Other

A Tale of Two Functions: Enzymatic Activity or Translational Repression by a Biotin-Dependent Enzyme

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Material World Adjunct Faculty Presentation

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Abstract:

Acetyl-CoA Carboxylase catalyzes the first committed step in fatty acid synthesis. Escherichia coli acetyl-CoA carboxylase is composed of biotin carboxylase, carboxyltransferase, and biotin carboxyl carrier protein functions. The accA and accD genes that code for the alpha and beta subunits, respectively, are not in an operon, yet yield an alpha2beta2 carboxyltransferase. This seminar will describe how carboxyltransferase regulates its own translation by binding the mRNA encoding its subunits. This interaction is mediated by a zinc finger on the beta subunit; mutation of the four cysteines to alanine diminished nucleic acid binding and catalytic activity. Carboxyltransferase binds the coding regions of both subunit mRNAs and inhibits translation, an inhibition that is relieved by the substrate acetyl-CoA. mRNA binding reciprocally inhibits catalytic activity. An unusual regulatory mechanism is proposed by which carboxyltransferase acts as a “dimmer switch” to regulate protein production and catalytic activity, while sensing the metabolic state of the cell through acetyl-CoA concentration.

Speaker's Bio:

Grover Waldrop received a Ph.D. degree in Biochemistry from State University of New York at Buffalo in 1988. He was a post-doctoral fellow with Howard K. Schachman at the University of California at Berkeley from 1988-1991 where he studied physical biochemistry. From 1991-1995, he was a postdoctoral fellow with W.W. Cleland at the University of Wisconsin at Madison focusing on enzyme kinetics. He joined the faculty at Louisiana State University in 1995 where he is now a Professor in the Department of Biological Sciences. His research interests are in the general area of enzyme structure and function with a particular focus on biotin-dependent carboxylases. He has published 48 peer-reviewed papers and has been the PI on grants from NSF, NIH, and Pfizer devoted to biotin-dependent carboxylases.

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