Methanotrophs are a unique set of bacteria capable of mitigating methane emissions by converting methane to carbon dioxide which has a lower global warming potential. Studies on methanotrophs mainly focus on understanding the physiological and biochemical properties of methanotrophs to model them for field scale applications. While methanotrophs are known to be sensitive to copper as it affects the activities of two forms of methane monooxygenase, information about the effect of other abundant metal ions in the environment is scarce. Understanding the behavioral response of methanotrophs to diverse environments is thus vital for exploiting them in bioremediation.

Firstly, the effect of metals other than copper on the expression and activity of methane monooxygenase was studied. Herein, gold was shown to affect the “copper-switch” by competing with copper for uptake by a copper chelating molecule, methanobactin, secreted by few methanotrophs. The presence of copper is well known to suppress the activity of soluble methane monooxygenase (sMMO), however, gold induced sMMO activity in *Methylosinus trichosporium* OB3b even in the presence of copper. This indicates the need for understanding how the relative abundance of metals in the environment affects methanotrophic activity.

Secondly, the effect of the rare earth metal, cerium, on the expression and activity of methanol dehydrogenase was studied. The study indicates that cerium acts as a switch between the two forms of methanol dehydrogenase in *M. trichosporium* OB3b. Such information will likely prove important when designing systems where one form of methanol dehydrogenase that has a catalytic advantage over the other form is preferred.

Thirdly, *M. trichosporium* OB3b when grown with copper and methanobactin from *Methylocystis* sp. strain SB2, induces sMMO activity. This shows that “cross-talk” can occur between methanotrophs and thus methanobactin qualifies as a signaling molecule affecting the gene expression in a methanotroph that did not secrete it.

Lastly, this study attempted to identify the complete regulatory basis of the “copper-switch” as competing models currently exist. A series of electro-mobility shift assays were performed between DNA upstream of genes and the gene products to determine if any specific gene product activates or suppresses the expression of the gene. The results are not confirmative and thus more work is needed to fully define the mechanism underlying the “copper-switch” in methanotrophs.