaoxia, Zhang, Haiyuan, Miller, Robert J., Keller, Arturo A., Nisbet, Roger M., Harthorn, Barbara H., Godwin, Hilary A., Lenihan, Hunter S., Liu, Rong, Gardea-Torresdey, Jorge, Cohen, Yoram, Mädler, Lutz, Holden, Patricia A., Zink, Jeffrey I., Nel, Andre E. 2013. Implementation of a multidisciplinary approach to solve complex nano EHS problems by the UC Center for the Environmental Implications of Nanotechnology. *Small*. 9: 1428-1443.
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## LECTURES

Holden, P.A. Ecological considerations of manufactured nanomaterials. Nanotox2014, 7<sup>th</sup> International Congress in Nanotoxicology, Antalya, Turkey, April 23 – 26, 2014.

Holden, P.A. Importance of bacteria when assessing manufactured nanomaterials environmental hazards and fates. 247<sup>th</sup> ACS National Meeting, Dallas, Texas, March 17. 2014.

Holden, P.A. September 8, 2013. Evidence for stability vs. biodegradability of condensed carbon materials in soil. 246<sup>th</sup> ACS National Meeting, Indianapolis, Indiana, September 8-12, 2013.

Holden, P. A. June 24, 2013. (Invited). Contemporary Nanomaterial Environmental Safety Assessment Including Prediction-Making Tools, Safer Design and Sustainability. 2013 GRC ETAB Summer Study, Semiconductor Research Corporation, Research Triangle Park, Durham, NC.

Holden, P. A. May 8, 2013. (Invited). Ecological Implications of Manufactured Nanomaterials: Assessment Approaches & Findings. UC CEIN Nano EHS Forum, CNSI, UCLA, Los Angeles, CA.

Holden, P. A. March 18, 2013. (Invited). Some Investigations of Metal Oxide Nanomaterials and Terrestrial Organisms. Agronomy Department Seminar, Purdue University, W. Lafayette, IN

Holden, P. A. February 28, 2013. (Invited). Evaluating Nanomaterial Safety in the Context of Ecological Processes. 2nd QNano Integrating Conference "Quality in nanosafety assessment – driving best practice and innovation" February 27 – March 1, 2013, IMG conference centre, Prague, Czech Republic

Holden, P.A. November 28, 2012. Human indicator persistence in the environment. State of the Science: Fecal Source Identification and Associated Risk Assessment Tools. Joint Workshop for the U.S. EPA and State of California Clean Beach Initiative, Southern California Coastal Water Research Project, Costa Mesa, CA.

Holden, P. A. November 6, 2012. Interactive Effects of Nano-TiO<sub>2</sub> and Soil Water on Soil Microbial Communities. Sustainable Nanotechnology Organization Conference 2012, Arlington, VA.

Holden, P.A. October, 2012. Urban Water Quality and Urban Infrastructure: What's the Connection?. Bren School Faculty Chat, UCSB.

Holden, P.A. August, 2012. Potential Ecological and Agricultural Outcomes of Manufactured Metal Oxide Nanomaterials in Soil. 244<sup>th</sup> American Chemical Society National Meeting, Philadelphia, PA

Holden, P. A. 6/12 Multidisciplinary Approaches to Understanding Environmental Implications of Engineered Nanomaterials TechConnect World 2012 Conferences and Expo, Santa Clara, CA (keynote)

Holden, P. A. 4/12 Microbial modifications of manufactured nanomaterials American Chemical Society, 243<sup>rd</sup> National Meeting, San Diego (invited)

Holden, P. A. 3/12 Environmental Applications and Implications of Nanotechnology SETAC North America, Boston, MA

Holden, P. A. 11/11 Effects of metal oxide nanomaterials on soil microbial populations and communities: observations and explanations Matthias Symposium, UC NRS, Bodega Bay (invited lecture)

Holden, P. A. 5/11 Bacterial Interactions with Engineered Nanomaterials in Soil and Water Environmental Nanotechnology Gordon Research Conference (invited)

Holden, P. A. 12/10 Bioavailability and Effects of Manufactured TiO<sub>2</sub> and Quantum Dot Nanomaterials to Environmental Microorganisms American Geophysical Union Fall Meeting, San Francisco (invited)

Holden, P. A. 11/10 Bioavailability and Fates of CdSe and TiO<sub>2</sub> Nanoparticles in Eukaryotes and Bacteria. Patricia A. Holden, Galen D. Stucky, and Jay L. Nadeau Interagency Nanotechnology Implications Grantees Workshop-EPA, NSF, NIH/NIEHS, NIOSH, and DOE November 7-11, 2010, Portland, OR

Holden, P. A. 10/10 UCSB Nanotechnology Industry Survey Overview; Nanomaterial Eco-Toxicology Impacts Nanotechnology VI: Progress in Protection, UC Center for Environmental Implications of Nanotechnology (UC CEIN) and the California Department of Toxic Substances Control (DTSC), UCLA

Holden, P. A. 8/10 Assessing Potential Ecological Implications of Engineered Nanomaterials: Insights from within the UC CEIN Nano2010, 5th International Conference on the Environmental Effects of Nanoparticles and Nanomaterials, Clemson, S.C.

Holden, P. A. 7/10 Environmental Implications and Applications of Nanotechnology. MRL Summer Intern Seminar Series, UCSB (invited lecture)

Holden, P. A. 6/10 Multidisciplinary Approaches and Insights into the Ecotoxicology of Engineered Nanomaterials by the UC CEIN New England Nanomanufacturing Summit 2010: the NSF Center for High-rate Nanomanufacturing at Northeastern University/UMass-Lowell, the NSF Center for Hierarchical Manufacturing at UMass-Amherst, and the National Nanomanufacturing Network

Holden, P. A. 5/10. Wetting and Drying Effects on Soil Microbial Communities in a California Grassland Ecosystem California Institute of Technology (invited seminar to Environmental Science and Engineering)

Holden, P. A. 5/10 Engineered Nanomaterials and Environmental Bacteria International Conference on the Environmental Implications of Nanotechnology (ICEIN), UCLA

Holden, P. A. (Invited) March 3, 2010. Substrate bioavailability in relationship to microbial growth habits in soils. International Symposium Microbial Contaminant Degradation at Biogeochemical Interfaces, Leipzig, Helmholtz Centre for Environmental Research – UFZ, Leipzig (Germany), March 2 – 4, 2010

Holden, P. A. (Invited) March, 2009. Bacterial Interactions with Engineered Nanomaterials, University of Iowa, Department of Chemical and Biochemical Engineering, & Nanoscience & Nanotechnology Institute.

Holden, P. A. (Invited) October 31, 2008. Interactions Between Pseudomonas Bacteria and Engineered Nanomaterials. UC Berkeley, Environmental Engineering Seminar Series.

Holden, P.A. (Invited) August 11, 2008. Environmental Considerations in Nanomaterials Health and Safety. 2008 ASTSWMO Hazardous Waste Managers Conference. "What's New on the RCRA Horizon?" August 11-13, 2008. San Diego, CA.

Holden, P. A. (Invited). August 6, 2008. Bacterial interactions with metal and metalloid nanomaterials Purdue University Conference on Nanotechnology and the Environment., Indiannopolis, IN August 5/6, 2008.

Holden, P. A. (Invited) Interactions of Bacteria w/ Engineered Nanomaterials. Spring Seminar Series. Bodega Marine Laboratory, University of California, Davis. May 7, 2008.

Holden, P. A. (Invited) A Survey of Current Practices in the Nanotechnology Workplace. California State University Northridge, Technical Symposium in Nanotechnology: Science and Safety. February 20, 2008.

Holden, P. A. (Invited) February, 2008. Molecular Biological Analysis of Coastal Creek Water Quality in Santa Barbara, CA. Stanford University, Environmental Engineering Seminar

Holden, P. A. (Invited) .July 16, 2007. Extracellular Matrices in Unsaturated Biofilms and their Roles in Bacterial Processes. 3<sup>rd</sup> International Symposium on Extracellular Enzymes in the Environment, Viterbo, Italy.

Holden, P. A. (Invited). March 28, 2007. Issues and Approaches to Tracking and Monitoring Sources of Fecal Pollution, Workshop on Beach Water Quality and Tourism in Southeast Asia: What Role for Public Information Programs? March 27-29, 2007, sponsored by the UC Institute on Global Conflict and Cooperation and the World Bank, Penang, Malaysia.

Holden, P. A. (Invited). February 16, 2007. Interactions of Engineered Nanoparticles with Bacteria: A Focus on CdSe Quantum Dots and *P. aeruginosa*. CNSI Nanotoxicology Seminar Series, UCLA.

Holden, P.A. January 9, 2007. Toxicity and Fate of CdSe Quantum Dots in *Pseudomonas aeruginosa*. Bren School, UCSB. (Inaugural lecture for the W'07 Seminar in Bioremediation, ESM595S).

Holden, P.A. November 13, 2006. Survey of Current Practices in the Nanotechnology Workplace. International Council on Nanotechnology (ICON) Fall Meeting, Tokyo.

Holden, P.A. (Invited). October 31, 2006. Toxicity and Fate of CdSe Quantum Dots in *Pseudomonas aeruginosa*. Department of Civil & Environmental Engineering, UCLA.

Holden, P.A. (Invited). June 6 2006. DNA-Based Source Tracking of Human Fecal Material: A Project for the City of Santa Barbara. USGS California District Meeting, Santa Barbara, CA.

Holden, P. A. May 9 2006. Review of Safety Practices in the Nanotechnology Industry: A Project for the International Council on Nanotechnology (ICON), Rice University, Houston, TX.

Holden, P. A. (Invited). April 2006. Unsaturated Bacterial Biofilm Characteristics and Interactions with Pollutants. UC Santa Cruz, Department of Environmental Toxicology.

Holden, P. A. (Invited). February 15, 2006. Potential Environmental Interactions of Bacteria and Engineered Nanoparticles CIRF Seminar Series UCSB.

Holden, P. A. (Invited). January 22, 2006. Microbial Source Tracking in Santa Barbara's Urban Watersheds: a Collaborative Effort. American Chemical Society 40<sup>th</sup> Western Regional Meeting, Anaheim, CA.

Holden, P. A. (Invited) November 2005. Transformations of Biologically-Conjugated CdSe Quantum Dots Released into Water and Biofilms. SETAC North America 26th Annual Meeting, Baltimore, Maryland.

Holden, P. A. (Invited). October 29, 2005. Insights into Unsaturated Biofilms. Southern California American Society for Microbiology (SCASM), San Diego.

Holden, P. A. October 2005. Transformations of Biologically-Conjugated CdSe Quantum Dots Released into Water and Biofilms. U.S. EPA Nanotechnology and the Environment: Applications and Implications Progress Review Workshop III, Washington, D.C.

Holden, P.A. (Invited). October 27-29 2004. Diffusional Constraints on Microbial Processes in Unsaturated Porous Media. Plenary talk at the 2<sup>nd</sup> Kirkham Conference (held every 4 years), Soil Physics, Logan UT.

Holden, P. A. (Invited). September 16-17 2004. Water, Interfaces and Environmental Complexity at the Microscale. Plenary talk at "Water: Challenges at the Intersection of Human and Natural Systems Workshop", a PNL sponsored NSF/DOE Workshop, Richland, WA.

Holden, P. A. (Invited) June 1 2004. Bacteria and Their Extracellular Matrices in Unsaturated Systems. Oregon State University IGERT Seminar Series in Subsurface Microbiology, Corvallis, OR.

Holden, P.A. (Invited) May 18 2004. Bacteria and Their Extracellular Polymeric Substances in Unsaturated Environments. U. C. Merced, School of Natural Sciences.

Holden, P. A. (Invited) and M.G. LaMontagne. March 16 2004. Molecular Community Analysis in Environmental Monitoring. Association of Environmental Health Sciences (AEHS), San Diego, CA.

Holden, P. A. 2004. Charting the Course of Human Waste Migration from Watersheds Through Coastal Waters. ASLO Ocean Sciences Meeting, Honolulu, HI.

Holden, P.A. (Invited). September 5 2003. Bacterial Communities as Indicators of Estuarine Ecosystem Health and Links to Watersheds. Invited talk to the Coastal and Estuarine Processes seminar series, Soil Science Department, University of Maine, Orono.

Holden, P.A. (Invited) Vadose Zone Bacterial Ecology from Particles to Profiles. Invited seminar to the Microbiology Department, Iowa State University, March 13, 2003.

Holden, P. A. (Invited). February 22 2002. The Underground Lives of Vadose Bacteria. Department of Civil and Environmental Engineering Seminar, Stanford University.

Holden, P. A. (Invited). February 13 2002. Bugs, Dirt and Water. Department of Geological Sciences Seminar, UCSB.

Holden, P. A. (Invited). February 1 2002. The Underground Lives of Vadose Bacteria. Scripps Institute of Oceanography Seminar, UC San Diego.

Holden, P. A. (Invited). February 5-7 2002. Urbanization and Coastal Water Quality: What Can Molecular Fingerprinting Tell Us? Microbial Source Tracking Workshop, sponsored by the U.S. Environmental Protection Agency, California State Water Resources Control Board, Southern California Coastal Water Research Project, and National Water Research Institute, Irvine CA.

Holden, P. A. (Invited). 2001. Developing Bacterial Community Fingerprinting for Watershed and Ocean Monitoring. American Association for the Advancement of Science, Pacific Division, UC Irvine, session entitled "Frontiers in the Science and Management of Coastal Water Quality".

Holden, P. A. 2001. Research Directions in Environmental Microbiology. U. C. Toxics Bioremediation Workshop, UCLA, Los Angeles, CA.

Holden, P.A. 2000. Coastal Water Quality Research at UCSB. Southern California Clean Beach Center Workshop, U.C. Irvine, CA.

Holden, P. A. 2000. Development of CSPEC, a Center for Studying Pathogens in Environments Along Coastlines. 2<sup>nd</sup> Bren School Water Quality Forum, UCSB.

Holden, P. A. 1999. Sleuthing Pathogens in Coastal Waters: Reasons and Avenues for Improvement. Departmental Seminar, Bren School, UCSB.

Holden, P. A. 1999. Soil as a Bioreactor: Concept and Implications. Annual Meeting of the Soil Science Society of America, Salt Lake City, UT.

Holden, P.A. 1999. Understanding Seasonal Variation of Bioavailability of Residual NAPL in the Vadose Zone. Bioremediation Program Review Meeting EPA/DOE/NSF/ONR, Bloomington, IL.

Holden, P. A. 1999. Development of Bacterial Community Fingerprinting for Ascertaining Coastal Water Quality. 1<sup>st</sup> Bren School Water Quality Forum, UCSB.

Holden, P. A. (Invited). 1998. Bacterial Biofilms: An Ecological and Environmental Engineering Perspective. Departmental Seminar in Mechanical & Environmental Engineering, UCSB.

Holden, P. A. (Invited). 1998. Pathogens in Coastal Waters: Questions of Detection, Origins, Ecology and Controls. Annual Meeting of the California Environmental Health Association, Ventura, CA.

Holden, P. A. (Invited). 1998. Research Directions in Environmental Microbiology. Annual Meeting of the California Water Environment Association, Oakland, CA.

Holden, P. A. 1996. The Role of Water Potential in the Biodegradation of Hydrocarbons. Departmental Seminar, Department of Environmental Science, Policy & Management, U.C. Berkeley.

Holden, P. A., M. K. Firestone and J. R. Hunt. May 8-10 1995. Unsaturated Zone Gas-Phase Biodegradation: The Importance of Water Potential. 50th Purdue Industrial Waste Conference, Purdue University, West Lafayette, IN.

### **OTHER PRESENTATIONS (partial list)**

Ervin, J. S., Van De Werfhorst, L. C., Holden, P. A. May 20, 2013. Microbial source tracking and the impact of an intermittently breaching lagoon at Arroyo Burro Beach, Santa Barbara, CA. 113<sup>th</sup> General Meeting of the American Society for Microbiology, Denver CO. May 18-21, 2013.

Van De Werfhorst, L. C., J. H. Priester, A. Horst, L. M. Tom, Y. Piceno, G. L. Andersen, P. A. Holden. May 19, 2013. Identification of PHB Producing Bacteria in Wastewater and the Effects of Manufactured Nanoparticles on PHB Production. 113<sup>th</sup> General Meeting of the American Society for Microbiology, Denver CO. May 18-21, 2013.

Kaweeteerawat, C. A. Ivask, H. Fischer, P. Holden, H. Godwin. May 21, 2013. Rapid Evaluation of Sub-lethal Effects of Nanoparticles in Escherichia coli. 113<sup>th</sup> General Meeting of the American Society for Microbiology, Denver CO. May 18-21, 2013.

Priester, J. H., R. E. Mielke, R. Werlin, A. M. Horst, E. Orias, P. A. Holden. June 17, 2012. Trophic Transfer of TiO<sub>2</sub> Nanoparticles in an Experimental Microbial Food Chain. 112<sup>th</sup> General Meeting of the American Society for Microbiology, San Francisco, CA.

Ebentier, D. L., Hanley, K. T., Boehm, A. B., Cao, Y. Gourmelon, M., Griffith, J. F., Holden, P. A., Lozach, S., McGee, C. D., Raith, M. R., Sadowsky, M. J., Scott, E. A., Shanks, O. C., Wang, D., Weisberg, S. B., Jay, J. A. June, 2012. Evaluation of the Intra- and Inter-laboratory Reproducibility of a Suite of PCR-based Microbial Source Tracking Assays. 112<sup>th</sup> General Meeting of the American Society for Microbiology, San Francisco, CA.

Layton, B. A., Y. Cao, E. Ballesté, A. Farnleitner, M. Gourmelon, J. Lee, W. Meijer, R. Noble, L. Peed, G. Reischer, L. Van De Werfhorst, A. Boehm, P. Holden, J. Jay, O. Shanks, J. Griffith. June, 2012. Performance of Human Fecal-Associated PCR-Based Methods in the California Source Identification Protocol Project. 112<sup>th</sup> General Meeting of the American Society for Microbiology, San Francisco, CA.

Cao, Y., L. C. Van De Werfhorst, E. A. Dubinsky, M. J. Sadowsky, G. L. Andersen, J. F. Griffith, P. A. Holden. June 2012. Evaluation of Four Molecular Community Analysis-based Methods for Detecting Human Waste and Fecal Sources in California. 112<sup>th</sup> General Meeting of the American Society for Microbiology, San Francisco, CA.

Kelty, C. A., M. R. Raith, J. F. Griffith, A. Schriewer, S. Wuertz, S. Mieszkin, M. Gourmelon, G. Reischer, A. Farnleitner, J. Ervin, P. Holden, J. A. Jay, A. B. Boehm, M. Sivaganesan, O. C. Shanks. Comparison of PCR-Based Assays for the Characterization of Cattle Fecal Pollution in California. 112<sup>th</sup> General Meeting of the American Society for Microbiology, San Francisco, CA.

Van De Werfhorst, L. C., Y. Cao, E. Scott, M. Raith, J. Griffith, P. A. Holden. June, 2012. Reproducibility Assessment of Two TRFLP Methods for Differentiating Human Waste and Animal Fecal Sources in Microbial Source Tracking. 112<sup>th</sup> General Meeting of the American Society for Microbiology, San Francisco, CA.

Van De Werfhorst, L. C., Murray, J. L. S., Reynolds, S., Reynolds, K., Holden, P. A. May 2011. Co-Evaluation of Canine Scent and Human-Specific Fecal Source Tracking in Santa Barbara, CA. 111<sup>th</sup> General Meeting of the American Society for Microbiology, New Orleans, LA.

Vukanti, R. V. N. R., Priester, J. H., Horst, A. M., Holden, P. A. May 2011. Elucidation of bacterial growth reduction mechanisms of metal oxide nanoparticles using high-throughput approaches. 111<sup>th</sup> General Meeting of the American Society for Microbiology, New Orleans, LA.

Priester, J. H., Singhal, A., Vukanti, R., Stucky, G. D., Holden, P. A. May 2011. Evaluating the Toxicity Mechanisms of Silver Nanoparticles in *Escherichia coli* and *Pseudomonas aeruginosa*. 111<sup>th</sup> General Meeting of the American Society for Microbiology, New Orleans, LA

Vukanti, R. V., Mielke, R. E., Schimel, J. P. Holden, P. A. May 2010. Interactions of engineered nanomaterials with bacterial cell surfaces and effects on growth rates. (poster)110<sup>th</sup> General Meeting of the American Society for Microbiology,

Wu, C., Sercu, B., Van De Werfhorst, L. C., DeSantis, T., Brodie, E. L., Hazen, T. C., Andersen, G. L., Holden, P. A. May, 2009. Bacterial Biogeography of an Urban Creek with Fecal Pollution (poster). 109<sup>th</sup> General Meeting of the American Society for Microbiology, San Diego, CA.

Schimel, J American Geophysical Union, Fall Meeting, 2008: Carbon in Deep Soil: why does it just sit there? Holden, P., Xiang, S., Roux-Michollet, D., Trumbore, S., Wetterstedt, M.

Holden, P. and J. Priester. (poster) Comparative Effects and Fates of Cd(II) Ions versus Bare CdSe Quantum Dots in *Pseudomonas aeruginosa*. SETAC Annual Meeting, November 18, 2008, Tampa, FL.

Horst, A. M, A. C. Neal, P. Sislian, W. H. Suh, L. Madler, G. D. Stucky, P. A. Holden. Dispersion of TiO<sub>2</sub> nanoparticle aggregates by *Pseudomonas aeruginosa* SETAC Annual Meeting, November 18, 2008, Tampa, FL.

Holden, P. A. Bioavailability and Fates of CdSe and TiO<sub>2</sub> NPs in Eukaryotes and Bacteria U.S. EPA/ DOE/ NSF Interagency Environmental Nanotechnology Grantees Workshop in Tampa, Florida on November 9-21, 2008

Horst, Allison, John Priester, Andrea Neal, Patricia Holden. Interactions of Bacteria with Engineered Nanomaterials. October 8, 2008. U.S. EPA-Sponsored International Environmental Nanotechnology Conference: Applications and Implications. Chicago, IL, USA 7-9 October, 2008.

Holden, Patricia, Allison Horst, Andrea Neal, John Priester. Nov.7., 2007. Metal and Metal Oxide Nanoparticle Interactions with *Pseudomonas*., Nov. 4-8, 2007 International Annual Meetings of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America in New Orleans, Louisiana.

Horst, Allison M and Patricia A. Holden. Nov.7., 2007. Toxicity and interactions of TiO<sub>2</sub> nanoparticles in planktonic *Pseudomonas putida*. Nov. 4-8, 2007 International Annual Meetings of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America in New Orleans, Louisiana.

Priester, J, P. Stoimenov, G. Stucky, R. Mielke and P.A. Holden. May 21-25 2006. (poster) Interactions of CdSe Quantum Dots with *Pseudomonas aeruginosa*. American Society for Microbiology 106th General Meeting, Orlando FL.

Van De Werfhorst, L., J. Murray, J. Zachary and P. A. Holden. May 21-25 2006 . (poster) Molecular and Culture-Based Source Tracking of Fecal Material in Two California Coastal Creeks. American Society for Microbiology 106<sup>th</sup> General Meeting, Orlando FL.

Horst, A., J. H. Priester , H. Boukhalfa, M. Neu, and P. A. Holden. May 21-25 2006. (poster) Effects of EDTA, Uranium(VI), and Complexed U(VI)-EDTA on Growth and EPS Production by Biofilm and Planktonic *Pseudomonas putida*. American Society for Microbiology 106<sup>th</sup> General Meeting, Orlando FL.

Cao, Y. and P.A. Holden. April 2006. Microbial Communities as Indicators of Pollutant Stress in Salt Marsh Systems. Association of Environmental Health Sciences (AEHS), San Diego.

Priester, J., P. Stoimenov, G. Stucky and P.A. Holden. November 2005. Interaction of semiconductor nanoparticles with *Pseudomonas aeruginosa*. Materials Research Society, Boston MA.

Cao, Yiping and P. A. Holden. June 5 - 9 2005. (poster) Significance of Particle-Associated Bacterial Communities in Salt Marsh Sediment Denitrification. American Society for Microbiology, 105th General Meeting, Atlanta, GA.

Priester, J. and P. A. Holden. June 5 - 9 2005. (poster) Chromium Accumulation and its Effects on the Macromolecular Composition of Unsaturated *Pseudomonas putida* Biofilms. American Society for Microbiology, 105th General Meeting, Atlanta, GA.

Steinberger, R.E., L. C. Van de Werfhorst and P. A. Holden. June 5 - 9 2005. (poster) Effects of Substratum Polarity on Unsaturated *P. aeruginosa* Biofilm Composition. American Society for Microbiology, 105th General Meeting, Atlanta, GA.

Brooks, D. J, S. B. Grant and P. A. Holden. June 5 - 9 2005. (poster) Progression of Riverine Bacterial Community Composition and Diversity During Two Large Rainstorms. American Society for Microbiology, 105th General Meeting, J Atlanta, GA.

Cao, Yiping and P. A. Holden. July 23-27 2004. EPS Composition of Denitrifying Biofilms from Wild-Type and Quorum Sensing Mutants of *Pseudomonas aeruginosa* as a Function of Nitrate Concentration. American Society for Microbiology, 2nd Conference on Cell-Cell Communication in Bacteria, Banff, Alberta, Canada.

Holden, P.A., L.C. Van de Werfhorst, N. Fierer and J. P. Schimel. 2003. Carbohydrate Content Along a California Grassland Vadose Zone Profile. Annual Meeting of the Soil Science Society of America, Denver, CO.

Brooks, D., J.L. Saleta, J. P. Schimel, N. Fierer and P. A. Holden. 2003. Heterogeneity Mapping of ESEM Images from a Vadose Zone Profile. Annual Meeting of the Soil Science Society of America, Denver, CO.

Holden, P.A. and M. G. LaMontagne. September 17 2003. Bacterial Communities as Indicators of Estuarine Ecosystem Health and Links to Watersheds. Estuarine Research Federation, Seattle WA.

Steinberger, R. E. and P. A. Holden. 2003. Quantification of Extracellular DNA from Pure and Mixed-Species Biofilms. Annual Meeting of the American Society for Microbiology, Washington, D.C.

LaMontagne, M.G., J. F. Griffith and P.A. Holden. 2003. Comparative Analysis of Animal Fecal Bacterial Communities Using Terminal Restriction Fragment Length Polymorphisms of Bacterial 16S rDNA PCR-Amplified from Fecal Community DNA. Annual Meeting of the American Society for Microbiology, Washington, D.C.

Cao, Y. M.G. LaMontagne and P. A. Holden. 2003. Analysis of Urban Watershed Aquatic Bacterial Community Composition Shows Influence of Human Activity. Annual Meeting of the American Society for Microbiology, Washington, D.C.

Holden, P. A. and M. G. LaMontagne. February 2003. Microbial Community Composition and Diversity as Indicators of Salt Marsh Ecosystem Health. American Society for Limnology & Oceanography, Salt Lake City, UT.

Holden, P. A. 2002. Carbon and Nitrogen Controls on Bacterial EPS in Unsaturated Biofilms. Soil Science Society of America Annual Meeting, Indianapolis, IN.

Steinberger, R. E. and P. A. Holden. 2002. Age and Carbon Source Effects on Unsaturated *Pseudomonas aeruginosa* Biofilms. Soil Science Society of America Annual Meeting, Indianapolis, IN.

Fierer, N., J. Schimel and P. A. Holden. 2002. The Relationship Between Microbial Community Structure and C Dynamics in a Soil Profile. Soil Science Society of America Annual Meeting, Indianapolis, IN

Holden, P. A. and M. G. LaMontagne. June 2002. Urbanization and Coastal Water Quality: What Can Molecular Fingerprinting Tell Us? American Society for Limnology & Oceanography, Victoria, BC.

LaMontagne, M.G., S. Bergmann, I. Leifer and P. A. Holden. May 2002. Assessment of the Effect of Marine Oil-Spills on Sediment Bacterial Diversity and Community Structure by PCR-TRFLP, Annual Meeting for the American Society for Microbiology, Salt Lake City, UT.

Cao, Y., M. G. LaMontagne and P. A. Holden. 2002. Urbanization and Coastal Water Quality: What Can Molecular Fingerprinting Tell Us? U.C. Toxic Substances Research and Teaching Program Annual Symposium, Long Beach, CA.

Kranz, N., M.G. LaMontagne and P. A. Holden. 2002. Assessment of the Effect of Marine Oil Seeps on Sediment Bacterial Community Structure and Diversity by PCR-TRFLP. U.C. Toxic Substances Research and Teaching Program Annual Symposium, Long Beach, CA.

Holden, P.A., J. Saleta and D. Pierce. 2001. Environmental Scanning Electron Microscopic Approaches to Resolving Soil Microbial Growth Habits. 93<sup>rd</sup> Annual Meeting of the Soil Science Society of America, Charlotte, NC.

Steinberger, R.E., A. R. Allen, H. G. Hansma and P. A. Holden. 2001. Nutritional Effects on Cell Length in Unsaturated *Pseudomonas aeruginosa* Biofilms. 101<sup>st</sup> General Meeting for the American Society for Microbiology, Orlando, FL.

LaMontagne, M.G., J. P. Schimel and P. A. Holden. 2001. Comparison of Surface and Subsurface Soil Bacterial Community Structure as Assessed by Terminal Restriction Fragment Length Polymorphisms of PCR-Amplified 16S-rDNA. 101<sup>st</sup> General Meeting for the American Society for Microbiology, Orlando, FL.

Fierer, N. G., P. A. Holden and J. P. Schimel. August 2001. Relationships Between Soil Microbial Community Structure and Soil Function Through a Depth Profile. Meeting of the International Society for Microbial Ecology (Amsterdam)

LaMontagne, M. G., J.P. Schimel and P. A. Holden. August 2001. Assessment of Heterogeneity within Soil Samples by Terminal Restriction Fragment Length Polymorphisms of PCR-Amplified 16S rDNA. Meeting of the International Society for Microbial Ecology (Amsterdam)

Steinberger, R. E., A. Paranjpye and P. A. Holden. 2000. Exopolymer Production by *Pseudomonas aeruginosa* Utilizing Hexadecane in Sand and Liquid Culture. 100<sup>th</sup> General Meeting for the American Society for Microbiology, Los Angeles, CA.

LaMontagne, M. G., C. M. Jessup and P. A. Holden. 2000. Combined Extraction of RNA and DNA for Molecular Analysis of Bacterioplankton Concentrated from Coastal and Estuarine Waters. 100<sup>th</sup> General Meeting for the American Society for Microbiology, Los Angeles, CA.

LaMontagne, M.G., P. A. Holden and C. M. Jessup. April 2000. Combined Extraction of RNA and DNA for Molecular Analysis of Bacterioplankton Concentrated from Coastal and Estuarine waters. 13<sup>th</sup> Annual Research Symposium for the UC Toxic Substances Research and Teaching Program, San Diego, CA.

Paranjpye, A., B. Bierwagen, S. Sirivithayapakorn, A. A. Keller and P. A. Holden. 1999. Understanding seasonal variation of bioavailability of residual NAPL in the vadose zone, EPA/600/R-99/092, 1999 Bioremediation Research Program Review, 29-30, Chicago, IL.

Jessup, C. M. and P. A. Holden. 1999. Application of a Community Fingerprinting Method to Trace Bacteria in Two California Coastal Watersheds. 91<sup>st</sup> Annual Meeting of the Soil Science Society of America, 91: 238, Salt Lake City, UT.

Holden, P. A. and B. Steets. 1999. Soil as a Bioreactor: Concept and Implications. 91<sup>st</sup> Annual Meeting of the Soil Science Society of America, 91: 238, Salt Lake City, UT.

Eustace, C., J. Kerns, J. Newman, R. Pingree, N. Vaziri, C. Wu, P. A. Holden and D. Siegel. June 20-24 1999. An Integrated Study of Bacterial Pollution at Santa Barbara County Beaches. 24<sup>th</sup> Annual Conference of the NAEP, Kansas City.

Jessup, C. and P. A. Holden. 1999. A Molecular Community Approach to Determining the Presence and Origin of Pathogens in Coastal Waters. Annual UC TSR&TP Symposium, Santa Barbara, CA.

Guigliano, J., B. Bierwagen, A. Keller and P. A. Holden. October 1999. Understanding Seasonal Variation of Bioavailability of Residual NAPL in the Vadose Zone. PA/600/R-98/122, 1996-1998 Bioremediation Research Program Review, Washington, DC/

Holden, P. A. May 20 1998. Culture Dependent Importance of Biosurfactant and Bioemulsifier-Producing Phenotypes in *Pseudomonas aeruginosa* Hexadecane Metabolism. American Society for Microbiology Conference Annual Meeting, Atlanta, GA.

Chen, B. J., P.A. Holden and R. M. White. 1997. Monitoring bacterial growth during toluene biodegradation with the flexural plate wave microsensors. Annual Meeting of the American Society for Microbiology, Miami, FL.

Holden, P. A. and M. K. Firestone. Sept. 30- Oct. 4, 1996. Water Effects on Microbial Biofilms. American Society for Microbiology Conference on Microbial Biofilms, Snowbird, UT.

Holden, P. A. and M.K. Firestone. May 20 1996. A System for Growing Non-Submerged Biofilms Under Varying Water Potential Conditions. American Society for Microbiology Annual Meeting, New Orleans.

Firestone, M. K. and P. A. Holden. October 1995. Soil microorganisms: how effective can they be in soil cleanup? 87<sup>th</sup> Annual Meeting of the Soil Science Society of America, St. Louis, MO.

Holden, P. A., L. Hersman and M. K. Firestone. Oct. 29-Nov. 3 1995. Biodegradation of Toluene in Volcanic Subsurface Material of Los Alamos, New Mexico. 87<sup>th</sup> Annual Meeting, Soil Science Society of America, St. Louis, MO.

Holden, P.A., T. Kneafsey, J. R. Hunt and M. K. Firestone. August 8-10 1995. Microbial Degradation of Petroleum Hydrocarbons in Unsaturated Soils: the Mechanistic Importance of Water Potential and the Exopolymer Matrix". Symposium on Bioremediation of Hazardous Wastes: Research, Development and Field Evaluations. Office of Research and Development, USEPA., Rye Brook, NY.

Holden, P. A. and M.K. Firestone. May 22 1995. The Effect of Water Potential on the Kinetics and Efficiency of Toluene Utilization by *Pseudomonas putida* mt-2". 95<sup>th</sup> General Meeting of the American Society for Microbiology, Washington, D.C.

Halverson, L. J., P. A. Holden and M.K. Firestone. May 1994. The Effects of Water Potential on the Growth and Utilization of Toluene by *Pseudomonas putida* mt-2. 94<sup>th</sup> General Meeting of the American Society for Microbiology, New Orleans, LA.

**RESEARCH SUPPORT** (chronological order)

Holden, P. A. and A. A. Keller. "A Microscale Approach to Simulating Seasonal Bioavailability Constraints in Intrinsic Biodegradation" U.C. Water Resources Center, \$59,967, 07/01/98 – 06/30/00.

Holden, P. A. "Microscale Mechanisms in Unsaturated Biofilm Substrate Availability: A Molecular Reporter System Approach" NSF, \$74,897, 07/01/98- 12/31/99.

Holden, P. A. "A Molecular, Community-Based Approach to Determine the Presence and Origin of Pathogenic Microorganisms in Littoral Regions" U.C. Toxic Substances Research and Teaching Program, \$49,994, 07/01/98-06/30/00.

Holden, P. A. and A. A. Keller "Understanding Seasonal Variation of Bioavailability of Residual NAPL in the Vadose Zone" U.S. Environmental Protection Agency, \$425,000, 10/01/98 – 09/30/01.

Holden, P. A., J. Dozier, J. Israelachvili, C. Safinya and G. Stucky. "Acquisition of an Environmental Scanning Electron Microscope System" NSF Major Research Instrumentation Program, \$450,000, 09/14/99-08/31/02.

Schimel, J. and P. A. Holden. "Linking Resource and Stress Gradients to Microbial Community Composition and Function Through the Soil Profile of a California Annual Grassland at the Sedgwick Reserve" NSF Microbial Observatories, \$664,819, 08/01/99-07/31/03.

Holden, P. A. "A Molecular, Community-Based Approach for Tracking Pathogenic Bacteria Through Watersheds to Coastal Waters" U.S. Geological Survey/Center for Water and Wildland Resources, \$24,997, 08/05/99- 8/04/00.

Higashi (UCD) / Fan (UCD) / Holden / Kuivila (USGS) / Nelson (UCD) / Scow (UCD). Western Center for Estuarine Ecosystem Indicator Research: Biogeochemistry and Bioavailability Component, \$1,199,028, 10/01/00-9/30/04.

Butler, A. and P.A. Holden. "Incorporation of Functionalized Mesoporous Silicate Materials (Containing Sequestered Biomolecules) Inside Cells or Cellular Membranes" UCSB MRL Seed Funding, \$40,000, 05/01/01-04/03/02.

Holden, P.A. and R. Haymon. "Microbe-Mineral Interactions in Deep Sea Hydrothermal Chimneys: A Physiological, Molecular and Geochemical Analysis". UCSB Committee on Research, \$7,000, 07/01/01-06/30/02.

Holden, P. A., J. Dozier, J. Israelachvili, J. Schimel and G. Stucky. "Acquisition of a Cryostage and Transfer System to Characterize Biological Systems and Frozen Materials with Environmental Scanning Electron Microscopy" NSF Major Research Instrumentation Program, \$109,088, 07/02/02-06/30/05.

Holden, P.A., M. Neu and L. Hersman. "Bacterial exopolymeric substances (EPS) and redox active metal/actinide desorption in the vadose zone". LANL-CARE (UCSB associated) program, \$60,000, 11/01/03-10/31/04.

Grant, S., B. Sanders and P. A. Holden, “Dynamics of point and non-point source fecal pollution from an urban watershed in southern California”. NIWR/USGS (\$100,000 to Holden), 01/01/04-12/31/06.

Haymon, R. M., P. A. Holden and S. Sievert. (WHOI). “SGER: Developing Metal-Tagged DNA Probes for High Resolution Imaging of Microbial Phylotype Distributions and Nanoscale Mineral/Microbe Associations in Environmental Samples” NSF (\$85,131), 03/01/04-02/28/05.

Holden, P. A. “DNA-Based Source Tracking of Human Fecal Material: A Proposal to the City of Santa Barbara” City of Santa Barbara (\$340,311), 07/01/04-06/30/07.

Holden, P. A., J. Nadeau and B. L. Cox. “Transformations of Biologically-Conjugated CdSe Quantum Dots Released into Water and Biofilms” U. S. E. P. A. (\$332,099), 01/01/04 – 09/30/07.

Neu, M., and P.A. Holden. “Stabilization of Plutonium in Subsurface Environments via Microbial Reduction and Biofilm Formation”. DOE (\$250,000), 10/01/04-09/30/07.

Holden, P.A. and J. P. Schimel. “Resource and Stress Interactions in Regulating Microbial Communities in a California Grassland Soil”, NSF (\$400,000), 3/01/05- 02/28/08.

Holden, P.A. “Self-Assembly of Bacterial Cell-Cell Signaling Biomolecules”, UCSB Academic Senate (\$6,598), 6/15/05-9/15/05

Holden, P.A., M. Delmas, B. Herr-Harthorn and R. Applebaum. “Review of Safety Practices in the Nanotechnology Industry”, International Council on Nanotechnologies (ICON), (\$55,000), 04/01/06-12/31/06.

Holden, P. A. “Assessing Microbial Communities in Permanganate-Treated Aquifer Materials Source”, ENVIRON (\$49,583), 10/03/06-06/30/08.

Stucky, G. and P.A. Holden. “Interactions of Engineered Nanoparticles with Societally- and Environmentally-Important Bacteria”. (Altair Nanotechnologies, Inc.), (\$311,384), 02/07/07 – 06/30/08.

Schimel, J. P., P. A. Holden, and J. Clark. “Microbial and hydrological control of the N-flush at the summer-winter seasonal transition”. UC Kearney Foundation. (\$157,466), 01/01/07-12/31/08

Holden, P. A., Stucky, G. and J. Nadeau. “Bioavailability and fates of CdSe and TiO<sub>2</sub> nanoparticles in eukaryotes and bacteria” (U.S. EPA) (\$ 399,986), 10/01/06-09/30/09

Holden, P.A. “Fecal Indicator Bacteria Source Tracking in the Middle Santa Ana River” (UC Irvine). \$39,335. 04/01/07-09/30/08

Holden, P. A. “DNA-Based microbial source tracking in Laguna Channel, Santa Barbara”. (City of Santa Barbara) (\$49,998) 02/01/08-12/31/08

Ohlmann, Carter, Libe Washburn, Patricia Holden. “Monitoring the Montecito outflow wastewater plume”. (Heal the Ocean) (\$337,026), 07/01/07-6/30/09

Holden, P. A. “Fate, Persistence, and Source Identification of Pathogens, Pathogen Indicator Bacteria, and Human Specific Markers in Coastal Beach and Wetland Sediment of Southern California”. (UC Riverside from UC Marine Council) (\$67,375) 07/01/08-08/31/09.

Holden, P. A. “Microbial Source Tracking Protocol Development” (City of Santa Barbara) (\$340,000) 10/14/08-10/13/10

Holden, P. A. and J. P. Schimel. “UC Center for the Environmental Implications of Nanotechnology” (NSF and U.S. EPA) (\$303,446 per year) Holden/ Schimel portion of Nel, A. et al. UCLA/UCSB etc. consortia). 10/01/08-09/30/13

Holden, P. A. “Microbial Communities in Malibu Lagoon”. US Geological Survey \$18,986. 04/01/10-9/30/11.

Holden, P. A. “Microbial Communities Involved in Bioplastics Synthesis”. Private Gift. \$9,000. 6/01/09-6/30/11.

Schimel, J. P. and P. A. Holden. “Controls over C sequestration: physics vs. physiology”. \$533,635. National Science Foundation. 01/01/11-12/31/13

Holden, P. A. “SIPP: Source Identification Protocol Project” \$569,000. Southern California Coastal Water Research Project. 07/01/10-06/30/14.

Holden, P. A. “Urban Water Environment” \$1,250,000. Private Gift

Nel, A., Godwin, H., Cohen, Y. Keller, A., Holden, P. A. “UC Center for the Environmental Implications of Nanotechnology” (NSF and U.S. EPA) \$24M across UCSB, UCLA, UCR, UCD, Columbia, Univ. Texas El Paso, and other collaborators. 10/01/13-09/30/18

Holden, P. A. “Determination of DNA-based Fecal Marker Aging Characteristics for Use in Quantitative Microbial Source Tracking” \$194,209. Southern California Coastal Water Research Project. 01/01/14-12/31/15.

### **SERVICE (partial)**

Panelist, National Science Foundation, Urban Research Initiative (1998).

Panelist, National Science Foundation, Microbial Observatories Program (2000).

Panelist, Huntington Beach Phase III Research Review, Orange County Sanitation District (2002-03)

Panelist, Kearney Foundation (2004).

Panelist, Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET, 2004)

Panelist, National Science Foundation, Water Cycle Science (2004).

Panelist, National Science Foundation, Frontiers in Biological Research (2005).

Member, Clean Beach Task Force, California State Water Resources Control Board, (2003- present)

Switzer Foundation Annual West Coast Retreat: Case Study Contributor for System’s Thinking Workshop (October, 2005).

Switzer Fellowship Interviewer, 2005-06.

Advisory Committee: Pacific Northwest Lab (PNL) Biomolecular Systems Initiative (2005-06)

Peer reviewer for NSF proposals (several per year).

Peer reviewer for CICEET proposals (2002), NOAA proposal (2006), California Sea Grant (2003, 2005), U.S. Civilian Research and Development Foundation Science Centers Program (2005)

Peer reviewer for Biodegradation, ES&T, Molecular Microbiology, AEM, Soil Science, Water Research, PNAS, Estuaries, Microbial Ecology, Microbiology, BMC Microbiology, Archives of Microbiology, European Journal of Soil Science, Oecologica, New Zealand of Marine and Freshwater Research, Journal of Environmental Quality, Water Resources Research, Estuarine Coastal and Shelf Science, Research in Microbiology, Vadose Zone Journal

UC Water Resources Center Advisory Committee (04, 05, 06)

UC Toxic Substances Research & Teaching Program Executive Committee (06 - )

Associate Editor, Soil Science Society of America Journal (SSSAJ; 06- )

Peer Reviewer, State of California Water Resources Control Board, Total Maximum Daily Load Developments for Pathogens, (4 total; Dana Point, San Diego, San Luis Obispo, Tomales Bay, 04-06).

Peer Reviewer, State of California Water Resources Control Board, Review of Volume 4, Potential Ground and Surface Water Impacts, UCRL-AR-135949, SWRCB Ethanol Study (1999)

Numerous Bren School and UCSB Committees (e.g. 3 years on UCSB Graduate Council, 2 years Bren School Executive Committee, Chair of Bren School Building Committee 2 years, Chair of Coal Oil Point Natural Reserve Advisory Committee 1 year, Member of Marine Science Institute Advisory Committee, 2 years Bren Dean Search Committee, 2 years Advisory Committee to Institute for Crustal Studies, 2 years UCSB Central Fellowship Reviews)

Invited participant in the workshop: Systems Microbiology and Extremophile Research Facility (SMERF) at the Pacific Northwest National Laboratory will hold the workshop on March 26, 2008

Participant / Advisory. U.S. EPA Nanomaterial Case Studies Workshop: Developing a Comprehensive Environmental Assessment Research Strategy for Nanoscale Titanium Dioxide 2009

Associate Editor, Journal of the Soil Science Society of America, 2009-2012

Panelist, NIH / NIEHS Special Emphasis Proposal Review Panel; Superfund Basic Research and Training Program, RTP/NC, 2009

Panel Discussant, State of CA DTSC/California Nano-Industry Network Symposium, Sacramento, 2009

Workshop Participant, SETAC Nanomaterials Technical Workshop, Clemson, 2010

Workshop Participant, NSF Chemistry Workshop on Nanomaterials and the Environment, Washington, D.C., June, 2011

Panelist, NSF Environmental Chemical Sciences (ECS) October 13-14 2011 at NSF in Arlington, VA, 2011.

Panel Moderator. Dec 3-4, 2012. NSF Nanoscale Science and Engineering Grantees Conference. Panel Focus: Biological interactions: microbes and in vitro cell cultures.

Panelist, NSF EHSNano EcoTox Panel III on April 17, 2014, Washington, D.C.

## **PROFESSIONAL MEMBERSHIPS**

National Society of Professional Engineers, Water Environment Federation, American Society for Microbiology, American Society for Civil Engineers, American Chemical Society.