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Dissecting the nitrogen assimilation system of E. coli: from molecules to physiology[1]

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Nitrogen assimilation is a major branch of cellular metabolism. For enteric bacteria such as E. coli, all of the nitrogen groups needed in biosynthesis are converted from ammonia by a relatively simple system comprised of 3 enzymes and 3 intermediate metabolites. This system is intricately regulated, at both the transcriptional and post-translational levels according to the nitrogen and carbon/energy status of the cell. While specific pieces of this regulation have been known for a long time, the strategy of regulation relating nitrogen influx to cellular demand is poorly understood. Clearly, the paradigm of end-product feedback inhibition well-established for the regulation of individual metabolic pathways is inadequate since there are too many products involving nitrogen. Through extensive experimental studies including quantitative characterization of the levels of key metabolites and enzymes for a carefully chosen spectrum of growth conditions and mutants, we obtain a dynamic picture of how the cell matches its rate of nitrogen assimilation with physiological needs through the intermediate metabolites.

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