Environmental Fate, Resistance Development and Toxicity of Antibiotics in Natural and Engineering Systems

Hui Li, Brian J. Teppen, Irene Xagoraraki, Stephen A. Boyd, James Tiedje Syed Hashsham, James E. Trosko, and Brad L. Upham

Project Abstract
Considerable amounts of antibiotics are present in our water system; however, their environmental fates and impacts remain largely unknown. We propose to conduct a series of seed research projects to investigate the fates of antibiotics in natural and engineered environments, within the broader and longer-term goals of linking environmental fate to development of microbial resistance and mammalian toxicity. The overall objective of this proposal is to develop a preliminary dataset from seed studies that will (1) be published to gain early research credibility, and (2) serve to develop and support hypotheses in pursuing external grants. To fulfill the objective, we will develop necessary techniques including both chemical and microbial protocols for conducting research of antibiotics in water and development of microbial resistance. In addition, we choose four research topics to investigate the fate of antibiotics in natural and engineered systems, which are (1) elucidate the interaction mechanisms of antibiotics with clay minerals in water, (2) understand sorption mechanisms and co-transport of antibiotics with dissolved organic substances in water, (3) investigate antibiotic removal and transformation products during drinking water and wastewater chlorination processes, and (4) mechanisms of water-borne antibiotics and their metabolites in pathogenesis of acute and chronic human disease. Establishing such preliminary datasets and knowledge base is imperative for further interdisciplinary research efforts and seeking external grants.