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Effect of Variable Fluxes on Optimal Flux Distribution in a Metabolic Network

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Abstract : Finding all optimal flux distributions of a metabolic model is an important challenge in systems biology. In this paper, a new algorithm is introduced to identify all alternate optimal solutions of a large scale metabolic network. The algorithm reduces the model to decrease computations for finding optimal solutions. The algorithm was implemented on the Escherichia coli metabolic model to find all optimal solutions for lactate and acetate production. There were more optimal flux distributions when acetate production was optimized. The model was reduced from 1076 to 80 variable fluxes for lactate while it was reduced to 91 variable fluxes for acetate. These 11 more variable fluxes resulted in about three times more optimal flux distributions. Variable fluxes were from 12 various metabolic pathways and most of them belonged to nucleotide salvage and extra cellular transport pathways.

Keywords : flux variability, metabolic network, mixed-integer linear programming, multiple optimal solutions
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