Poster Presentation

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The organomercurial lyase Merb possesses unique metal-binding properties

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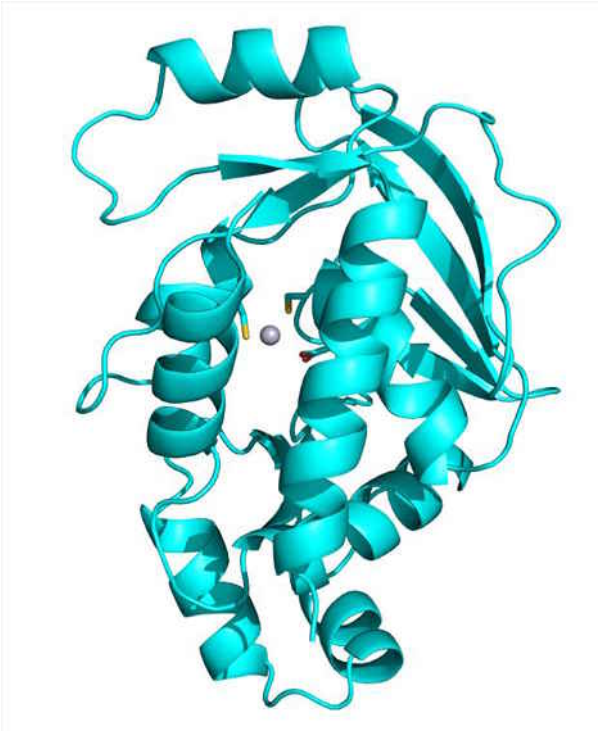
Select bacterial strains survive in mercury-contaminated environments due to acquisition of a transferable genetic element known as the mer operon. The mer operon typically encodes for a series of proteins that includes two enzymes, MerA and MerB. The organomercurial lyase (MerB) cleaves carbon-mercury bonds of organomercurial compounds yielding ionic mercury Hg (II) and a reduced-carbon compound. The Hg (II) ion product remains bounds until it is shuttled directly to the mercuric ion reductase (MerA) to be reduced. Based on NMR spectroscopy and X-ray crystallography studies[1], we have determined that Cys96, Asp99 and Cys159 of E. Coli MerB form a catalytic triad required for cleavage of the carbon-Hg bond and binding of the Hg (II) ion product. The three catalytic residues are conserved in 61 of 65 known variants of MerB and the four remaining variants retain both cysteine residues, but contain a serine in place of Asp99. Given its unique activity, we have examined the role of serine as a catalytic residue and the ability of MerB to cleave other organometals such as organotin (known substrates or inhibitors) and organolead compounds. Soaking MerB crystals with either dimethyltindibromide or trimethylleadchloride compound indicates that MerB crystals have the capacity to cleave both carbon-Sn and carbon-Pb bonds, and we have determined crystal structures of a MerB-Sn and a MerB-Pb complex. Furthermore, substitution of Ser for Asp99 (MerB D99S) in E. coli MerB alters the metal-binding specificity, as MerB D99S chelated an unknown metal during its purification. X-ray crystallography, ICP-MS and electron paramagnetic resonance (EPR) studies were performed to identify the unknown metal and the results of these studies will be presented. Given that mercury contaminated sites are often contaminated with other heavy metals, these studies indicate that other heavy metals may have important implications when using MerA and MerB in bioremediation of organomercurial compounds.

[1] *J. L. Vanasse, M. Lefebvre, P. D. Lello, et al., The Journal of biological chemistry, 2009, 284(2), 938–944.*



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