# Unexpected Effects of Gene Deletion on Mercury Interactions with the Methylation-**deficient Mutant Δ*hgc*AB**

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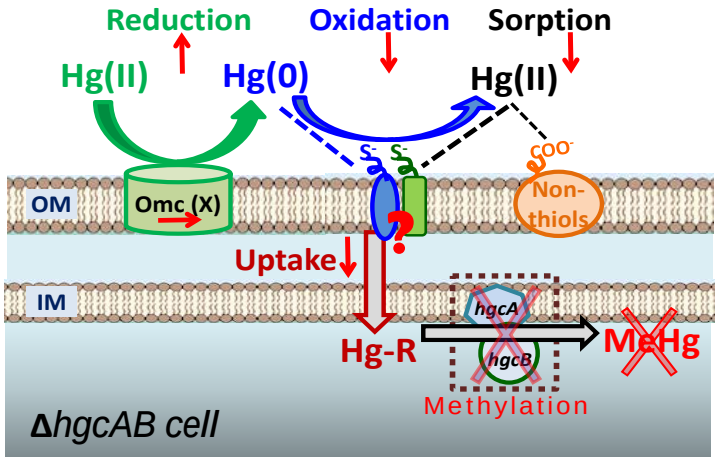
**DOE Office of Science/Biological & Environmental Research**

## *Objective*

- Determine how deletion of hgcAB gene pairs affects mercury (Hg)-cell surface interactions and intracellular uptake of Hg by certain anaerobic bacteria.




## *New Science*

- Deletion of hgcAB gene pairs results in unexpected increase of Hg(II) reduction but decreased Hg(0) oxidation by the methylating bacteria *Geobacter sulfurreducens* PCA and *Desulfovibrio desulfuricans* ND132.
- Δ*hgc*AB mutants also contain lower amounts of cellular thiols than the wild-type (WT) strains, accounting for decreased adsorption and intracellular uptake of Hg.
- Despite the lack of methylation activity, Hg uptake by the Δ*hgc*AB continued, albeit at a slower rate than the WT.

## *Significance*

- Provides additional insights into the mechanisms and biochemical pathways of microbial uptake and methylation of Hg in the environment.

Lin, H., R.A. Hurt Jr, A. Johs, J.M. Parks, J.L. Morrell-Falvey, L. Liang, D.A. Elias, and B. Gu. 2014. Unexpected effects of gene deletion on mercury interactions with the methylation-deficient mutant Δ*hgcAB*. Environ. Sci. Technol. Lett. 5:271-276 (doi: 10.1021/ez500107r).

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The *hgcA* and *hgcB* gene pair is essential for mercury (Hg) methylation by certain anaerobic bacteria, but little is known about how deletion of *hgcAB* affects cell surface interactions and intracellular uptake of Hg. Here, we compare Δ*hgcAB* mutants with the wild-type (WT) strains of both *Geobacter sulfurreducens* PCA and *Desulfovibrio desulfuricans* ND132 and observe differences in Hg redox transformations, adsorption, and uptake in laboratory incubation studies. In both strains, deletion of *hgcAB* increased the reduction of Hg(II) but decreased the oxidation of Hg(0) under anaerobic conditions. The measured cellular thiol content in Δ*hgcAB* mutants was lower than the WT, accounting for decreased adsorption and uptake of Hg. Despite the lack of methylation activity, Hg uptake by the Δ*hgcAB* continued, albeit at a slower rate than the WT. These findings demonstrate that deletion of the *hgcAB* gene not only eliminates Hg methylation but also alters cell physiology, resulting in changes to Hg redox reactions, sorption, and uptake by cells.

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