Detoxification of Superoxide Radical by Reduction Reaction Mechanism of Superoxide Reductase SOR

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Recently, a new concept in the field of cellular defenses against oxidative stress has emerged[1]. A new antioxidant system called superoxide reductase SOR was discovered, by which some anaerobic or microaerophilic microorganisms detoxify superoxide radical. This system catalyzes a monoelectronic reduction of $O_2^{\bullet-}$ into H_2O_2:

$$O_2^{\bullet-} + 1e^- + 2H^+ \rightarrow H_2O_2 \quad \text{(SOR)}$$

The SOR active site consists of a Fe^{2+} center in an unusual [His_4Cys_1] square pyramidal coordination, which reacts at a nearly diffusion-controlled rate with $O_2^{\bullet-}$.

We are studying the reaction mechanism of the SORs from *Desulfoarculus baarsii* and *Treponema pallidum.* The approach combines different techniques, pulse radiolysis, resonance Raman spectroscopy, protein crystallography and site-directed mutagenesis[2-4]. We have characterized the formation of two transient intermediates during the catalytic cycle, consistent with the formation of iron(III)-peroxo and iron(III)hydroperoxo species, respectively[2,3]. Recently, a crystal structure of a SOR-ferrocyanide complex has been solved at 1.7 Å resolution[4]. The reactivity of the SOR-ferrocyanide complex with superoxide has been investigated.

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