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Dynamic Optimization of Nitrogen Assimilation in *Chlamydomonas reinhardtii*

Optimization approaches are a useful tool to study principles behind dynamics observed in the regulation of metabolic pathways [1]. While earlier studies considered mostly steady-state systems [1, 2], the dynamic regulation, or just-in-time activation, of metabolic pathways has attracted increasing attention [3, 4] and was experimentally observed in the amino acid biosynthesis of *Escherichia coli* [4]. Using dynamic optimization by solving a nonlinear, dynamic optimal control problem with the quasi-sequential approach [5], we investigate the regulation of the nitrogen assimilation and the nitrogen metabolism [6] by the circadian clock [7] of the green algae *Chlamydomonas reinhardtii*. The aim of our analysis is to identify which enzymes within a drastically simplified model of the metabolism of *C. reinhardtii* need to be subjected to circadian control in order to adapt the organism to day-night rhythms. Moreover, the physiological and environmental constraints that imply the necessity of circadian regulation of different enzymes are investigated. Important components of such a model are appropriate kinetics of participating reactions as well as concentrations of enzymes and metabolites. We developed such a model focusing on nitrogen metabolism including assimilation, transport and processing in *C. reinhardtii*. This model was analyzed under different environmental conditions and provides first insights into the cause of the dynamics of metabolite and enzymes concentrations observed in the course of a day.

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