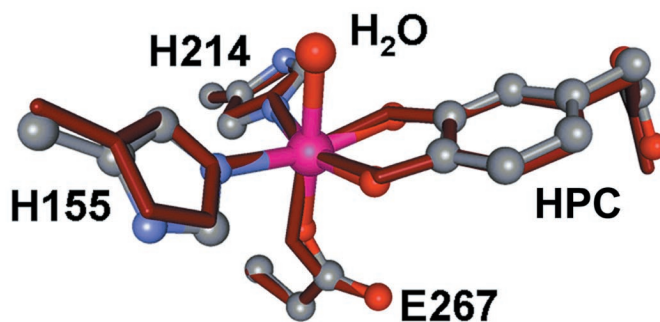


A Cambialistic Pair of Fe- and Mn-Dependent Dioxygenases

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Two homologous enzymes from *Arthrobacter globiformis* and *Brevibacterium fuscum* that utilize mononuclear active sites coordinated to the 2-His-1-carboxylate facial triad have been found to catalyze the extradiol cleavage of homoprotocatechuate (HPC), the key ring-cleaving step in the degradation of tyrosine. These two HPC 2,3-dioxygenases (HPCD) have nearly identical tertiary structures (left image) and active site coordination geometries when HPC is bound to the metal center (right image). [*B. f.* HPCD (1Q0C.pdb) = blue line and 5-coordinate maroon line structures; *A. g.* HPCD (1F1V.pdb) = green ribbon and 6-coordinate ball and stick structures] However, these enzymes utilize different transition metals for catalysis: *B. f.* HPCD uses Fe, while Mn is required in *A. g.* HPCD. Employing recombinant expression in *E. coli*, we have over-expressed and isolated these two enzymes with the alternative, non-native transition metal in their active sites, *i.e.* an Fe-dependent *A. g.* HPCD and a Mn-dependent *B. f.* HPCD. In this work we report a series of experiments characterizing the reactivity and spectroscopic properties of these enzymes. Together, these data firmly establish a new class of cambialistic [from the Latin *cambialis*, suggesting the capability of making a cofactor change] enzymes with the ability to effectively use either Fe or Mn for catalysis.



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