



**Exponent<sup>®</sup>**  
Engineering & Scientific Consulting

**Chris Brueck, Ph.D.**

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## Professional Profile

Dr. Brueck is an environmental engineer-in-training in Exponent's Environmental & Earth Sciences practice. He specializes in environmental chemistry and microbiology with particular emphasis in agricultural waste management and environmental chemical fate and transport. He also has expertise in the areas of analytical chemistry, nontargeted analysis, cheminformatics, and data science for chemical identification. Dr. Brueck helps clients tackle problems related to site investigation and remediation, chemical forensics, carbon offset technology, and data retrieval and management.

Dr. Brueck's research has focused on the fate of anthropogenic organic chemicals in a variety of matrices including wastewater, animal manure, biosolids, and vegetables using modern analytical chemistry and data analysis techniques. He has experience modeling chemical degradation kinetics, measuring contaminant partitioning coefficients, and identifying transformation products and metabolites from the biodegradation of various pesticides, antibiotics, and animal feed additives during anaerobic digestion. Dr. Brueck has developed computational methods to process large chemical datasets to identify and predict molecular relationships.

Dr. Brueck is skilled in data visualizations, multivariate statistical analyses, and task automation using R and Python programming languages. He has developed image processing methods for particle tracking in 3-dimensions from datasets produced by x-ray microtomography. Chris has analytical expertise in high-performance liquid chromatography (HPLC) coupled with high-resolution mass spectrometry (Orbitrap and QTOF), gas chromatography (GC) with either thermal conductivity detectors (TCD) or flame ionization detectors (FID).

## Academic Credentials & Professional Honors

Ph.D., Environmental Health and Engineering, Johns Hopkins University, 2022

M.S., Geography and Environmental Engineering, Johns Hopkins University, 2017

M.S., Chemical and Biological Engineering, Oregon State University, 2016

B.S., Civil Engineering, Temple University, 2013

NSF Graduation Research Fellowship, 2015–2020

NSF Integrative Graduate Education and Research Traineeship, 2016–2018

Jay D. Samstag Engineering Fellowship, 2016–2017

Oregon State University Environmental Engineering Fellowship, 2013–2014

Temple University Civil Engineering Senior Design Project Award, 2013

NSF Nanotechnology Undergraduate Research Award, 2012

## Licenses and Certifications

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Professional Certificate in Data Science

## Prior Experience

Graduate Teaching Assistant, Engineering Microbiology, Johns Hopkins University, 2017–2018

Graduate Teaching Assistant, Moment, Heat and Mass Transfer, Oregon State University, 2013–2014

## Professional Affiliations

American Chemical Society

American Bar Association (associate member)

## Publications

Abrahamsson, D., C. L. Brueck, C. Prasse, D. A. Lambropoulou, L. Koronaiou, M. Wang, J. Park, and T. J. Woodruff. 2023. Extracting structural information from physicochemical property measurements using machine learning – a new approach for structure elucidation in non-targeted analysis. *ES&T* 57(40):14827–14838

Brueck, C.L. Determining the fate of organic contaminants in agricultural systems: applications for high-resolution mass spectrometry. Dissertation. Johns Hopkins University, Baltimore, MD.

Brueck, C. L., S. L. Nason, M. G. Multra, and C. Prasse. 2022. Assessing the fate of antibiotics and agrochemicals during anaerobic digestion of animal manure. *STOTEN* 856:159156.

Brueck, C. L. and D. Wildenschild. 2020. A proximity-based image-processing algorithm for colloid assignment in segmented multiphase flow datasets. *Journal of Microscopy* 277(2):118–129.

Jiang, L., T. Li, J. Jenkins, Y. Hu, C. L. Brueck, H. Pei, and M. J. Betenbaugh. 2020. Evidence for a mutualistic relationship between the cyanobacteria *Nostoc* and fungi *Aspergilli* in different environments. *Applied Microbiology and Biotechnology* 104:6413–6426.

Almquist, V., C. Brueck, S. Clarke, T. Wanzek, and M.I. Dragila. 2018. Bioavailable water in coarse soils: a fractal approach. *Geoderma* 323:145–155.

Paradiś, A., C. Brueck, D. Meisenheimer, T. Wanzek, and M.I. Dragila. 2017. Sandy soil microaggregates: rethinking our understanding of hydraulic function. *Vadose Zone J.* 16(9):1–10.

Brueck, C. 2016. Exploring colloid transport in unsaturated porous media using x-ray microtomography. Thesis. Oregon State University, Corvallis, OR.

Kaveh, R., Y. Li, S. Rangbar, R. Tehrani, C. Brueck, and B. Van Aken. 2013. Changes in *Arabidopsis thaliana* gene expression in response to silver nanoparticles and silver ions. *ES&T* 47(18):10637–10644.

## **Presentations**

Brueck, C.L., E. Lopez-Haz, S. Lansing, J. Ogejo, and C. Prasse. 2023. Using non-targeted chemical analysis methods to detect emerging contaminants in dairy manure management systems. American Chemical Society National Meeting, San Francisco, CA, August 13–17.

Brueck, C.L., X. Xin, S. Lupolt, B. Kim, R. Santo, A. Williams, K. Nachman, and C. Prasse. 2023. Nontargeted chemical analysis and risk assessment of organic contaminants in darkibor kale grown under rural and urban growth conditions. University of Washington Civil and Environmental Engineering Environmental & Water Program Seminar, Seattle, WA, May 18.

Brueck, C.L., J. Ogejo, S. Lansing, and C. Prasse. 2022. Anthropogenic chemicals in cattle manure: combining high-resolution mass spectrometry and machine learning to identify unknown chemicals and predict their concentrations. American Chemical Society National Meeting, San Diego, CA, March 20–24.

Brueck, C.L., S.L. Nason, M.G. Multra, and C. Prasse. 2021. Determination of degradation pathways for antibiotics and agrochemicals during anaerobic digestion of animal manure. American Chemical Society National Meeting & Expo, Atlanta, GA, August 22–26.

Brueck, C.L., S.L. Nason, E.J. Bouwer, and C. Prasse. 2020. Fate of agrochemicals during anaerobic digestion: quantifying degradation and identifying transformation products using orbitrap mass spectrometry. American Chemical Society National Meeting, San Francisco, CA, August 13–17.

Brueck, C.L., S.L. Nason, E.J. Bouwer, and C. Prasse. 2020. Fate of agrochemicals during anaerobic digestion: quantifying degradation and identifying transformation products using orbitrap mass spectrometry. Environmental Health and Engineering Annual Retreat, Johns Hopkins University, Baltimore, MD, January 17.

Brueck, C.L., S.L. Nason, C. Prasse, and E.J. Bouwer. 2019. Benefits and risks of using anaerobic digestion effluent for hydroponic agriculture. Association of Environmental Engineering and Science Professors, Arizona State University, Tempe, AZ, May 14–16.

Brueck, C.L., S.L. Nason, C. Prasse, and E.J. Bouwer. 2019. Recycling dairy farm anaerobic digestion effluent for cultivation of *Lactuca sativa* (romaine lettuce) via Hydroponic Agriculture. Environmental Health and Engineering Annual Retreat, Johns Hopkins University, Baltimore, MD, January 18.

Brueck, C.L. and Bouwer, E.J. 2018. Biotechnology integration for enhanced crop yield, nutrient recycling, and bioenergy production from a dairy farm. National Science Foundation Integrative Graduate Education and Research Traineeship Colloquium, Johns Hopkins University, Baltimore, MD, June 22.

Brueck, C.L. and E.J. Bouwer. 2018. Resource recovery in aquaponics systems and beyond! Department of Geography and Environmental Engineering Seminar, Johns Hopkins University, Baltimore, MD, April 28.

Brueck, C.L. 2018. Aggregate structure and water retention in coarse sandy soils. Department of Geography and Environmental Engineering Integrative Graduate Education and Research Traineeship Research Seminar, Johns Hopkins University, Baltimore, MD, April 5.

Brueck, C.L. and V. Burrowes. 2017. Peru research trip summary. Department of Geography and Environmental Engineering Integrative Graduate Education and Research Traineeship Research Seminar, Johns Hopkins University, Baltimore, MD, October 5.

Brueck, C.L. and V. Burrowes. 2017. Team caca and surfaces. Integrative Graduate Education and Research Traineeship International Research Presentation, Kosek Laboratory, Iquitos, Peru, July 1.

Wildenschild, D. and C.L. Brueck. 2017. Exploring unsaturated colloid deposition and mobilization in 3D with x-ray microtomography. InterPore 2017, Rotterdam, Netherlands, May 8–11.

Brueck, C.L. 2017. Exploring colloid transport in unsaturated porous media using x-ray microtomography/bioavailable water in coarse soils: a fractal approach. Department of Geography and Environmental Engineering Seminar, Johns Hopkins University, Baltimore, MD, March 7.

Brueck, C.L. and D. Wildenschild. 2015. Colloid transport in unsaturated porous media: 3D visualization using synchrotron x-ray microtomography. American Geophysical Union Fall Meeting, San Francisco, CA, December 14–18.

Brueck, C.L. and D. Wildenschild. 2015. The role of flow rate and moisture content on colloid mobility in unsaturated porous media. Hydrophiles Water Research Symposium, Oregon State University, OR, April 24–26.

## Project Experience

### Sediment

Performed positive matrix factorization (PMF) with the EPA tool PMF 5.0 and identified multiple contaminant sources during a chemical forensics investigation (with polycyclic aromatic hydrocarbons [PAHs], metals, and dioxins/furans) in a river with contaminated sediment.

Filtered data for GIS spatial analysis and assessed different spatial interpolation methods for concentration contour mapping in surface and subsurface river sediments.

Created an R-based mapping tool to identify and download relevant total suspended solids (TSS) data from U.S. Geological Survey (USGS) stations. Evaluated temporal trends in support of a river sediment transport analysis.

### Groundwater

Performed data mining of California Water Board's GeoTracker for a major industrial oil company to assess the magnitude and spatial extent of groundwater contamination at California remediation sites.

Wrote R scripts to conduct multi-year statistical trend analysis (Mann-Kendall) to evaluate the attenuation of groundwater contaminants including benzene, methyl tert-butyl ether (MTBE), total petroleum hydrocarbons (TPH), tetrachloroethene (PCE), and others.

Identified groundwater contaminants that exceeded drinking water maximum concentration limits (MCLs) and created a portfolio highlighting risk drivers at sites of interest in California.

### Surface Water

Evaluated the temporal relationships between various water quality parameters within a hypereutrophic lake from a dataset spanning multiple decades.

### Carbon Offsets

Designed a testing program to assist in the evaluation of a methane emission control product. Evaluated available data and collaborated on a scientific manuscript demonstrating efficacy of the product. Data are intended to support a carbon offset credit application.

### Data Analytics and Management

Developed tools and automated scripts to access and summarize publicly available data from the following sources:

- USGS National Water Information System (NWIS) mapper
- U.S. Environmental Protection Agency (EPA) Water Quality Portal (formerly STORET)
- EPA CompTox Dashboard
- PubChem
- California's Water Boards GeoTracker