Engineering High Yield Production of L-Serine in Cyanobacterium *Synechococcus* sp. PCC 7002

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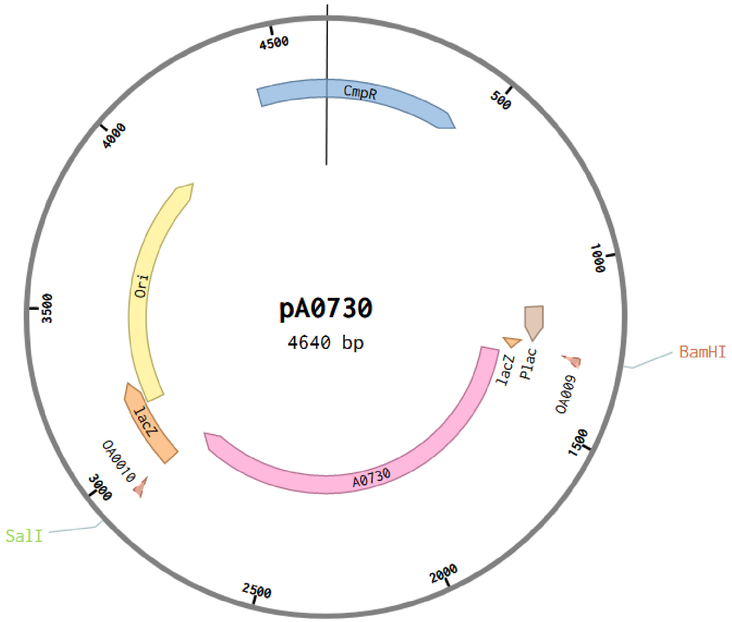
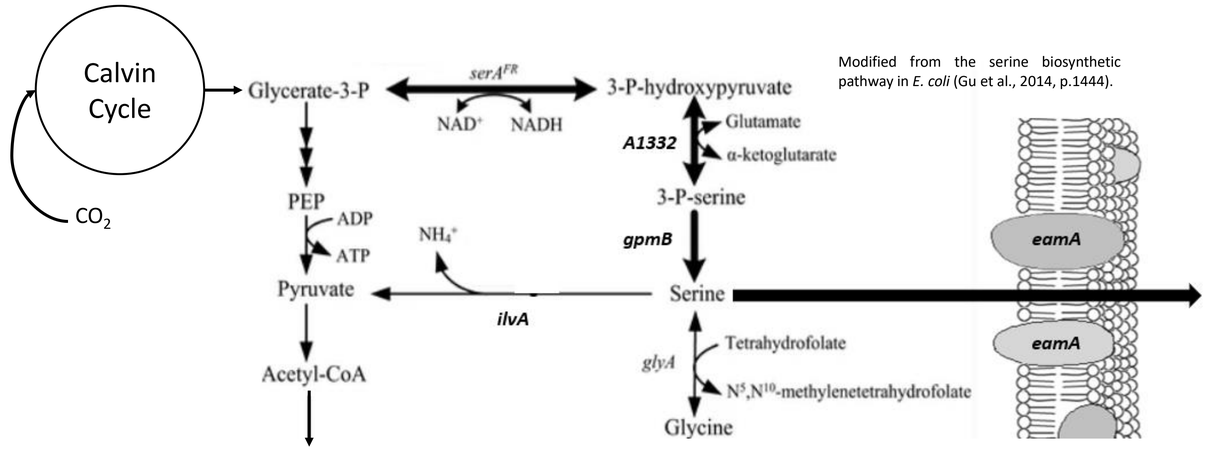
Introduction

This research focusses on the production of renewable chemicals, specifically the amino acid L-serine, directly from CO_2 and light using engineered cyanobacteria. A key degradation gene, *ilvA*, was identified as a candidate for deletion but is the only known pathway for isoleucine production. A plasmid was constructed containing PCC 7002's native *A0730* gene to determine if it can provide an alternative route for isoleucine formation. If functional, a Synechococcus sp. PCC 7002 Δ*ilvA* strain is expected to increase L-serine accumulation.

Current Results

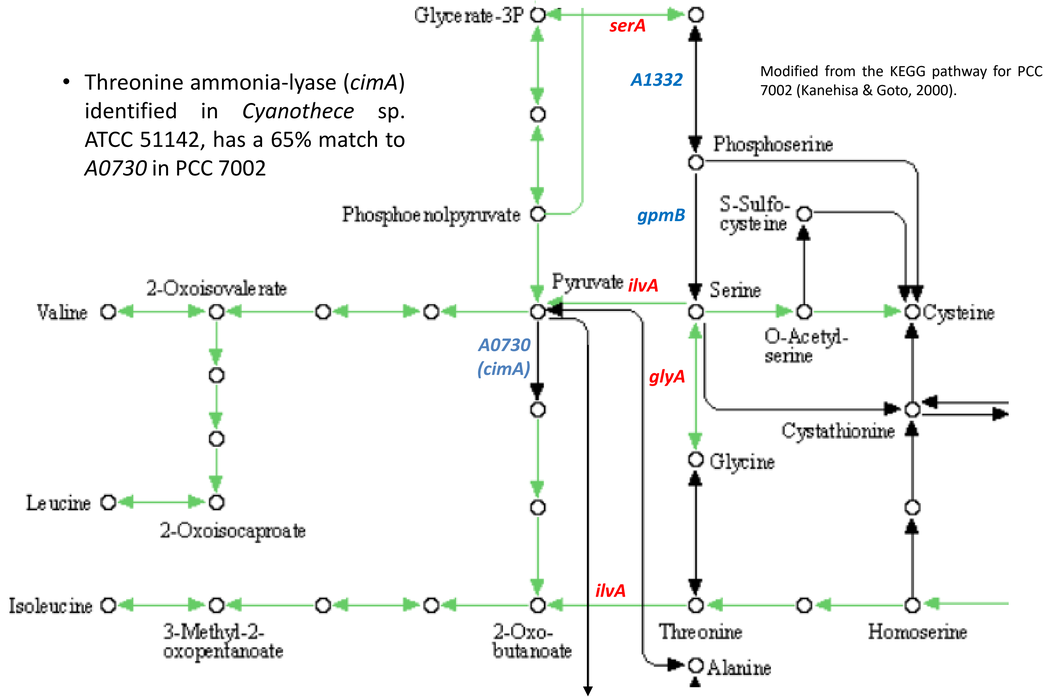


Biosynthesis of L-Serine



Modified from the serine biosynthetic pathway in *E. coli* (Gu et al., 2014, p.1444).

- Threonine ammonia-lyase (*cimA*) identified in *Cyanothece* sp. ATCC 51142, has a 65% match to *A0730* in PCC 7002



Modified from the KEGG pathway for PCC 7002 (Kanehisa & Goto, 2000).

Current Work

- Verify plasmid using colony PCR and submitting for sequencing
- Since *E. coli* with *ilvA* deletion can't grow in 0.4% glucose, check if pA0730 restores growth
- Remove *ilvA* from the newly engineered PCC 7002 strain

Future Work

- Test new exporters (*thrE* and *SerE*) as alternatives to *eamA*
- Introduce a *serB* and *serC* operon in case of tight regulation by native genes
- Delete and/or repress the degradation genes *ilvA* and *glyA* to increase titers
- Track other metabolites in the pathway like 2-HGA

References

Gu, P., Yang, F., Su, T., Li, F., Li, Y., & Qi, Q. (2014). Construction of an l-serine producing Escherichia coli via metabolic engineering. *Journal of Industrial Microbiology & Biotechnology, 41*(9), 1443-1450. doi:10.1007/s10295-014-1476-6

Kanehisa, M. and Goto, S. (2000). KEGG: Kyoto Encyclopedia of Genes and Genomes. Nucleic Acids Res. 28, 27-30.

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