Dr. Frank Loeffler

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Frank Loeffler is an environmental microbiologist whose research centers on discovering novel microbial processes that advance understanding of natural and engineered systems.

The Loeffler lab conducts fundamental research in interrelated focal areas: microbial detoxification of environmental pollutants, carbon and nitrogen cycling processes in soils and subsurface environments related to greenhouse gas emissions, the natural cycling of halogens, and microbial ecology. His research group uncovers novel microbes with properties of interest, explores microbe-microbe interactions to better predict microbial community structure, function and evolution, studies degradation pathways and enzymes of interest, and develops environmental monitoring tools for organisms and processes of interest. He interacts with professional engineers and remediation project managers to effectively transition research findings into practice (i.e., bioremediation applications).

In this work, Dr. Loeffler integrates cultivation and physiological characterization of enrichment cultures and isolates with (meta)genome and (meta)transcrip-tome sequencing, metaproteomics and metabolomics workflows, and various analytical techniques (e.g., geochemical measurements, NMR, qPCR). These efforts unravel how microbial community structure and dynamics determine function under different environmental conditions and in response to perturbations (e.g., climate change). These collaborative efforts train students at the interface of microbiology, chemistry, environmental engineering and computational biology (bioinformatics).

Research questions are addressed in interdisciplinary teams, often in conjunction with industry or government partners for rapid transition of laboratory findings to real world applications.

Projects:

- Microbial degradation of chlorinated ethenes
- Design and validation of a high-throughput qPCR approach for environmental monitoring of reductive dechlorination processes
- Microbially mediated abiotic degradation of carbon tetrachloride
- Microbial metabolism of chlorinated C_1 compounds
- Treatability studies to assess intrinsic degradation potential
- Fate of bisphenol A (BPA) in anoxic sediments
- Nitrogen cycling and nitrous oxide emissions from soil ecosystems
- Effect of cobamides on microbial community structure and function
- Microbial degradation of per- and polyfluoroalkyl substances (PFASs)
- International collaboration in the area of the food, energy and water (FEW) nexus. Dr. Loeffler leads a team to establish a research coordination network (FEWSTERN) between the U.S. and China. FEWSTERN identifies transdisciplinary research opportunities for researchers in the U.S. and China working on the sustainable use of natural resources for FEW systems.

Selected Papers

Yin, Y., Yan, G. Chen, F. Kara Murdoch, N. Pfisterer, and F.E. Löffler. 2019. Nitrous oxide is a potent inhibitor of bacterial reductive dechlorination. Environ. Sci. Technol. 53:692-701.

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Higgins, S.A., E. Padilla-Crespo, and F.E. Löffler. 2018. Draft genome sequences of the 1,2-dichloropropane-respiring *Dehalococcoides mccartyi* strains RC and KS. Microbiol. Resour. Announc. 7:e01081-18.

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Marcet, T., N. Capiro, Y. Yang, F.E. Löffler, and K.D. Pennell. 2018. Impacts of low-temperature thermal treatment on microbial detoxification of tetrachloroethene under continuous flow conditions. Water Research, 145:21-29.

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Hallin, S., L. Philippot, F.E. Löffler, R.A. Sanford, and C.M. Jones. 2018. Genomics and ecology of novel N_2O reducing microorganisms. Trends Microbiol. 26:43-55.

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Chen, G., S. Kleindienst, D.R. Griffiths, E.E. Mack, E.S. Seger, and F.E. Löffler. 2017. Mutualistic interaction between dichloromethane- and chloromethane-degrading populations in an anaerobic consortium. Environ. Microbiol. 19:4784-4796.

Yang, Y., N.L. Cápiro, T. Marcet, J. Yan, K.D. Pennell, and F.E. Löffler. 2017. Organohalide respiration with chlorinated ethenes under low pH conditions. Environ. Sci. Technol. 51:8579-8588.

Yang, Y., S.A. Higgins, J. Yan, B. Şimşir, K. Chourey, R. Iyer, R.L. Hettich, B. Baldwin, D.M. Ogles, and F.E. Löffler. 2017. Grape pomace compost harbors organohalide-respiring *Dehalogenimonas* species with novel reductive dehalogenase genes. The ISME Journal. 11:2767-2780.

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Im, J., and F.E. Löffler. 2016. Fate of Bisphenol A in terrestrial and aquatic environments. Environ. Sci. Technol. 50:8403-8416.

Lee, J., J. Im, U. Kim, and F. E. Löffler. 2016. A data mining approach to predict *in situ* detoxification potential of chlorinated ethenes. Environ. Sci. Technol. 50:5181-5188.

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Justicia-Leon, S. D., S. Higgins, E. Erin Mack, D. R. Griffiths, S. Tang, E. A. Edwards, and F. E. Löffler. 2014. Bioaugmentation with distinct *Dehalobacter* strains achieves chloroform detoxification in microcosms. Environ. Sci. Technol. 48:1851-1858.