Systematic debottlenecking of isobutyraldehyde production in cyanobacteria

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Project Goals: This project aims to develop a systematic approach to identify and alleviate bottleneck reactions that limit carbon flux towards desired products in engineered cyanobacteria.

Our lab has previously developed isotopically nonstationary ^{13}C-MFA (INST-MFA) (*1-4*) as a technology to assess the photoautotrophic metabolism of cyanobacteria (*4*) and plant leaves (*5*). Recently, we combined INST-MFA with rational metabolic engineering to improve the productivity of an isobutyraldehyde (IBA) producing mutant of the cyanobacterium *Synechococcus elongatus* PCC7942 (*6*).

This presentation describes our current effort at refactoring previously engineered cyanobacteria strains (in (*6*)) to identify the metabolic phenotypes that contribute to enhanced strain performance. The results led us to hypothesize that the bottleneck to IBA lies around the pyruvate node. By perturbing the fluxes around pyruvate, we were successful at further increasing IBA productivity.

Our efforts demonstrate that INST-MFA can play an important role in the strain optimization workflow of industrially relevant autotrophic systems.

References

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