

Specific Uptake of Hg-thiol Complexes in *Geobacter Sulfurreducens* as Compared to *Desulfovibrio Desulfuricans* ND132

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One key factor controlling the production and accumulation of methylmercury in environments, such as the East Fork Poplar Creek (EFPC) ecosystem (at the DOE Oak Ridge Reservation) is the species of Hg(II) available for uptake by methylating bacteria. Little is known about the mechanism of Hg(II) uptake and methylation in bacteria; however, Hg(II) uptake studies with *Geobacter sulfurreducens* suggest the involvement of an unknown facilitated transport mechanism of Hg(II)-thiol species that has greater substrate specificity than observed in the sulfate-reducing bacterium, *Desulfovibrio desulfuricans* ND132. In short-term washed cell assays, *G. sulfurreducens* displayed enhanced Hg(II) uptake and methylation rates of specific Hg-thiol complexes (e.g. Hg-cysteine) at thiol concentrations found in the environment. Cells were able to discriminate between related thiols (penicillamine and cysteine), which vary only on the thiol carbon chain, as observed by the lack of Hg(II) uptake and methylation of Hg-penicillamine complexes. In contrast, changes to the amino group of cysteine, such as its removal (e.g., thioglycolate) or changes in chirality (L- vs D-form), did not appear to affect Hg(II) methylation. Similar to *G. sulfurreducens*, the sulfate-reducing bacterium, *Desulfovibrio desulfuricans* ND132, showed a modest increase in the Hg(II) methylation rate in the presence of cysteine relative to no-thiol or sulfide-added controls. However, the uptake and methylation of these Hg-thiol complexes lacked the specificity displayed by *G. sulfurreducens*. For instance, similar Hg(II) methylation rates were observed regardless of the thiol added (glutathione, penicillamine, or cysteine). These data suggest that a facilitated uptake mechanism for Hg(II)-thiol complexes is present in both sulfate- and iron-reducing bacteria, but with quite different patterns of specificity. As part of the collaborative research with the SFA of the Oak Ridge National Laboratory, our future plan will attempt to determine the specific Hg(II) species involved in bacterial uptake, and elucidate possible mechanism(s) of methylation by *G. sulfurreducens* and *Desulfovibrio desulfuricans* ND132.