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SUMMARY: Geomicrobiologist and Environmental Microbiologist with 32 years of experience in academic and industrial research laboratories. Major areas of expertise are microbial ecology, anaerobic bacterial physiology, biodegradation and remediation of pollutants in soil and groundwater, hydrogen generation, molecular microbial ecology, genomics, and cultivation of novel microorganisms.

PROFESSIONAL EXPERIENCE

- 2003- **Research Associate Professor (2007) and Senior Research Scientist**, University of Illinois at Urbana-Champaign (UIUC), Dept. of Geology. •Written multiple DOE, NSF and EPA funded proposals related to geomicrobiology, bioremediation and microbial ecology as a co-PI. •Coordinate data collection and analysis for synthesis into written reports and manuscripts. • Supervise graduate and undergraduate students • Co-advise multiple Ph.D. and MS students in Geology. •Manage lab facilities •Teach one undergraduate or graduate class in microbial ecology or geomicrobiology.
- 2002-2015 **Bioremediation Consultant** *JRW BioRemediation*: •Designed microcosm evaluations of anaerobic chloroethene remediation. •Provided expert interpretation and recommendations for application to bioremediation systems. *Clayton Environmental and Bureau Veritas*: •Helped design pilot anaerobic bioremediation system for EPA Superfund site in Chicago area. • Grew and delivered active anaerobic TCE dechlorinating microbial culture for remediation project. •Reviewed project plan for site closure in regards to bioremediation. *St. John-Mittelhauser & Associates*: •Consult on remediation project at industrial site in Indiana.
- 1997-2003 **Assistant professor**, UIUC, Dept. of Civil and Environmental Engineering. • Directed the research of 11 graduate and 13 undergraduate students. • Served on 10 Ph.D. dissertation committees. • Obtained funding for 15 research projects. • Published eleven peer-reviewed papers. • Presented 37 posters and talks at national and international meetings. • Honored as GE scholar for completing innovative teaching improvement program.
- 1996-1997 **Post-doctoral fellow** with *Dr. John Leigh* in the Marine Bioremediation Program at the University of Washington, Seattle, WA. • Developed protocols for isolating anaerobic PAH degrading bacteria. • Collaboratively published one paper on a new nitrate-reducing naphthalene degrader.
- 1989-1996 **Graduate research assistant** with *Dr. James Tiedje*, NSF Center for Microbial Ecology, Michigan State University. • Isolated two new anaerobic dechlorinating bacteria and one new hydrogen-producing bacterium. • Patented hydrogen production process. • Published four papers from doctoral research.
- 1989-1989 **Scientist** at Enviro Corp. in Bellevue, WA. • Designed bioremediation projects as part of collaborative consulting team.
- 1985-1989 **Scientist** at Ecova Corporation in Redmond, WA. • Designed and directed bench scale bioremediation studies. • Wrote one paper on bioremediation of PCP in soil.

1982-1985 **Graduate research assistant** with *Dr. Donald A. Klein* at Colorado State University.
 •Conducted research involving microbial-mediated arsenic mobilization.

EDUCATION

Ph.D. Microbiology, Michigan State University, East Lansing, MI . **1996**
Dissertation title : Physiological Characterization of Anaerobic Food
 Webs that Reductively Dechlorinate Chlorophenols.

M.S. Microbiology, Colorado State University, Fort Collins, CO. **1985**

B.A. Biology, Whitman College, Walla Walla, WA . **1981**

PATENTS

Sanford, R. A., J. W. Urbance, J. A. Breznak and J. M. Tiedje. 1996. Self-sustaining hydrogen production from anaerobic formate oxidizing microbial culture. U.S. Patent No. 5,705,374

Rajagopalan, N., T. A. Rusk, and R. A. Sanford. 2005. Methods and Systems for Membrane Testing (*Use of magnetic bacteria and magnetic particles as indicators of semi-permeable barrier integrity*). Application 10/364,244 Jan., 2005 U.S. Patent and Trademark Office.

PROFESSIONAL ASSOCIATIONS

American Society for Microbiology.
 International Society for Microbial Ecology
 Geochemical Society
 Ecology Society of America

PROFESSIONAL ACTIVITIES

Manuscript and Proposal Review

- Editorial Board *Applied and Environmental Microbiology*; 2010-2019.
- Reviewed manuscripts for the following journals: *Applied and Environmental Microbiology*, *Applied Microbiology and Biotechnology*, *Biodegradation*, *Bioremediation Journal*, *Chemosphere*, *Environmental Science and Technology*, *FEMS Microbiology Letters*, *FEMS Microbiology Ecology*, *Geotechnical and Geological Engineering*, *International Journal of Systematic and Evolutionary Microbiology*, *Journal of Environmental Quality*, *Journal of Environmental Toxicology*, *Journal of Soil and Sediment Contamination*, *Journal of Environmental Engineering*, *PLOS ONE* and *Science*.
- Reviewed research proposals for NSF, DOE and SeaGrant. Served on DOE review panel in 2002, 2009, 2014 and 2015.

Invited Presentations

Aug. 1995 "Anaerobic Microbial Communities that Dechlorinate Chlorophenols; Evidence for Widespread Halorespiration", Univ. of Michigan, Environ. Engin. Dept.

July 1996 "Halorespiring Microorganisms, Evidence for Significant Diversity in Anaerobic Food-Webs," Dept. of Microbiology, University of British Columbia, Vancouver, B.C.

April 2000 "Advances in Bioremediation Technology: How do we get there?," Environmental Horizons 2000 Conference, University of Illinois at Urbana-Champaign.

July 2000 "Continuous growth of solvent-utilizing anaerobes using a novel strategy: TENAX (a solid phase polymer)", NIBH, Tsukuba, Japan.

Sept. 2000 "Microbiology in Environmental Engineering: Forays into Interdisciplinary Research", Center for Microbial Ecology Retreat, Guest lecture at the Kellogg Biological Station, Michigan.

April 2001 "The use of T-RFLP to identify TNT- and RDX-degrading bacterial populations in an anaerobic fluidized bed reactor", American Chemical Society National Meeting, San Diego, CA.

Nov. 2001 “Passive In-situ Bioremediation of NAPL Tetrachloroethene using Chitin and Other Polymeric Organic Material”, Civil Engineering Department, Northwestern University.

Invited Presentations (continued)

Mar. 2005 “New Tricks to Study New Bugs for Bioremediation Applications”, Department of Civil and Environmental Engineering, Georgia Institute of Technology.

Mar. 2005 “New Tricks to Study New Bugs for Bioremediation Applications”, Argonne National Lab.

Sept. 2005 “Bacterial Mediated Metal Reduction and Other Novel Biogeochemical Processes: the *Anaeromyxobacter* Case-Study”, UIUC Dept. of Geology Colloquium.

May 2007 “The Case History of *Anaeromyxobacter dehalogenans*; Lessons of Integrated Physiological, Ecological and Genomic Studies”, Technical University of Denmark, Lyngby.

Nov. 2008 “Learning How to “Think” Like a Microbe; an Adventure in Ecology, Physiology and Genomics with my Friend *Anaeromyxobacter dehalogenans*” Univ. of Illinois. IGB.

April 2009 “Perspectives on Mixed Redox Zonation; the *Anaeromyxobacter* Story, Tales from the Mahomet Aquifer and What Biogeochemical Modeling Tells Us”, Argonne National Lab.

Sept. 2010 “*Anaeromyxobacter* Biochemistry and Physiology”, Argonne National Lab, SFA meeting.

Jan. 2011 “Monitoring the Mahomet Aquifer: Perspectives on New Monitoring Tools, Thermodynamics, and Biogeochemistry”, Illinois State Water Survey colloquium.

Feb. 2011 “Learning how to “Think” like a Microbe; an Exploration of Subsurface Ecosystems”, PNNL, Richland, WA.

Aug. 2011 “Learning how to “Think” like a Microbe; an Exploration of Subsurface Ecosystems”, University of Tennessee, Knoxville, TN.

Oct. 2011 “Fate of Uranium in Space and Time: a Microbial Perspective”, Argonne National Lab.

Ph.D. Students

(UIUC Dept. of Civil and Environmental Engineering (CEE)):

Qiang He (2003) Dissertation Title: Physiological Characterization of Acetotrophic Anaerobic Respiration Using *Anaeromyxobacter dehalogenans* as a Model Organism

Rachel Brennan (2003) Dissertation Title: Evaluation of Chitin as an Electron Donor and Nutrient Source for Simulating the In Situ Bioremediation of Chlorinated Solvents

(UIUC Dept. of Geology):

Theodore (Ted) Flynn (2010) (co-advised). Microbial Diversity and Groundwater Chemistry in a Pristine Aquifer

PUBLICATIONS

Journal Articles

Yamamoto, K., Hackley, K. C., Kelly, W. R., Panno, S. V., Sekiguchi, Y., Sanford, R. A., et al. (2019). Diversity and geochemical community assembly processes of the living rare biosphere in a sand- and-gravel aquifer ecosystem in the Midwestern United States. *Scientific Reports*, 1–11. <http://doi.org/10.1038/s41598-019-49996-z>

Deng, J., Zhou, L., Sanford, R. A., Shechtman, L. A., Dong, Y., Alcalde, R. E., et al. (2019). Adaptive Evolution of *Escherichia coli* to Ciprofloxacin in Controlled Stress Environments: Contrasting Patterns of Resistance in Spatially Varying versus Uniformly Mixed Concentration Conditions. *Environmental Science and Technology*, 53(14), 7996–8005. <http://doi.org/10.1021/acs.est.9b00881>

Chee-Sanford, J., Tian, D., & Sanford, R. (2019). Consumption of N₂O and other N-cycle intermediates by *Gemmatimonas aurantiaca* strain T-27. *Microbiology (Reading, England)*, 61, 533–10. <http://doi.org/10.1099/mic.0.000847>

- Chen, S., Chee-Sanford, J. C., Yang, W. H., Sanford, R. A., Chen, J., Yan, X., & Shan, J. (2019). Effects of triclosan and triclocarban on denitrification and N₂O emissions in paddy soil. *Science of the Total Environment*, *695*, 133782. <http://doi.org/10.1016/j.scitotenv.2019.133782>
- Schmitt, S., J. L. Conroy, T. M. Flynn, R. A. Sanford, M. C. Higley, M. Chen, and B. W. Fouke (2019). Salinity, microbe and carbonate mineral relationships in brackish and hypersaline lake sediments: A case study from the tropical Pacific coral atoll of Kiritimati. *The Depositional Record*, *29*, 29–18. <http://doi.org/10.1002/dep2.71>
- Giannetta, M. G., R. A. Sanford, J. L. Druhan. 2019 A Modified Monod Rate Law for Predicting Variable S Isotope Fractionation as a Function of Sulfate Reduction Rate. *Geochim. Cosmochim. Acta.* *258*, 174–194.
- Cannon, J., R.A. Sanford, L. Connor, W.H. Yang, J. Chee-Sanford. (2019). Sequence alignments and validation of PCR primers used to detect phylogenetically diverse *nrfA* genes associated with dissimilatory nitrate reduction to ammonium (DNRA), Data in Brief, <https://doi.org/10.1016/j.dib.2019.104016>.
- Berns, E. C., R. A. Sanford, A. J. Valocchi, T. J. Strathmann, C. E. Schaefer, and C. J. Werth. (2019). Contributions of biotic and abiotic pathways to anaerobic trichloroethene transformation in low permeability source zones. *J. Contam. Hydro.*, 103480. <http://doi.org/10.1016/j.jconhyd.2019.04.003>
- Cannon, J., R. A. Sanford, L. Connor, W. H. Yang, and J. Chee-Sanford. 2019. Optimization of PCR primers to detect phylogenetically diverse *nrfA* genes associated with nitrite ammonification. *J. Microbiol Methods*, *160*, 49–59. <http://doi.org/10.1016/j.mimet.2019.03.020>
- Dong, Y., R. A. Sanford, W. P. Inskeep, V. Srivastava, V. Bulone, C. J. Fields, et al. 2019. Physiology, Metabolism, and Fossilization of Hot-Spring Filamentous Microbial Mats. *Astrobiology*. <http://doi.org/10.1089/ast.2018.1965>
- Michelson, K., R. E. Alcalde, R. A. Sanford, A. J. Valocchi, and C. J. Werth. 2019. Diffusion-Based Recycling of Flavins Allows *Shewanella oneidensis* MR-1 To Yield Energy from Metal Reduction Across Physical Separations. *Environ. Sci. Technol*, *53*(7), 3480–3487. <http://doi.org/10.1021/acs.est.8b04718>
- Alcalde, R. E., K. Michelson, L. Zhou, E. V. Schmitz, J. Deng, R. A. Sanford, et al. 2019. Motility of *Shewanella oneidensis* MR-1 Allows for Nitrate Reduction in the Toxic Region of a Ciprofloxacin Concentration Gradient in a Microfluidic Reactor. *Environ Sci and Technol*, 1–10. <http://doi.org/10.1021/acs.est.8b04838>
- Krichels, A., E. H. DeLucia, R. Sanford, J. Chee-Sanford, and W. H. Yang. 2019. Historical soil drainage mediates the response of soil greenhouse gas emissions to intense precipitation events. *Biogeochem.* 1–18, <https://doi.org/10.1007/s10533-019-00544-x>
- Sivaguru, M., Saw, J. J., Williams, J. C., Lieske, J. C., Krambeck, A. E., Romero, M. F., Sanford, R.A., et al. 2018. Geobiology reveals how human kidney stones dissolve in vivo. *Scientific Reports*, *8*(1), 1–9. <http://doi.org/10.1038/s41598-018-31890-9>
- Onley J.R., S. Ahsan, R. A. Sanford, and F. E. Löffler. 2018. Denitrification by *Anaeromyxobacter dehalogenans*, a common soil bacterium lacking nitrite reductase gene(s) (*nirS* and/or *nirK*). *Appl Environ Microbiol* *84* (4), e01985 17–14. <https://doi.org/10.1128/AEM.01985-17>.
- Orellana, L.H., J. C. Chee-Sanford, R. A. Sanford, F. E. Löffler, K. T. Konstantinidis. 2018. Year-round shotgun metagenomes reveal stable microbial communities in agricultural soils and novel ammonia oxidizers responding to fertilization. *Appl Environ Microbiol* *84*:e01646-17. <https://doi.org/10.1128/AEM.01646-17>.
- Hallin, S., L. Philippot, L., F. E. Löffler, R. A. Sanford, and C. M. Jones. 2017. Genomics and ecology of novel N₂O-reducing microorganisms. *Trends Microbiol.* *26*: 1–13.
- Michelson, K., R. A. Sanford, A. J. Valocchi, C. J. Werth. 2017. Nanowires of *Geobacter sulfurreducens* require redox cofactors to reduce metals in pore spaces too small for cell passage. *Environ. Sci. Technol.* *51*: 11660–11668.
- Singh, R., M. Sivaguru, G. A. Fried, B. W. Fouke, R. A. Sanford, M. Carrera, C. J. Werth. 2017. Real rock-microfluidic flow cell: a test bed for real-time in situ analysis of flow, transport, and reaction in a subsurface reactive transport environment. *J. Contam. Hydro.* *204*: 28–39.
- Dong, Y., R. A. Sanford, Y.-J. Chang, M. J. McInerney, and B. W. Fouke. 2017. Hematite Reduction Buffers Acid Generation and Enhances Nutrient Uptake by a Fermentative Iron Reducing Bacterium, *Orenia metallireducens* Strain Z6. *Environ. Sci. Technol.* *51*: 232–242.
- Dong, Y., R. A. Sanford, M. I. Boyanov, K. M. Kemner, T. M. Flynn, E. O'Loughlin, Y.-J. Chang, R. A. Locke II, J. R. Weber, S. M. Egan, R. I. Mackie, I. Cann, and B. W. Fouke. 2016. *Orenia Metallireducens* sp. nov. strain Z6, a Novel Metal-Reducing Firmicute From the Deep Subsurface. *Appl. Environ. Microbiol.* *AEM.02382–16*.
- Dong, Y., R. A. Sanford, M. I. Boyanov, K. M. Kemner, T. M. Flynn, E. O'Loughlin, Y.-J. Chang, R. A. Locke II, J. R. Weber, S. M. Egan, and B. W. Fouke. *Tepidibacillus Decaturensis* Sp. Nov.: a Microaerophilic, Moderately Thermophilic Iron-Reducing Bacterium Isolated From a Depth of 1.7 Km in the Illinois Basin, USA. *Intern. J. Syst. Evol. Microbiol.* *IJSEM-D-16-00105R2*.
- Yoon, S.; Nissen, S.; Park, D.; Sanford, R. A.; Löffler, F. 2016. Nitrous Oxide Reduction Kinetics Distinguish Bacteria

- Harboring Clade I Versus Clade II *nosZ*. Appl. Environ. Microbiol., AEM.00409–AEM.00416.
- Higgins, S. A.; Welsh, A.; Orellana, L. H.; Konstantinidis, K.; Chee-Sanford, J. C.; Sanford, R. A.; Schadt, C. W.; Löffler, F. 2016. Detection and Diversity of Fungal Nitric Oxide Reductase Genes (*P450^{nor}*) in Agricultural Soils. Appl. Environ. Microbiol., 82 (10), 2919–2928.
- Dong, Y.; Chang, Y.-J.; Sanford, R. A.; Fouke, B. W. 2016. Draft Genome Sequence of *Tepidibacillus Decaturensis* Strain Z9, an Anaerobic, Moderately Thermophilic, and Heterotrophic Bacterium From the Deep Subsurface of the Illinois Basin, USA. Genome Announc., 4 (2), e00190–16.
- Singh, R.; Yoon, H.; Sanford, R. A.; Katz, L. E.; Fouke, B. W.; & Werth, C. J. 2015. Metabolism Induced CaCO₃ Biomineralization During Reactive Transport in a Micromodel: Implications for Porosity Alteration. Environ. Sci. Technol. <http://pubs.acs.org/doi/pdf/10.1021/acs.est.5b00152>.
- Hwang, C., A. Copeland, S. Lucas, A. Lapidus, K. Barry, T. Glavina del Rio, E. Dalin, H. Tice, S. Pitluck, D. Sims, T. Brettin, D. C. Bruce, J. C. Detter, C. S. Han, J. Schmutz, F. W. Larimer, M. L. Land, L. J. Hauser, N. Kyrpides, A. Lykidis, P. Richardson, A. Belieav, R. A. Sanford, F. E. Löffler, M. W. Fields. 2015. Complete Genome Sequence of *Anaeromyxobacter* Sp. Fw109-5, an Anaerobic, Metal-Reducing Bacterium Isolated From a Contaminated Subsurface Environment. Genome Announc. 3, 1–2.
- Tang, Y.; Werth, C. J.; Sanford, R. A.; Singh, R.; Michelson, K.; Nobu, M.; Liu, W.-T.; Valocchi, A. J. 2015 Immobilization of Selenite via Two Parallel Pathways During in Situ Bioremediation. Environ. Sci. Technol., 49:4543–4550.
- Yoon, S.; Cruz-García, C.; Sanford, R.; Ritalahti, K.; Löffler, F. 2014. Denitrification versus respiratory ammonification: environmental controls of two competing dissimilatory NO₃⁻/NO₂⁻ reduction pathways in *Shewanella loihica* strain PV-4. The ISME Journal. doi:10.1038/ismej.2014.201
- Dong, Y., Sanford, R., Locke, R. A., II, Cann, I. K., Mackie, R. I., & Fouke, B. W. 2014. Fe-oxide grain coatings support bacterial Fe-reducing metabolisms in 1.7–2.0 km-deep subsurface quartz arenite sandstone reservoirs of the Illinois Basin. Frontiers in Microbiol., doi:10.3389/fmicb.2014.00511.
- Orellana, L. H., L. M. Rodriguez-R, S. Higgins, J. C. Chee-Sanford, R. A. Sanford, K. M. Ritalahti, F. E. Löffler, K. T. Konstantinidis. 2014. Detecting nitrous oxide reductase (*nosZ*) genes in soil metagenomes: method development and implications for the nitrogen cycle. mBio, 5(3): e01193-14.
- Basu, A., T. M. Johnson, & R. A. Sanford. 2014. Cr Isotope Fractionation Factors for Cr(VI) Reduction by a Metabolically Diverse Group of Bacteria. Geochimica Et Cosmochimica Acta, 142, 349–361.
- Basu, A., R. A. Sanford, T. M. Johnson, C. C. Lundstrom, F. E. Löffler. 2014. Uranium Isotopic Fractionation Factors during U(VI) Reduction by Bacterial Isolates. Geochimica Et Cosmochimica Acta, 136C (2014), pp. 100–113 DOI: 10.1016/j.gca.2014.02.041.
- Welsh, A., J. Chee-Sanford, L. Connor, F. Löffler, and R. Sanford. 2014. Refined *NrfA* phylogeny improves PCR-based *nrfA* gene detection. Appl. Environ. Microbiol. doi:10.1128/AEM.03443-13.
- Dong, Y., C. G. Kumar, N. Chia, P. Kim, P. A. Miller, N. D. Price, I. K. O. Cann, T. M. Flynn, R. A. Sanford, I. G. Krapac, R. A. Locke II, P.-Y. Hong, H. Tamaki, W.-T. Liu, R. I. Mackie, A. G. Hernandez, C. L. Wright, M. A. Mikel, J. L. Walker, M. Sivaguru, G. Fried, A. C. Yannarell, and B. W. Fouke. 2013. *Halomonas sulfidaeris*-dominated microbial community inhabits a 1.8 km-deep subsurface Cambrian Sandstone reservoir. Environ. Microbiol., n/a–n/a. doi:10.1111/1462-2920.12325
- Kirk, M. F., E. F. U. Santillan, R. A. Sanford, & S. J. Altman. 2013. CO₂-induced shift in microbial activity affects carbon trapping and water quality in anoxic bioreactors. Geochimica Et Cosmochimica Acta, 122, 198–208. doi:10.1016/j.gca.2013.08.018
- Flynn, T. M., R. A. Sanford, H. Ryu, C. Bethke, A. D. Levine, N. J. Ashbolt, & J. W. Santo Domingo. 2013. Functional microbial diversity explains groundwater chemistry in a pristine aquifer. BMC Microbiol., 13(1), 146. doi:10.1186/1471-2180-13-146.
- Yoon, S., Sanford, R., & Löffler, F. 2013. *Shewanella* spp. Use acetate as an electron donor for denitrification but not ferric iron or fumarate reduction. Appl. Environ. Microbiol., 79(8), 2818–2822.
- Sanford, R. A., Wagner, D. D., Wu, Q., Chee-Sanford, J. C., Thomas, S. H., Cruz-García, C., Rodríguez, G., Massol-Deya, A., Krishnani, K. K., Ritalahti, K., Nissen, S., Konstantinidis, K., and Löffler, F. (2012). Unexpected nondenitrifier nitrous oxide reductase gene diversity and abundance in soils. Proc. Nat. Acad. Sci. doi:10.1073/pnas.1211238109
- Flynn, T. M., R. A. Sanford, J. W. Santo Domingo, N. J. Ashbolt, A. D. Levine and C. M. Bethke. 2012 The Active Bacterial Community in a Pristine Confined Aquifer. Wat. Res. Res. 49:WO9510.
- Bethke, C. M., R. A. Sanford, M. F. Kirk, Q. Jin, and T. M. Flynn. 2011. The thermodynamic ladder in geomicrobiology. American J. Sci., 311:183–210.

- Bopp IV, C. J., C. C. Lundstrom, T. M. Johnson, R. A. Sanford, P. E. Long, and K. H. Williams.** 2010. Uranium $^{238}\text{U}/^{235}\text{U}$ isotope ratios as indicators of reduction: results from an in situ biostimulation experiment in Rifle, Colorado, U.S.A. Environ. Sci. Technol., 44: 5927-5933.
- Thomas, S. H., R. A. Sanford, B. K. Amos, M. Leigh, E. Cardenas, and F. E. Löffler.** 2010 Unique ecophysiology among U(VI)-reducing bacteria as revealed by evaluation of oxygen metabolism in *Anaeromyxobacter dehalogenans* strain 2CP-C. Appl. Environ. Microbiol., 76: 176-183.
- Houseal, A. K.; Fouke, B. W.; Sanford, R. A.; Fuhrmann, R.; Petrick, E.** 2010. Mammoth Hot Springs: Where change is constant. Yellowstone Sci. 18 (3), 7–14.
- Thomas, S. H., E. Padilla-Crespo, P. M. Jardine, R. A. Sanford, and F. E. Löffler.** 2009, Diversity and distribution of *Anaeromyxobacter* strains in a Uranium-contaminated subsurface environment with nonuniform flow. Appl. Environ. Microbiol. 75: 3679-3687.
- Piggot, A. M., B. W. Fouke, M. Siyaguru, R. A. Sanford, and H. R. Gaskins.** 2009. Change in zooxanthellae and mucocyte tissue density as an adaptive response to environmental stress by the coral, *Montastraea annularis*. Mar. Biol., 156: 2379-2389.
- Marshall I, M. J., A. C. Dohnalkova, D. W. Kennedy, A. E. Plymale, S. H. Thomas, F. E. Löffler, R. A. Sanford, J. M. Zachara, J. K. Fredrickson, and A. S. Beliaev.** 2009, Electron donor-dependent radionuclide reduction and nanoparticle formation by *Anaeromyxobacter dehalogenans* strain 2CP-C. Environ. Microbiol., 11: 534-543.
- Park, J., R. A. Sanford, and C. M. Bethke.** 2009, Microbial activity and chemical weathering in the Middendorf aquifer, South Carolina. Chemical Geology 258: 232-241.
- Strycharz, S. M., T. L. Woodard, J. P. Johnson, K. P. Nevin, R. A. Sanford, F. E. Löffler, and D. R. Lovley.** 2008, Graphite electrode as a sole electron donor for reductive dechlorination of tetrachlorethene by *Geobacter lovleyi*. Appl. Environ. Microbiol., 74: 5943-5947.
- Thomas, S. H., R. D. Wagner, A. K. Arakaki, J. Skolnick, J. R. Kirby, L. J. Shimkets, R. A. Sanford, F. E. Löffler.** 2008, The mosaic genome of *Anaeromyxobacter dehalogenans* strain 2CP-C suggests an aerobic common ancestor to the delta-Proteobacteria. Plos One, 3(5) e2103.
- Bethke, C. M., D. Ding, Q. Jin and R. A. Sanford.** 2008, Origin of microbiological zoning in groundwater flows. Geology, 36:739-742.
- Flynn, T. M., R. A. Sanford and C. M. Bethke.** 2008, Attached and suspended microbial communities in a pristine confined aquifer. Wat. Res. Res. 44, W07425, doi:10.1029/2007WR006633.
- Kwon, M-J., R. A. Sanford, J. Park, M. F. Kirk, and C. M. Bethke.** 2008 Microbiological response to well pumping. Ground Water, 46:286-294.
- Sanford, R. A., Q. Wu, Y. Sung, S. H. Thomas, B. K. Amos, E. K. Prince and F. E. Löffler.** 2007, Hexavalent uranium supports growth of *Anaeromyxobacter dehalogenans*, and *Geobacter spp.* with lower than predicted biomass yields. Environ. Microbiol., 9: 2885-2893.
- Klaus, J. S., I. Janse, J. M. Heikoop, R.A. Sanford, and B.W. Fouke.** 2007, Coral microbial communities, zooxanthellae, and mucus along gradients of seawater depth and coastal pollution. Environ. Microbiol., 9: 1291-1305.
- Mehnert, E., T. R. Holm, T. M. Johnson and R. A. Sanford,** 2007, Denitrification in the shallow ground water of a tile-drained, agricultural watershed. J. of Environmental Quality, 36: 80-90.
- Rademacher, L., C. Lundstrom, T. Johnson, R. A. Sanford, J. Zhou, and Z. Zhang.** 2006, Experimentally determined uranium isotope fractionation during bacterial and abiotic reduction. Environ. Sci. Technol., 40: 6943-6948.
- Brennan, R. A., R. A. Sanford, and C. J. Werth,** 2006, Chitin and corncobs as electron donor sources for the reductive dechlorination of tetrachloroethene. Water Research., 40: 2125-2134.
- Wu, Q., R. A. Sanford and F. E. Löffler,** 2006, Uranium(VI) reduction by *Anaeromyxobacter dehalogenans* strain 2CP-C. Appl. Environ. Microbiol., 72: 3608-3614.
- Roadcap, G., R. A. Sanford, Q. Jin, J. R. Pardinas, and C. M. Bethke,** 2006, Extremely alkaline (pH > 12) ground water hosts diverse microbial community. Ground Water, 44:511-517.
- Park, J., R.A. Sanford and C.M. Bethke,** 2006. Geochemical and microbiological zonation of the Middendorf Aquifer,

South Carolina. Chemical Geology, 230: 88-104.

- Sung, Y., K. Fletcher, K. M. Ritalahti, R. P. Apkarian, N. Ramos-Hernandez, R. A. Sanford, N. Mesbah, and F. E. Löffler, 2006, *Geobacter lovleyi* sp. nov. strain SZ, a novel metal-reducing and tetrachloroethene-dechlorinating bacterium Appl. Environ. Microbiol., 72: 2775-2782.
- Brennan, R. A., R. A. Sanford and C. J. Werth, 2006, Biodegradation of tetrachloroethene by chitin fermentation products in a continuous flow column system. J. of Environ. Eng., 132: 664-673.
- Shimomura, T. and R. A. Sanford. 2005, Reductive Dechlorination of Tetrachloroethene in a Sand Reactor Using a Potentiostat. J. Environ. Qual., 34: 1435-1438.
- Cupples, A. M., R. A. Sanford, and G. K. Sims, 2005, Dehalogenation of the Herbicides Bromoxynil (3,5-Dibromo-4-Hydroxybenzotrile) and Ioxynil (3,5-Diiodo-4-Hydroxybenzotrile) by *Desulfitobacterium chlororespirans*. Appl. Environ. Microbiol. 71: 3741-3746.
- Holt, J., S. Hothem, H. Howerton, R. Larson, and R. Sanford, 2005, 9,10-Phenanthrenequinone photoautocatalyzes its formation from phenanthrene, and inhibits biodegradation of naphthalene. J. Environ. Qual., 34:462-468.
- He, Q. and R. A. Sanford. 2004. Acetate threshold concentrations suggest varying energy requirements during anaerobic respiration by *Anaeromyxobacter dehalogenans*. Appl. Environ. Microbiol., 70:6940-6943.
- Kirk, M. F., T. R. Holm, J. Park, Q. Jin, R. A. Sanford, B. W. Fouke, and C. M. Bethke. 2004. Bacterial sulfate reduction limits Arsenic contamination in groundwater. Geology 32: 953-956.
- He, Q. and R. A. Sanford. 2004. The generation of high biomass from chlororespiring bacteria using a continuous fed-batch bioreactor. Appl. Microbiol. and Biotech. 65: 377-382.
- Nambi, I. M., C. J. Werth, R. A. Sanford, and A. J. Valocchi. 2003. Pore-scale analysis of anaerobic halo-respiring bacterial growth along the transverse mixing zone of an etch silicon pore network. Environ. Sci. Technol. 37: 5617-5624.
- Sung, Y., K. M. Ritalahti, R. A. Sanford, J. W. Urbance, S. J. Flynn, J. M. Tiedje, and F. E. Löffler. 2003. Characterization of two tetrachloroethene-reducing, acetate-oxidizing anaerobic bacteria and their description as *Desulfuromonas michiganensis* sp. nov. Appl. Environ. Microbiol. 69: 2964-2974.
- He, Q. and R. A. Sanford. 2003. Characterization of Fe(III) reduction by chlororespiring *Anaeromyxobacter dehalogenans*. Appl. Environ. Microbiol., 69: 2712-2718.
- He, Q. and R. A. Sanford. 2002. Induction characteristics of reductive dehalogenation in the *ortho*-halophenol respiring bacterium, *Anaeromyxobacter dehalogenans*. Biodegradation, 13: 307-316.
- Brennan, R. A. and R. A. Sanford. 2002. Continuous steady-state method using Tenax for delivering tetrachloroethene to chloro-respiring bacteria. Appl. Environ. Microbiol., 68: 1464-1467.
- Sanford, R. A., J. R. Cole, and J. M. Tiedje. 2002. Characterization and description of *Anaeromyxobacter dehalogenans* gen. nov., sp. nov., an aryl-halo-respiring facultative anaerobic myxobacterium. Appl. Environ. Microbiol., 68: 893-900.
- Vera, S. M., C. J. Werth, and R. A. Sanford. 2001. Evaluation of different polymeric organic materials for creating conditions that favor reductive processes in groundwater. Bioremediation J., 5: 169-181.
- Skerlos, S.J., N. Rajagopalan, R.E. DeVor, S.G. Kapoor, R.A. Sanford. 2001. Model of biomass concentration in a metalworking fluid reservoir subject to continuous biofilm contaminantion during the use of membrane filtration to control microorganism growth. Accepted Transactions of NAMRI/SME, Volume 29, May.
- Sun, B., J. R. Cole, R. A. Sanford, and J. M. Tiedje. 2000. Isolation and characterization of *Desulfovibrio dechloracetivorans* sp. nov., a marine dechlorinating bacterium growing by coupling the oxidation of acetate to the reductive dechlorination of 2-chlorophenol. Appl. Environ. Microbiol., 66: 2408-2413.
- Rockne, K. J., J.C. Chee-Sanford, R. A. Sanford, B. P. Hedlund, J. T. Staley, and S. E. Strand. 2000. Anaerobic naphthalene degradation by microbial pure cultures under nitrate-reducing conditions. Appl. Environ. Microbiol. 66: 1595-1601.
- Löffler, F. E., J. M. Tiedje, and R. A. Sanford. 1999. The fraction of electrons consumed in electron acceptor reduction (f_e) and hydrogen thresholds as indicators of halo-respiratory physiology. Appl. Environ. Microbiol. 65: 4049-4056.
- Natarajan, M. R., W.-M. Wu, R. Sanford, and M. K. Jain. 1999. Degradation of biphenyl by methanogenic microbial consortium. Biotechnol. Lett. 21:741-745.

- Sanford, R. A. and J. M. Tiedje.** 1997. Chlorophenol dechlorination and subsequent degradation in identifying microcosms fed low concentrations of nitrate. Biodegradation 7: 425-434.
- Sanford, R. A., J. R. Cole, F. E. Löffler and J. M. Tiedje.** 1996. Characterization of *Desulfitobacterium chlororespirans* sp. nov., which grows by coupling the oxidation of lactate to the reductive dechlorination of 3-chloro-4-hydroxybenzoate. Applied and Environmental Microbiology 62: 3800-3808.
- Löffler, F. E., R. A. Sanford and J. M. Tiedje.** 1996. Initial characterization of a reductive dehalogenase from *Desulfitobacterium chlororespirans* strain Co23. Applied and Environmental Microbiology 62: 3809-3813.
- Mahaffey, W. and R. A. Sanford.** 1991. Bioremediation of PCP contaminated soil: bench to full scale implementation. Remediation 1(3): 305-323.
- Sanford, R. A. and D. A. Klein.** 1988. Environmental bioremediation for organometallic compounds: microbial growth and arsenic volatilization from soil and retorted shale. Applied Organometallic Chemistry 2:159-169.

Edited Book Chapters:

- Sanford, R. A., J. Chowdhary, F. E. Löffler.** 2016. Organohalide-Respiring Deltaproteobacteria Deltaproteobacteria. *In Organohalide-Respiring Bacteria*; L. Adrian and F. E. Löffler eds. Springer Berlin Heidelberg; pp 235–258.
- Löffler, F. E. and R. A. Sanford,** 2005. Analysis of trace H₂ metabolism. *In Methods in Enzymology, Vol. 397, J. Leadbetter* ed. 568 pp.
- Löffler, F. E., R. A. Sanford, and K. M. Ritalahti,** 2005. Enrichment, cultivation, and detection of reductively dechlorinating bacteria. *In Methods in Enzymology, Vol. 397, J. Leadbetter* ed. 568 pp.

Conference Proceedings:

- Martin, J. P., K. S. Sorenson, Jr., L. N. Peterson, R. A. Brennan, C. J. Werth, R. A. Sanford, G. H. Bures, and C. J. Taylor.** 2002. Enhanced CAH dechlorination in a low permeability variably-saturated medium. Proceedings of the Third International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Monterey, Calif. May, 2002.
- Shiffer, S., R. Sanford, T. Matos, E. Mehnert, D. A. Keefer, W. S. Dey and T. R. Holm.** 2001. Natural attenuation of nitrate in the Big Ditch watershed, Illinois., *In Bioremediation of Inorganic Compounds*, A. Leeson, B. M. Peyton, J. L Means, and V. S. Magar eds., Proceedings from the Sixth International In Situ and On-Site Bioremediation Symposium, June, 2001. Vol. 6(9) p. 179-186.
- Vera, S. M., R. A. Brennan, C. J. Werth, and R. A. Sanford.** 2000. Analysis of substrates to support a halo-respiration enhanced redox transition zone, HERTZ, in chlorinated solvent impacted groundwater. Proceedings of the International Conference on Groundwater Research, Copenhagen, Denmark, June 6-8, 2000.
- Löffler, F. E., J. M. Tiedje, and R. A. Sanford,** 2000. Molecular tools and physiological measures to detect chlororespiring bacteria. Proceedings of the Fifth International Symposium on Environmental Biotechnology (ISEB), Kyoto, Japan, July 9-13, 2000.
- Skerlos, S.J., N. Rajagopalan, R.E. DeVor, S.G. Kapoor, R.A. Sanford,** 2000. Model of biomass concentration in membrane filtration recycling systems subject to single substrate limited growth kinetics. Proceedings of the ASME: Manufacturing Science and Engineering Division. Orlando, FL Volume 10, November, 2000. (To be published: July, 2001)
- Brennan, R. A., A. R. Swanson, F. E. Löffler, and R. A. Sanford.** 1999. Chlorinated solvent bioremediation: a novel approach to measuring bacterial kinetics, *In Engineered Approaches for In Situ Bioremediation of Chlorinated Solvent Contamination*, A. Leeson and B. C. Alleman eds., Proceedings from the Fifth International In Situ and On-Site Bioremediation Symposium, April 1999, San Diego, CA., Batelle Press, Columbus, p. 21-26.
- Rockne, K. J., J. C. Chee-Sanford, R. A. Sanford, B. Hedlund, J. T. Staley, and S. E. Strand.** 1999. Naphthalene degradation and mineralization by nitrate-reducing and denitrifying pure cultures, *In Engineered Approaches for In Situ Bioremediation of Chlorinated Solvent Contamination*, A. Leeson and B. C. Alleman eds., Proceedings from the Fifth International In Situ and On-Site Bioremediation Symposium, April 1999, San Diego, CA., Batelle Press, Columbus, vol. 5 (8) p. 191-196.
- Tiedje, J. M., R. A. Sanford and A. A. Massol-Deya.** 1995. Advantages and disadvantages of consortia in bioremediation. *In Bioremediation: The Tokyo □94 Workshop*, OECD, Paris. p 357-367.

- Sanford, R. A. and J. M. Tiedje.** 1993. Biodegradation of 2,4-D, and chlorophenols under denitrifying conditions in soil column, microaerobic and anoxic enrichments. *In* : International Symposium Soil Decontamination Using Biological Processes, DECHEMA, Frankfurt. 1992. p 543-548.
- Sanford, R. A., D. A. Klein, and R. R. Meglen.** 1985. Microbial potentiation of arsenic transport from soil and oil shale energy waste. *In* Planetary Ecology, D. E. Caldwell, J. A. Brierley, and C. L. Brierley eds., Van Nostrand Reinhold Co. New York, pp 169-177.

Bulletins or Reports:

- Sanford, R. A., T. M. Flynn, and W. Kelly.** 2006. Microcosm study of arsenic fate in Mahomet aquifer sediment and groundwater. Illinois State Water Survey. MTAC Publication TR06-08.
- Adrian, N. R., R. A. Sanford, S. H. Oh, and L. Raskin.** 2001. Characterization of microbial communities in an anaerobic fluidized bioreactor treating TNT using molecular techniques. Technical Report, U.S. Army, Corp of Engineers, CERL, Champaign, IL., Report Number ERDC/CERL TR-01-10.
- Klein, D. A., R. A. Sanford, and R. R. Meglen.** 1983. Microbial role in trace element releases from porous energy residuals. In Environmental Chemistry of Oil Shale Development. Tech. Prog. Rep. U.S. Dept. Energy, DE-ACO2-83ER60121. (CIRES, Univ. of Colo., Boulder, Co