

## FREDERICK S. COLWELL

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### EDUCATION

B.A., Biology, Whitman College, 1977

M.S., Microbiology, Northern Arizona University, 1982

Thesis title: Interactions of Selected Bacteria and Algae from Wastewater Oxidation Ponds

Ph.D., Microbiology, Virginia Tech, 1986

Thesis title: Changes in Respiration Rates and Biomass Attributes of Epilithon Due to Extended Exposure to Zinc

Postdoctoral research: Determination of physiological differences among strains of *Thiobacillus ferrooxidans*; Idaho National Laboratory

### EXPERIENCE

Professor, Oregon State University 2006-present

Idaho National Laboratory  
Biotechnology Department

Consulting Scientist 1998-2006

Advisory Scientist 1994-1998

Scientific Specialist 1992-1994

Senior Scientist 1990-1992

Scientist 1988-1990

Idaho State University, Dept. of Biology 1990-2006

Pocatello, ID

Adjunct and graduate faculty member

University of Idaho, Dept. Bacteriology and Biochem. 1986-1987; 1993-2007

Moscow, ID

Affiliate faculty member

EG&G Idaho, Inc., Biotechnology 1986-1988

Postdoctoral fellowship, Associated Western Universities

## AREAS OF SPECIALIZATION

### RESEARCH

- Assessed effect of metals on bacterial growth rates
- Investigated use of sulfate-reducing bacteria to remove metals from contaminated surface waters
- Evaluated ambient rates of phenol degradation in freshwaters
- Characterized physiology of distinct strains of *Thiobacillus ferrooxidans*
- Enumeration, physiological characterization of subsurface microbial communities
- Enrichment of trichloroethylene degrading microbes
- Development of a differential soil bioreactor used to simulate in situ degradation by indigenous or introduced microbial communities and obtain realistic terms for microbial growth and contaminant degradation rates
- Determination of volumetric productivity and adsorption isotherms for a biofilter capable of degrading volatile hydrocarbons extracted from contaminated soils
- Enrichment and characterization of microbes for microbial enhanced oil recovery
- Development of methods to sample the deep subsurface terrestrial environments for biological and abiological features. Includes use of tracers for quality control/quality assurance
- Characterization of microbial communities from deep subsurface terrestrial environments including determinations of physiologically diverse communities, molecular characterization of communities, activities, and the effects of temperature and pressure on growth rates
- Microbiology of methane hydrate-bearing and gas rich seafloor and subpermafrost sediments
- Use of microbial community structure and function to determine environmental impact in surface waters and aquifers
- Development of remote, non-powered sensor technologies
- Lead on INEEL initiative for conservation and sustainable use of thermophilic microbial biodiversity at Yellowstone National Park
- Microbial ecology of the Snake River Plain aquifer including C-1 cycling and natural attenuation of trichloroethylene
- Microbiologically induced calcite precipitation as a strategy for removing hazardous divalent cations from aquifers
- Ecology of toxic cyanobacterial blooms
- Biogeochemistry of geological carbon sequestration

### TEACHING AND TRAINING

- Instructor in symposium for wastewater treatment engineers
- Instructor in college-level laboratories in biology, microbiology, genetics, field botany, and ecology
- Directed undergraduate research including technique development and assignment of work
- Designed and taught Univ. of Idaho accredited microbiology lecture and laboratory for university extension
- Mentor of undergraduate student research fellows at the Idaho National Laboratory and at Oregon State University

- Consultant and Scientist-in-Residence for San Francisco Exploratorium in the design of Winogradsky columns and demonstration of the Volta apparatus (July 2001)
- Faculty member at the International Ocean Sciences Summer School and PhD Student Forum, Multidisciplinary Research of Geo-Bio-Chemical Interactions in the Ocean and at the Seafloor, Xiamen, China (July 2011)
- Faculty member, Deep Subsurface Microbiology Summer School, Tongji University, Shanghai, China (July 2013)
- Organizer and instructor at 2016 Deep Carbon Observatory Summer School, Yellowstone National Park (July 2016)
- Host, OSU Alumni Association travel to Australia and New Zealand (Feb 8)
- OSU courses taught:
  - OC669 IGERT Team Synthesis, 1 credit (Fall 06, Win 07, Spr 07; Fall 07, Win 08, Spr 08)
  - OC607 IGERT Subsurface Biosphere Seminar, 1 credit (Fall 07, Win 08, Spr 08)
  - OC399H Astrobiology (OSU Honors College), 2 credits (Spr 08, Spr 09, Spr 10, Spr 11)
  - OC407H Astrobiology (OSU Honors College), 2 credits (Fall 11, 12, 13, 14, 15, 16, 17, 18), OC407, 507, 607 CEOAS Student Forum, 1 credit, (Fall 12, Win 13, Spr 13), OC103 (Spr 16, 17, 18), Cascadia Field Trip (Fall 12, 13, 14, 16, 17, 18)

## COMMITTEES AND SCHOLARLY ACTIVITIES

### *Reviews and editorial responsibilities*

- Ad hoc reviewer of proposals (submitted to National Science Foundation, NASA, US Department of Agriculture, Ocean Drilling Program, Sea-Grants Program, US DOE Office of Science and SBIR programs, Murdock Trust, American Chemical Society Petroleum Research Fund)
- Ad hoc reviewer of manuscripts (submitted to Appl. Biochem. Biotechnol.; Appl. Environ. Microbiol., Biofouling; Biogeoscience; Canad. J. Microbiol.; Environ. Microbiol.; ES&T; FEMS Microbiol. Ecol.; GCA; G<sup>3</sup>; Geomicrobiol. J.; Microb. Ecol.; Ocean Drilling Program; Science; Vadose Zone J.)
- Member Editorial Review Board for Ocean Drilling Program, Leg 204, Hydrate Ridge (2003 - 2007)
- Guest editor for Geomicrobiology Journal special issue dedicated to the Joint International Symposia on Subsurface Microbiology and Environmental Biogeochemistry (2005 - 2007)
- Reviewer for *Applied and Environmental Microbiology* (2004-present)

### *Organization of meetings and conferences*

- Member of Organizing Executive Committee for International Biohydrometallurgy Symposium (Aug 1993)
- Member of organizing committee for 4<sup>th</sup> International Symposium on Subsurface Microbiology, Vail, CO (Aug 1999)
- Member of International Steering Committee for the 5<sup>th</sup> International Symposium on Subsurface Microbiology (Jul 2001)
- Member of Local Organizing Committee for 2003 Meeting of the International Symposium on Environmental Biogeochemistry (Sep 2001)
- Co-host, with Ron Crawford, of Environmental Genomics Workshops at University Place, Idaho Falls, ID (Sep 2002; 2003)

- Co-organizer for the 6<sup>th</sup> International Symposium on Subsurface Microbiology (Aug 2005)
- Member of International Steering Committee for the 7<sup>th</sup> International Symposium on Subsurface Microbiology (Nov 2008)
- President, International Society for Subsurface Microbiology (Nov 2008- present)
- Invited theme chair for INVEST meeting to plan the IODP beyond 2013 in Bremen, Germany (Sep 2009)
- Invited participant to international workshop aimed at integrating deep biosphere research into the Intercontinental Drilling Program (ICDP) in Potsdam, Germany (Sep 2009)
- Invited participant to international workshop to define deep subsurface microbiology elements of the Deep Carbon Observatory on Catalina Island, CA (Mar 2010)
- Local Organizing Committee for the 2010 International Symposium for Microbial Ecology (ISME) in Seattle, WA (Aug 2010)
- Member, International Steering Committee for the 8<sup>th</sup> International Symposium on Subsurface Microbiology (Sep 2011)
- Organizer, Deep Carbon Observatory, Deep Life Science Community Workshop, in Portland, OR (May 2013)
- Member, International Steering Committee for the 9<sup>th</sup> International Symposium on Subsurface Microbiology (Oct 2014)
- Organizer, Deep Carbon Observatory, Census of Deep Life Workshop, in Redondo, CA (May 2016)
- Organizer, Deep Carbon Observatory, Census of Deep Life Workshop, in Portland, OR (Sep 2017)

#### *Expert panels*

- Invited panelist to evaluate water and air regeneration systems for extended space flight at Space Station Freedom: Microbiology Conference. (Nov 1989; see NASA Conference Publication 3108)
- Invited scientist to help define new research applications and for optical imaging hardware and pattern matching software for AMBIS Systems, Inc. (May 1990)
- Invited scientist to explore potential research approaches to discerning the origins of microbes present in the deep terrestrial subsurface, DOE/OHER Microbial Origins Workshop (Oct 1991)
- Member of workshop in Costa Rica to develop consensus-building initiative for conservation and sustainable use of thermophilic microbial biodiversity at Yellowstone National Park (Jan 1996)
- Review panel member for the University of Idaho Environmental Science program (Feb 2005)
- Review panel member for the Department of Energy, Office of Science NABIR UMTRA field site (Feb 2005)
- Member of the Scientific Technology Panel for the Integrated Ocean Drilling Program (Aug 2006 – Aug 2009)
- Expert panel member and co-author of the 2008 report published by the Council of Canadian Academies (Ottawa, Canada) entitled *Energy from Gas Hydrates: Assessing the Opportunities and Challenges for Canada* (Apr 2007-Jun 2008)

- Member external advisory panel for Northern Arizona University IGERT Program (May 2008-present)
- Review panel member for NASA, Exobiology proposals (Jan 2009)
- Steering committee member, Dark Energy Biosphere Institute, Research Coordination Network (2009-present)
- Review panel member for the Department of Energy, Office of Science, Graduate Fellowship Program (Feb 2010)
- Review panel member for the Department of Energy, Office of Science, Subsurface Biogeochemistry Research Program (Oct 2010)
- Reviewer of User Proposals for DOE Office of Science Environmental Molecular Sciences Laboratory at Pacific Northwest National Laboratory (2010-present)
- Scientific Steering Committee Member for the Deep Carbon Observatory's Deep Life Community (2011-present)
- Review panel member for the Department of Energy, Office of Science, Subsurface Biogeochemistry Research Program, Science Focus Area for SLAC National Accelerator Laboratory (Apr 2011)
- Ethics panel member, Center for Dark Energy Biosphere Investigations, NSF Science and Technology Center (2011-present)
- Co-Chair and Chair Postdoctoral Fellowship Review Committee, Center for Dark Energy Biosphere Investigations, NSF Science and Technology Center (2012-present)
- Member OSU Microbiome Initiative Advisory Board (2016)
- Co-author OSU Carbon Action Planning Guide (2016)

*Other*

- Drilling and Sampling Technologies Steering Committee for sampling the deep subsurface for microorganisms. Department of Energy, Office of Health and Environmental Research (1990)
- Master Strategy Committee for the Transitional Program of the Subsurface Science Initiative sponsored by the Department of Energy, Office of Health and Environmental Research (1990)
- Co-chair for Environmental Biotechnology Session at the Sixteenth Symposium on Biotechnology for Fuels and Chemicals at Gatlinburg, TN (May, 1994)
- Co-chair for Bioprospecting Symposium within Microbial Diversity Colloquium at Annual Meeting of the American Society for Microbiology, Chicago, IL (May 1999)
- Elected as Alternate Councilor for Division N (Microbial Ecology) for the American Society for Microbiology, Jan 1999-Jun 2001
- Member of INEEL FY99 Enterprise Forum review (Jan and Aug 1999)
- Co-convener for two sessions entitled: "Constraints on Microbial Survival in Geological Environments" at Fall Meeting of the American Geophysical Union, San Francisco, CA (Dec 2000)
- Co-convener for two sessions entitled: "Assessing Bioremediation" at Fall Meeting of the American Geophysical Union, San Francisco, CA (Dec 2001)
- Associate for Integrative Graduate Education and Research Traineeships (IGERT) Program funded by NSF to study Life Below the Earth's Surface (beginning 2001)
- Interviewed for ASM's Microbe World Radio Spot Program (Mar 2003)
- Interviewed for BBC Radio 4 Series *Wild Underground* (Oct 2003)

- Co-convenor for session entitled: "Methane Hydrates: Fuel, Carbon Storage, and Climate Change" at the 2004 Annual Meeting of the American Association for the Advancement of Science (AAAS), Seattle, WA (Feb 2004)
- Graduate Council, Oregon State University (Oct 2007-Sep 2010)
- Chair of the Promotion and Tenure Committee, College of Oceanic and Atmospheric Sciences, Oregon State University (Sep 2010 - Jan 2011)
- Chair of the Peer Review of Teaching Committee, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University (2012-2013; 2017-2018; 2018-2019)
- Member, OSU Microbiome Initiative Advisory Board (2016-present)

#### ADMINISTRATION AND SUPERVISION

- Directed DOE-Teacher Research Associates (1990, 1992, 1994-1999)
- Mentor of Associated Western Universities undergraduate, graduate, high school and university faculty fellows at INEEL (1987-1999); EMCOM (Environmental Management Career Opportunities for Minorities) faculty and students during summer internship at INEEL (1991, 1993); EMCORE (Environmental Management Career Opportunities Research Experience) faculty and students during summer internships (1991, 1993); OSU Research Experience for Undergraduate (REU) (2007); OSU Subsurface Biosphere Initiative undergraduate fellows (2008)
- Co-coordinator and presenter for Workshop on Potential Subsurface Science Program Investigations in Support of Test Area North Injection Well Remediation at INEEL (Feb. 1996)
- Geomicrobiology Group Leader in INEEL Biotechnology Department (1999-2004)
- Biological Sciences Discipline Lead for INEEL Subsurface Science Initiative (2000-2001; 2003-2004)

#### FUNDED GRANTS

- Study of organic carbon use by microbial communities exposed to zinc (PI; 1985; Sigma Xi; \$1,500)
- Innovative research to study subsurface microorganisms and degradation of low molecular weight halocarbons (PI; 1988; EG&G Idaho, Exploratory Research and Development Program; ca. \$100,000)
- Complete degradation of mixed halocarbons by methanogenic/methanotrophic microbial communities (Co-PI with G Andrews; 1989-92: Department of Energy, Office of Health and Environmental Research; ca. \$450,000)
- Development of hardrock sampling procedures (PI; 1990; Department of Energy, Office of Health and Environmental Research; ca. \$50,000)
- Preliminary identification of bioremediation field research site (PI; 1990; Department of Energy, Office of Health and Environmental Research; ca. \$25,000)
- High rate biodegradation of groundwater contaminants (Co-PI; 1990; EG&G Idaho, Exploratory Research and Development Program; ca. \$100,000)
- Deep subsurface sample acquisition and processing at the Idaho National Engineering Laboratory for the Deep Subsurface Microbiology Transitional Program (PI; 1990-3; Department of Energy, Office of Health and Environmental Research; \$920,000)

- Biological tracers for deep drilling and subsurface characterization (PI; 1991; EG&G Idaho, Exploratory Research and Development Program; ca. \$75,000)
- Screening of deep subsurface microbes for degradative capabilities (PI; 1991; DOE Office of Technology Development; ca. \$100,000)
- Removal and degradation of hydrocarbon and halocarbon vapors by biofiltration (Co-PI with W Apel; 1992; DOE Office of Technology Development; ca. \$150,000)
- Degradation of organic contaminants by microbes from the surface and deep subsurface at DOE sites (PI; 1992; DOE Office of Technology Development; ca. \$100,000)
- High temperature/pressure sampling and experiments for deep subsurface microbes (PI; 1992; Department of Energy, Office of Health and Environmental Research; \$11,000)
- Nutrient diffusing substrata to conduct rational bioremediation (PI; 1993-5; EG&G Idaho and LMITCO, Laboratory Directed Research and Development; \$60,000)
- Biodegradation of high explosive materials (co-PI with F Roberto; 1993-5; EG&G Idaho and LMITCO, Laboratory Directed Research and Development; \$60,000)
- Ecology of subsurface microbial communities: Implications of temperature, pressure and electron flow (1994-8; Department of Energy, Office of Health and Environmental Research; \$789,000)
- Quality assurance/quality control tracers and core collection for microorganisms at the Tuba City, AZ UMTRA site (PI; 1995; Univ. of New Mexico; \$10,000)
- Microbial corrosion of concrete: Sensors and test cells (PI; 1995-6; LMITCO, Laboratory Directed Research and Development; \$370,000)
- Microbiology of gas hydrate formations (PI; 1996-8; JAPEx; \$120,000)
- Control of biologically active degradation zones by vertical heterogeneity: Applications in fractured media (PI; 1996-9; Environmental Management Science Program, Department of Energy, Office of Health and Environmental Research; \$2,100,000)
- Exploratory gas hydrate research (co-PI with R Cherry; 1998-9; LMITCO, Laboratory Directed Research and Development; \$300,000)
- Microbiology of gas hydrates (PI; 1998-9; Department of Energy, Office of Fossil Energy; \$30,000)
- Calcite precipitation and trace metal partitioning in groundwater and the vadose zone: Remediation of strontium-90 and other divalent metals and radionuclides in arid western environments (co-PI with R Smith; 1998-01; Environmental Management Science Program, Department of Energy, Office of Health and Environmental Research; \$1,000,000)
- Realistic rates for in situ biogenic methane production in gas hydrates (PI; funded: 2001-4; Department of Energy, Office of Fossil Energy; \$500,000)
- Coupling of realistic rate estimates with genomics for assessing contaminant attenuation and long-term plume containment (PI; 2002-5; Environmental Management Science Program, Department of Energy, Office of Science; \$1,063,000)
- Geomicrobiology of subsurface environments (PI; 2000-5; Office of Environmental Management, Department of Energy; \$3,750,000)
- Bioremediation of carbon tetrachloride at USDA sites (PI; 2004-5; Argonne National Laboratory; \$26,000)
- Mining the soil metagenome for novel biodegradation genes (co-PI with R Crawford; 2003-5; National Institute of Environmental Health Sciences; ca. \$350,000)

- Coupled biogeochemical process evaluation for conceptualizing trichloroethylene co-metabolism (PI with co-PIs R Crawford, M Conrad, R Starr, C Radtke, H Howard, and D Newby; 2005-9; DOE Office of Science, Environmental Management Science Program; \$1,800,00)
- Methanogenesis in hydrate-bearing sediments: Integration of experimental and theoretical approaches (PI with co-PIs G Dickens and W Ussler; 2005-10; DOE Office of Fossil Energy; \$950,000)
- Towards biological control of toxic algal blooms: Genetic characterization of toxin-producing cyanobacteria and their infecting viruses in the Klamath River system (co-PI with T Dreher; 2008-10; Oregon SeaGrant; \$180,000)
- Modeling gas charge in marine sediments (PI through subcontract; 2007-9; Dept. of Interior, Minerals Management Service; \$8,000)
- Idaho National Laboratory faculty-staff exchange project (PI; 2008; Idaho National Laboratory; \$10,000)
- Microbial activity and precipitation at solution-solution mixing zones in porous media (PI with co-PIs G Redden, R Gerlach, B Wood, D Wildenschild; funded: 2009-12; DOE Office of Science; \$1,239,000)
- Biogeochemistry of carbon sequestration in Columbia River basalts (co-PI with M Fisk; subcontract from Montana State Univ.; 2009-10; Montana State Univ. and Portland General Electric; \$20,000 in FY09, \$10,000 in FY10)
- Coupled diffusion and reaction processes in rock matrices: Impact on dilute groundwater plumes (Co-PI with C Schaefer; subcontract from Shaw Environmental, Inc.; 2009-10; Strategic Environments Research and Development Project; \$10,000)
- Exploring Diversity and Distribution of Deep Life (PI with co-PI M Sogin; funded 2010-2012; Alfred P. Sloan Foundation; \$700,000)
- Microbiological Studies of Basalt Exposed to Supercritical CO<sub>2</sub> (PI; funded 2012; DOE Office of Fossil Energy; \$47,000)
- Gas Hydrate Dynamics on the Alaskan Beaufort Continental Slope: Modeling and Field Characterization (co-PI with M Hornbach; funded 2012; DOE Office of Fossil Energy; \$1,105,328)
- Feasibility of Biogeochemical Sealing of Wellbore Cements: Lab and Simulation Tests (co-PI with M Torres; funded 2013; DOE National Energy Technology Lab; \$255,038)
- Assessing the Response of Methane Hydrates to Environmental Change at the Svalbard Continental Margin (co-PI with M Torres; funded 2013; DOE Office of Fossil Energy; \$645,723)
- Collaborative Research: Laboratory-to-Field Scaling and Geophysical Monitoring for Soil Bio-Improvement (co-PI with D Ntarlagiannis; funded 2014; NSF; \$205,000)
- Post-Expedition Award - Microbiology of sediment interfaces in deep cores from the South China Sea (PI; funded 2015-6; U.S. Science Support Program; \$15,000)
- Toward a 4D Planetary Carbon Circulation Model (co-PI with E. Cottrell; funded 2014-16; Alfred P. Sloan Foundation; \$599,862)
- The Deep Carbon Observatory's Deep Life Community Census of Deep Life - 2014-2018 (co-PI with M Sogin; funded 2013-18; Alfred P. Sloan Foundation; \$31,359)
- Edginess in the subsurface: Microbial diversity of deep seafloor ecotones (PI with A Thurber; funded 2015-6; C-DEBI; \$80,466)



- Deep Carbon Observatory 2016 Summer School (PI; funded 2015-2017; Alfred P. Sloan Foundation; \$119,000)
- Quantifying Subsurface Biogeochemical Variability in a High Altitude Watershed During Winter Isolation (PI; funded 2017-2019; U.S. Department of Energy; \$199,865)
- Biogeochemistry of deep Gulf of Mexico hydrate bearing sediments (PI; funded 2017-2021; University of Texas, U.S. Department of Energy; \$463,535)

## PRESENTATIONS, PAPERS, AND PATENTS

### PRESENTATIONS

- Platform presentations at Soc. Environ. Toxicol. Chem. (1985) branch meetings Am. Soc. Microbiol. (1982, 1984, 1990, 1995), national meeting Am. Soc. Microbiol. (1989, 1994, 1998), annual meeting Am. Inst. of Chem. Eng. (1991), International Symposium for Subsurface Microbiology (1993, 1996, 1999, 2008, 2011, 2014), Am. Geophys. Union (1996, 1999, 2001, 2004, 2007, 2008, 2009, 2013, 2016, 2018, 2019), Amer. Assoc. Petrol. Geol. (1999, 2009), Western Pacific Geophysical Union (2000), Geolog. Soc. Amer. (2005, 2011, 2012)
- Authored or co-authored poster presentations at national meetings of Am. Geophys. Union (1990, 1992, 1997, 1998, 2000, 2001, 2002, 2005, 2008, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019), Am. Soc. Microbiol. (1983, 1985-88, 1990-94, 1996, 1998, 2000, 2001, 2002, 2003, 2004, 2005), European Geophys. Soc. (1998), Geolog. Soc. Amer. (1997, 1998, 2011, 2017), Internat. Symp. Microb. Ecol. (2010), Soc. Environ. Toxicol. Chem. (1987, 1990, 1991, 1993), Ocean Sciences (2010, 2012, 2014, 2018)
- Co-authored presentations (number shown in brackets) at the each of the nine International Symposia for Subsurface Microbiology (1990 [1], 1993 [8], 1996 [6], 1999 [7], 2002 [2], 2005 [4], 2008 [1], 2011 [3], 2014 [2], 2017 [1])

### *Invited talks*

- Lecturer for the Distinguished Lecturer Series of the Ocean Leadership's, U.S. Science Support Program (affiliated with the Integrated Ocean Drilling Program) during 2009-10 academic year; lectures given at University of Illinois – Urbana-Champaign, Johnson State College, University of Rhode Island, University of Georgia, New Mexico State University, University of Miami, Montana State University, University of Minnesota-Duluth
- Speaker at Science Pub – Corvallis, OR on the subject of Astrobiology (2011)
- Speaker at Corvallis Academy of Life Long Learning (2016)
- Speaker at Science Pub – Bend, OR on the subject of Subsurface Microbiology (2019)
- At the following universities or institutions:  
Utah State University (1991), Northern Arizona University (1991), Whitman College (1991, 1997, 2007), Idaho State University (1991, 1992, 1994, 1995, 1997, 1999, 2000), Mary Washington College (1992), Montana State University (1992), Colorado Mountain College (1994), University of Idaho (1996, 2007), California State University at Humboldt (1999), Lawrence Berkeley National Laboratory - UC, Berkeley (1999), Shizuoka University, Shizuoka, Japan (2001), Exploratorium, San Francisco, CA (2001), Oregon State University (2002), Portland State University (2005), Colorado School of Mines (2005), University of Oregon (2007), Oregon Health Sciences University (2009), National Energy Technology Laboratory (2010), Lamont Doherty Earth Observatory, Columbia University (2010), Tongji University, Shanghai, PRC (2012); China University

of Geosciences, Beijing, PRC (2012); Ohio State University (2015); Texas A&M Galveston (2016); Southern University of Science and Technology, Shenzhen, China (2017); University of Maryland (2018)

- At the following meetings:

31th Annual Meeting of the Idaho Academy of Science, Idaho Falls, ID (1989); PNW Branch Meeting of the American Society for Microbiology, Moscow, ID (1990); INEEL Scholastic Tournament, Idaho Falls, ID (1990); DOE Aseptic Drilling and Sample Handling Workshops, Santa Fe, NM and Boulder, CO (1993); EMR Technical Interchange Symposium, Salt Lake City, UT (1993); PNW Branch Meeting, American Society for Microbiology, Missoula, MT (1995); AGU Fall Meeting, San Francisco, CA, (1996); Conference on Hazardous Wastes and Materials, Pocatello, ID (1997); 125th Anniversary of Yellowstone National Park Symposium, Bozeman, MT (1998); Annual Meeting of the American Society for Microbiology, Atlanta, GA (1999); Department of Energy, Headquarters, Washington, DC (2000); 5th RIDGE Theoretical Institute on the Subsurface Biosphere at Mid-Ocean Ridges, Big Sky, MT (2000); International Continental Drilling Program, Mallik Gas Hydrate Research Well Workshop, Almer, Ontario, Canada (2001); Physical and Chemical Property Measurements for the Gas Hydrate R&D Community, San Francisco, CA (2001); Columbia University's Biosphere 2 Climate Change Workshop, Oracle, AZ (2001); Annual Meeting of the AAAS, Denver, CO (2003) and Chicago, IL (2009); Environmental Management Science Program symposium at the 225th National Meeting of the American Chemical Society, New Orleans, LA (2003); Goldschmidt Conference, Kurashiki, Japan (2003; keynote); AGU Fall Meeting, San Francisco, CA (2003); National Research Council consideration of the SECUREarth Research Initiative, Washington, DC (2004); AAPG Hedberg Research Conference, Vancouver, BC, Canada (2004); IV International Workshop on Methane Hydrate Research and Development, Victoria, BC, Canada (2005); AGU Spring Meeting, Acapulco, Mexico (2007); Korean Integrated Ocean Drilling Program Special Symposium, Jeju Island, South Korea (2009); Gordon Research Conference on Natural Gas Hydrate Systems, Colby College, Waterville, ME (2010); Workshop on New Horizons for International Investigations into Carbon Cycling in the Deep Crustal Biosphere, Bloemfontein, South Africa (2011); Geological Society of America Annual Meeting, Minneapolis, MN (2011; Pardee Symposium keynote speaker); C-DEBI All-Hands Meeting, Marina, CA (2012); Geological Society of America Annual Meeting, Charlotte, NC (2012; Pardee Symposium); "Deep Carbon in Deep Time" Short Course Lecturer at the Geological Society of America Annual Meeting, Vancouver, Canada (2014); AGU Fall Meeting, San Francisco, CA (2016); Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX (2018); DEEP2018, Beijing, China (2018); AGU Fall Meeting, Washington, DC (2018); Deep Carbon Observatory meeting, National Academy of Sciences (2019)

## PUBLICATIONS

1. Colwell, F.S. and H.K. Speidel. 1985. Diffusion through a double-sided plate: Development of a method to study alga-bacterium interactions. *Appl. Environ. Microbiol.* 50: 1357-1360.

2. Genter, R.B., F.S. Colwell, J.R. Pratt, D.S. Cherry, and J. Cairns. 1988. Changes in epilithic communities due to individual and combined treatments of zinc and snail grazing in stream mesocosms. *Toxicol. Ind. Health*. 4: 185-201.
3. Colwell, F.S., S.G. Hornor, and D.S. Cherry. 1989. Evidence of structural and functional adaptation in epilithon exposed to zinc. *Hydrobiologia*. 171: 79-90.
4. Peters, G.T. and F.S. Colwell. 1989. Mineralization of [<sup>14</sup>C]-phenol by heterotrophic microorganisms in streams. *Hydrobiologia*. 174: 79-87.
5. Colwell, F.S. 1989. Microbiological comparison of surface soil and unsaturated subsurface soil from a semiarid high desert. *Appl. Environ. Microbiol.* 55: 2420-2423.
6. Colwell, F., G. Stormberg, T. Phelps, S. Birnbaum, J. McKinley, S. Rawson, C. Veverka, S. Goodwin, P. Long, B. Russell, T. Garland, D. Thompson, P. Skinner and S. Grover. 1992. Innovative techniques for collection of saturated and unsaturated subsurface basalts and sediments for microbiological characterization. *J. Microbiol. Meth.* 15: 279-292.
7. Andrews, G. F., J. Walton, R. Larsen, R. Shimsky, S. Hansen, and F. Colwell. 1992. The design of in-situ bioremediation, pp. 1024-1029. *Proc. of the International Topical Meeting on Nuclear and Hazardous Waste Management. Spectrum '92. Boise, ID. American Nuclear Society.*
8. Apel, W.A., W.D. Kant, F.S. Colwell, B. Singleton, B.D. Lee, G. F. Andrews, A.M. Espinosa, and E.G. Johnson. 1994. Chapter 9. Removal of gasoline vapors from air streams by biofiltration, pp. 142-159. In (D.W. Tedder and F.G. Pohland, eds) *Emerging Technologies in Hazardous Waste Management IV. ACS Symposium Series 554. American Chemical Society. Washington, DC.*
9. Griffin, W.T., B.F. Russell, and F.S. Colwell. 1994. Microbiological sampling procedures for the deep subsurface, pp. 297-300. In *Proceedings of the VIIth International Symposium on the Observation of the Continental Crust Through Drilling. Santa Fe, NM.*
10. Palumbo, A.V., J. McCarthy, A. Parker, S. Pfiffner, F.S. Colwell and T.J. Phelps. 1994. Potential for microbial growth in arid subsurface sediments. *Appl. Biochem. Biotechnol.* 45/46: 823-834.
11. Colwell, F.S., P.A. Pryfogle, B.D. Lee and C.W. Bishop. 1994. Use of a cyanobacterium as a particulate tracer for terrestrial subsurface applications. *J. Microbiol. Meth.* 20: 93-101.
12. Balkwill, D.L., D.R. Boone, F.S. Colwell, T. Griffin, T.L. Kieft, R.M. Lehman, J.P. McKinley, S. Nierzwicki-Bauer, T.C. Onstott, H.Y. Tseng, G. Gao, T.J. Phelps, D. Ringelberg, B. Russell, T.O. Stevens, D.C. White, and F.J. Wobber. 1994. DOE seeks origin of deep subsurface bacteria. *EOS* 75: 385-396.
13. Lehman, R., F.S. Colwell, D. Ringelberg and D.C. White. 1995. Combined microbial community-level analyses for quality assurance of terrestrial subsurface cores. *J. Microbiol. Meth.* 22: 263-281.
14. Story S., P. Amy, C. Bishop and F.S. Colwell. 1995. Bacterial transport in volcanic tuff cores under saturated flow conditions. *Geomicrobiol. J.* 13: 249-264.
15. McKinley, J.P. and F.S. Colwell. 1996. Application of perfluorocarbon tracers to microbial sampling in subsurface environments using mud-rotary and air-rotary drilling techniques. *J. Microbiol. Meth.* 26: 1-9.
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91. Ohan, J., S. Saneiyani, D. Ntarlagiannis, J. Lee, S.E. Burns, and F. Colwell. Microbial community dynamics of an aquifer biostimulated to precipitate calcite. In preparation.
92. Colwell, F.S., A.R. Thurber, R. Harris, J. Ladau, K. G. Lloyd, E. Shock, and A. Trehu. Expanding life's boundaries: A grand challenge of estimating where and how life survives in Earth and other planets. In preparation.
93. Graw, M.F., J.W. Pohlman, S. Krause, S. Krause T. Treude, C.D. Ruppel, and F.S. Colwell. Microbial communities vary across methane-bearing sediments on the US Atlantic Margin. In preparation.

#### INVENTIONS AND PATENTS

- U.S. Patent granted November, 1997, entitled: Method and Apparatus for Determining Nutrient Stimulation of Biological Processes (No. 5,686,299)
- U.S. Patent granted April, 1998, entitled: Retroreflective Sensor Packages for Remote Readout (No. 5,822,074)

- U.S. Patent granted July, 1999, entitled: Method and Apparatus for Determining Nutrient Stimulation of Biological Processes (No. 5,922,559)

## **MAJOR FIELD PROGRAM LEADERSHIP AND PARTICIPATION**

- 1990 Eastern Snake River Plain at the Idaho National Laboratory, ID**
- 1993 Hanford/GEMHEX, WA
- 1994 Taylorsville Basin, VA
- 1995 Cerro Negro, NM
- 1995 Piceance Basin, CO**
- 1996-8 Test Area North, Idaho National Laboratory**
- 2002 Mallik Gas Hydrate Research Well, NWT, Canada
- 2002 ODP Leg 201, Hydrate Ridge, shore-based scientist
- 2005-9 Test Area North, Idaho National Laboratory**
- 2007 Mt. Elbert Gas Hydrate Research Well, Milne Point, AK
- 2009 Wallula Pilot Geologic Carbon Sequestration, Wallula Gap, WA
- 2014 IODP Leg 349, South China Sea Tectonics
- 2015 Coring deep sea methane seeps on the U.S. Atlantic Continental Margin
- 2016 Norwegian-German coring the Svalbard Margin, shore-based scientist
- 2016 Microbial induced calcite precipitation field study at Rifle, CO**
- 2017 Copper River Delta sediment sampling and osmosampler installation**
- 2017/18 Osmosampler deployments at Rocky Mountain Biological Station**
- 2018 Tsunami sediment sampling, Netarts Bay, OR
- 2018 Copper River Delta sediment sampling and osmosampler retrieval**

**Bold – Projects for which I was the lead scientist**

## **AWARDS AND ACADEMIC HONORS**

- Arizona Water Pollution Control Federation Scholarship, 1981
- Elected to Phi Kappa Phi, Northern Arizona University, 1982
- Outstanding Achievement Award, Northern Arizona University, 1982
- Mineral and Mining Resources Research Institute Fellowship, Virginia Tech, 1982-1983
- Associate Member, Sigma Xi Research Society, 1985
- Certificate of Appreciation from Acting Director of DOE Office of Energy Research (for outstanding management of field research in support of the DOE Subsurface Science Program, 1991)
- R&D 100 Award Recipient for development of the Biocube Aerobic Biofilter, 1993
- Certificate of Appreciation from Director of DOE Office of Energy Research (for outstanding contributions in deep microbiology field research at Cerro Negro, New Mexico, 1994, and specifically implementation of a new multidisciplinary approach to determine the origins of deep microbial communities, 1994)
- Lockheed Martin Award for Excellence in recognition of exceptional quality performance and achievement for outstanding scientific research for an Environmental Management Science Program proposal, October 1996

- Lockheed Martin Award for Excellence in recognition of exceptional quality performance and achievement for outstanding accomplishment in the transfer of basic research results to the cleanup of the TAN TCE plume, November 1997
- Co-recipient of Bechtel Outstanding Technical Paper Award, 2002
- Outstanding Mentor Award, Idaho National Laboratory, 2006
- Distinguished Lecturer for Ocean Leadership's, U.S. Science Support Program (affiliated with the Integrated Ocean Drilling Program), 2009-10
- SERDP Environmental Restoration Project-of-the-Year Award (co-performer), 2013

## **PROFESSIONAL SOCIETIES**

- American Geophysical Union
- International Society for Subsurface Microbiology
- Union of Concerned Scientists

## **COMMUNITY SERVICE ACTIVITIES**

- Speaker for Idaho National Engineering Laboratory Speaker's Bureau (lecturer at regional events)
- Judge for Greater Idaho Falls and local grade school annual science fairs
- Organizer and instructor of 1991 and 1992 Longfellow Elementary School Science Club, District 91, Idaho Falls, ID
- Coach for American Youth Soccer Organization, YMCA Indoor Soccer, Bonneville Youth Soccer League (last 15 years) for recreational, competition, premier and junior high school and high school teams
- U.S. Soccer Federation coaching certificates ("D" level license); Bonneville Youth Soccer League (Youth Development Coach)
- National Soccer Coaches of America Association National-Level License (Jan 2001)
- 1999 Director of Bonneville Youth Soccer League Idaho Falls Summer Shoot Out Tournament
- Founding Board Member and Secretary for the Ballistic Soccer Club, a non-profit club for premier boys soccer teams.
- CEOAS Martin Luther King Day of Service volunteer (Jan 2010, 2011, 2012, 2013)
- Salmon Bowl Tournament volunteer (Feb 2011-2012, 2016)
- Hands-On DNA Extraction Activity at the Corvallis da Vinci Days Annual Celebration of Science and Arts (2009, 2010, 2011, 2016)
- Outreach lecture to students at the Xiamen University Affiliated Keji (Science and Technology) High School, Xiamen, China (Jul 2011)
- SOLV Oregon Coast cleanup volunteer on CEOAS Team (Mar 2012)
- Board Member (Secretary [June 2016-2019] and conservation co-chair [Jul 2013-Dec 2014]) for the Bluebacks, Trout Unlimited Chapter (ca. 100 volunteer h per yr)
  - Planned and led steelhead spawning surveys on the South Fork Siletz (2014-2016)
  - Planned and led river cleanup expeditions on South Santiam River (2015, 2016, 2017, 2018)
  - Field trip instructor for K-12 students during Linn-Benton Salmon Watch (2015, 2016 2017)

- Blog posts on The Plainspoken Scientist, the AGU's blog on science communication <http://blogs.agu.org/sciencecommunication/2013/11/05/what-would-leonardo-do/>
- Blog post on Tumblr.com (<http://osugeomicro.tumblr.com/>) during JOIDES Resolution Expedition 349, South China Sea
- Outreach video tours during JOIDES Resolution Expedition 349, South China Sea: University of Nebraska State Museum, Lincoln, Nebraska; Hamagin Space Science Center, Kangawa, Japan; School of Earth, Ocean, and Climate Science, Indian Inst. Technology, Bhubaneswar, India; River Ridge High School, New Pt. Richey, FL; Colorado State University.
- Participant in AGU's Mentoring Meetup and Sharing Science Programs at the Fall Meeting

## STUDENTS ADVISED AT OSU

### Graduate Student Thesis Advisor

Brandon Briggs (PhD, COAS, 2007-2011; [bbriggs6@alaska.edu](mailto:bbriggs6@alaska.edu))  
 Jessica Buser-Young (MS, Microbiology, 2018-present; [buserj@oregonstate.edu](mailto:buserj@oregonstate.edu))  
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 Andrew Schwartz ([co-advisor], MS, Microbiology, 2008-2011; [ads.andrew@gmail.com](mailto:ads.andrew@gmail.com))  
 Amy Smith ([co-advisor], PhD, CEOAS, 2011-2017; [smitham4@oregonstate.edu](mailto:smitham4@oregonstate.edu))  
 Jessie Wishart (MS, Microbiology, 2012-2015 [did not complete]; [jessiewishart@gmail.com](mailto:jessiewishart@gmail.com))  
*Italics = degree completed*

### Undergraduate Student Research Mentor

Matthew Borchers (OSU, Biochemistry, 2014-16)  
 Jennifer Brooks (Univ. Portland, REU, 2007)  
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 Tiffany Chan (OSU, Chemical Engineering, 2015-17)  
 Grace D'Angelo (OSU, Microbiology, 2014-17)  
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 Samantha Dawson (OSU, Microbiology, 2019)  
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 Sydney Fox-Middleton (Santa Clara Univ., REU, 2019, [sfoxmiddleton@scu.edu](mailto:sfoxmiddleton@scu.edu))  
 Michael Graw (Cornell Univ., REU, 2011)  
 Teague Green (OSU, Microbiology, 2012)  
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 Ryan Moore (OSU, Engineering, 2010)  
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 Katie Powers (OSU, Microbiology, 2008-09)  
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 Stella Ross (Univ. of Washington, REU, 2017)  
 Amanda Schwartz (OSU, Microbiology, 2008-09)  
 Sonia Trevino-Dopatka (University of Wisconsin, REU, 2010)

Madeline Tyler (OSU, Microbiology, 2019)  
Johannes Vielig (OSU, Microbiology, 2014)  
Hiu Yip (OSU, Microbiology, 2009-10)  
*Italics = undergraduate thesis advisor*