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Structural Studies of Galactose Oxidase

J. Vitali (AECOM), M.J. Colaneri (SUNY Old Westbury), J. Peisach (AECOM), and J.W. Whittaker (OHSU)
Beamline(s): X12C

The enzyme Galactose Oxidase catalyzes the oxidation of primary alcohols with O₂ producing aldehydes and hydrogen peroxide – $RCH_2OH + O_2 \rightarrow RCHO + H_2O_2$. Galactose is the best known substrate, while other primary alcohols can be oxidized at much lower rates. The initial mechanistic step is thought to be the ligation of galactose O6 to copper, allowing H6 to hydrogen bond with a nearby tyrosine. The rate limiting step of the overall reaction is the abstraction of the pro-S hydrogen from the C5 of galactose.

Changes in the copper EPR spectra of frozen solutions of galactose oxidase containing a derivative of galactose have identified a potential inhibitor of this enzyme. Crystals of the enzyme complex with this inhibitor diffract to 1.3 Å resolution, linear R-fac = 0.030. The complex has electron density in the active site and we are trying to model it in terms of the inhibitor.

We anticipate that this work will give direct insight into the mechanism of action of this well known enzyme.