MS07-P04 | Regioselective Carboxylation by Prenylated Flavin and Mn-Dependent Decarboxylases

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Carboxylation reactions received considerable attention in view of the use of CO_2 as abundant C_1-building block for sustainable chemical production. However, to date only a few examples of CO_2 fixation reactions have been realized on industrial scale, mainly due to the high-energy input required for substrate activation. In order to expand the biocatalytic carboxylation toolbox, we searched and characterized enzymes enabling the regiocomplementary *para*- and *ortho*-carboxylation of electron-rich aromatic compounds.

The enzyme-catalyzed *para*-carboxylation of catechols employs 3, 4-dihydroxybenzoic acid decarboxylase (AroY). Crystal structures and accompanying solution data confirm AroY utilizes the recently discovered prenylated FMN cofactor (prFMN), and requires oxidative maturation to form the catalytically competent prFMN^{iminium} species. The enzymes form hexameric assemblies, arranged as a trimer of dimers. The same quaternary structure is observed for all crystallographically independent AroY monomers, and in the 4.6 Å cryo-EM solution structure of *apo*-AroY. The putative flexibility of individual domains and its influence on enzyme mechanism is discussed.

The *ortho*-carboxylation of resorcinol is achieved by utilization of 2, 3-dihydroxybenzoic acid decarboxylase from *Aspergillus oryzae*. The tetrameric arrangement of its amidohydrolase fold subunits, as well as metal ion promiscuity allowing for the incorporation of Mg^{2+} in its active site instead of Mn^{2+} are explored.

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