Unique Enzymatic Reaction Depending on Iron-Sulfur Cluster and Its Maturation

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Iron-sulfur (Fe-S) clusters are versatile cofactors of proteins that are involved in electron transport, enzyme catalysis and regulation of gene expression. 2-Hydroxyacyl-CoA dehydratases are two-component systems composed of an activator, Archerase, and the actual dehydratase, component D. Archerase, a homodimer with one [4Fe–4S] cluster, transfers an electron to component D, a heterodimer with 1-2 [4Fe–4S] clusters and FMN, concomitant with hydrolysis of two ATP. From component D the electron is further transferred to the substrate, where it facilitates elimination of the hydroxyl group. After elimination the electron is handed-over to the next incoming substrate without further hydrolysis of ATP (Figure 1).

The synthesis of Fe-S clusters and their insertion into apoproteins involves the function of complex cellular machineries. Cysteine desulfurase is a pyridoxal-5'-phosphate-dependent enzymes that cleave sulfur from cysteine via an enzyme cysteinyl persulfide intermediate and provides sulfur for the biosynthesis of Fe-S proteins. A similar but different mechanism is employed in the degradation of selenocysteine by selenocysteine lyase, a selenium-specific enzyme participating in selenium metabolism.

Properties and function of unique enzymes relating to Fe-S cluster will be presented.

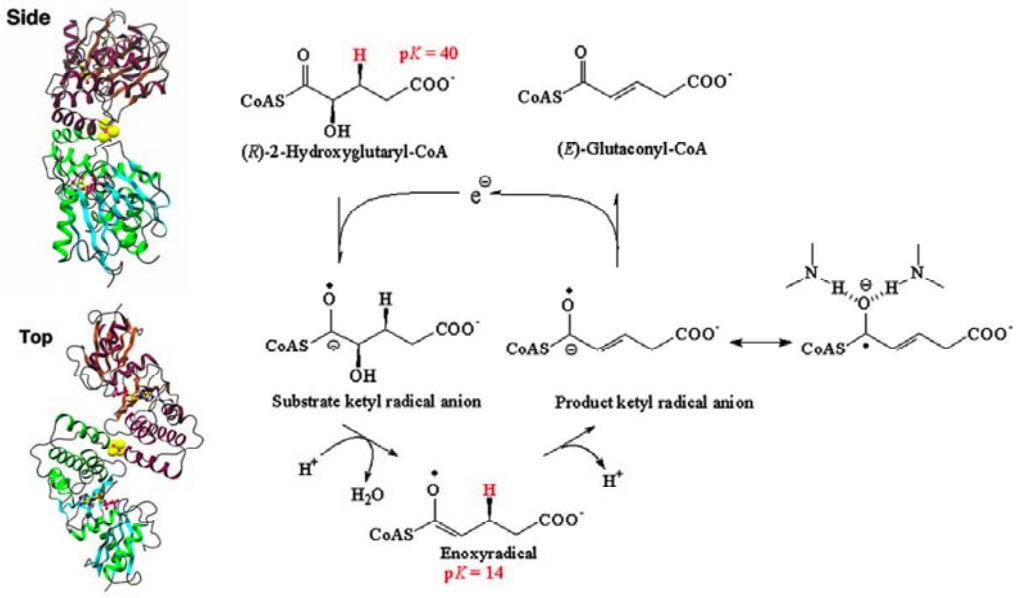

Figure 1: Crystal structure of Archerase (left) and the reaction catalyzed by 2-hydroxyacyl-CoA dehydratase.

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