ORGANIC POLLUTANT BIODEGRADATION:

DETERMINING KINETICS AND IDENTIFYING ACTIVE ENZYMES IN SOIL SYSTEMS

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Microorganisms are responsible for the major mass-reducing processes that can detoxify and remove organic pollutants from soils, sediments and water systems. While many pollutants can be metabolized by microorganisms as carbon and energy sources, some of the more toxic, persistent and widely distributed pollutants are not readily biodegraded through these conventional processes. Cometabolism is a process in which microorganisms can biodegrade compounds that they cannot use a carbon and energy sources. In this process benign, non-toxic stimulants are used to promote selective growth of microorganisms that express highly non-specific enzymes that can then fortuitously biodegrade target pollutants.

There are many biological materials (biomarkers) that can used to identify and quantify bacteria in soil systems. These include, DNA, RNA and phospholipids. However, these biomarkers typically provide an indirect estimate of microbial abundance and it is often difficult to expltrapolate a rate of contaminant biodegradation from biomarker assays. Our current interest lies in using specific proteins as a biomarker for specific biodegradation processes and using of activity based protein profiling and environmental proteomics identify and quantify specific active enzymes in soil systems. Our emphasis is on microbial cometabolic processes involving the use of gaseous hydrocarbons (*e.g.* methane, propane) to stimulate the biodegradation of important emerging contaminants such as 1,4-dioxane.

The goals of this project will be to (a) quantify the rates of hydrocarbon stimulated 1,4-dioxane biodegradation and (b) the use of activity-based protein profiling and environmental proteomics to identify and quantify the of bacterial monooxygenase enzymes responsible for hydrocarbon and 1,4-dioxane biodegradation. The long-term aim will be to determine whether protein quantification can used to accurately describe and predict rates of contaminant biodegradation in soil systems.