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Serendipity and Bioaugmentation: The Strange True Story of Pseudomonas stutzeri KC

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Serendipity and quirky unexpected turns play a large role in research and technology development, and this oft-ignored fact is amply illustrated by the discovery of the denitrifying aquifer bacterium *Pseudomonas stutzeri KC* and by its on-going application for carbon tetrachloride remediation. This presentation is the story of strain KC: its fortuitous discovery (Criddle et al., 1990), unexpected physiological and genetic attributes, and the auspicious events that led to its full-scale application for carbon tetrachloride remediation. When grown under iron-limiting conditions (pH ~8.2), genes are induced in strain KC that enable production and secretion of a unique chelating agent that can transform carbon tetrachloride (CT) when it is chelated with copper. This agent was recently identified by Lee et al. (1999) as pyridine-2,6-(bis)thiocarboxylate (PDTC). In anoxic environments, the PDTC-copper complex can mediate rapid CT transformation to carbon dioxide and non-volatile products, without production of chloroform. Respiring cells can regenerate PDTC transformation activity, enabling faster and more extensive transformation. This activation can be mediated by diverse cell types. Microcosm experiments established that at a pH near 8.2, strain KC is competitive with the native microflora of many soils and groundwaters, and can mediate CT transformation by producing PDTC. Through extreme good fortune, a nearly "ideal" carbon tetrachloride spill site at Schoolcraft, Michigan, became available to the research team, enabling a series of exploratory bench and pilot studies. These studies led to a successful long-term full-scale remediation effort. This effort in turn resulted in the development of several broadly applicable strategies for cost-effective chemical and organism delivery in subsurface environments (Hyndman et al., 2000).

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