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Insights into the kinetics of oxidative proline metabolism

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Abstract

The proline metabolic pathway is of importance for understanding mechanisms of bioenergetics and stress response in various organisms. Proline metabolism has been shown to have multiple roles in stress defense involving intracellular redox homeostasis, osmoprotection, cell signaling, chaperone activity, and scavenging of reactive oxygen species. The involvement of proline metabolism in cellular signaling may possibly involve reactive oxygen species (ROS) production during oxidative proline metabolism. The interconversion of proline and glutamate form the two main branches of the proline metabolic pathway. Proline is oxidized by proline dehydrogenase (PRODH) and Δ1-pyrroline-5-carboxylate (P5C) dehydrogenase (P5CDH) to form glutamate while P5C synthetase and P5C reductase catalyze the reduction of glutamate back to proline. To gain insights into the bioenergetics of proline metabolism and how proline affords stress protection, the kinetics of proline oxidative metabolism were investigated. In *Escherichia coli,* PRODH and P5CDH are combined into a single polypeptide called proline utilization A (PutA). Studies of PutA have provided evidence for substrate channeling between PRODH and P5CDH active sites and have shown that the oxidative step involving electron transfer from reduced flavin to ubiquinone is rate limiting during catalytic turnover. Whether substrate channeling also occurs in separate PRODH and P5CDH enzymes is not known but results from new experiments testing this possibility will be discussed.

Biography

Donald Becker is a Professor of Biochemistry at the University of Nebraska-Lincoln. He is the director of the Nebraska Redox Biology Center, which is funded by the NIH IDeA program and has a unifying focus of exploring fundamental questions in redox biology that are of significant importance to human health.