

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

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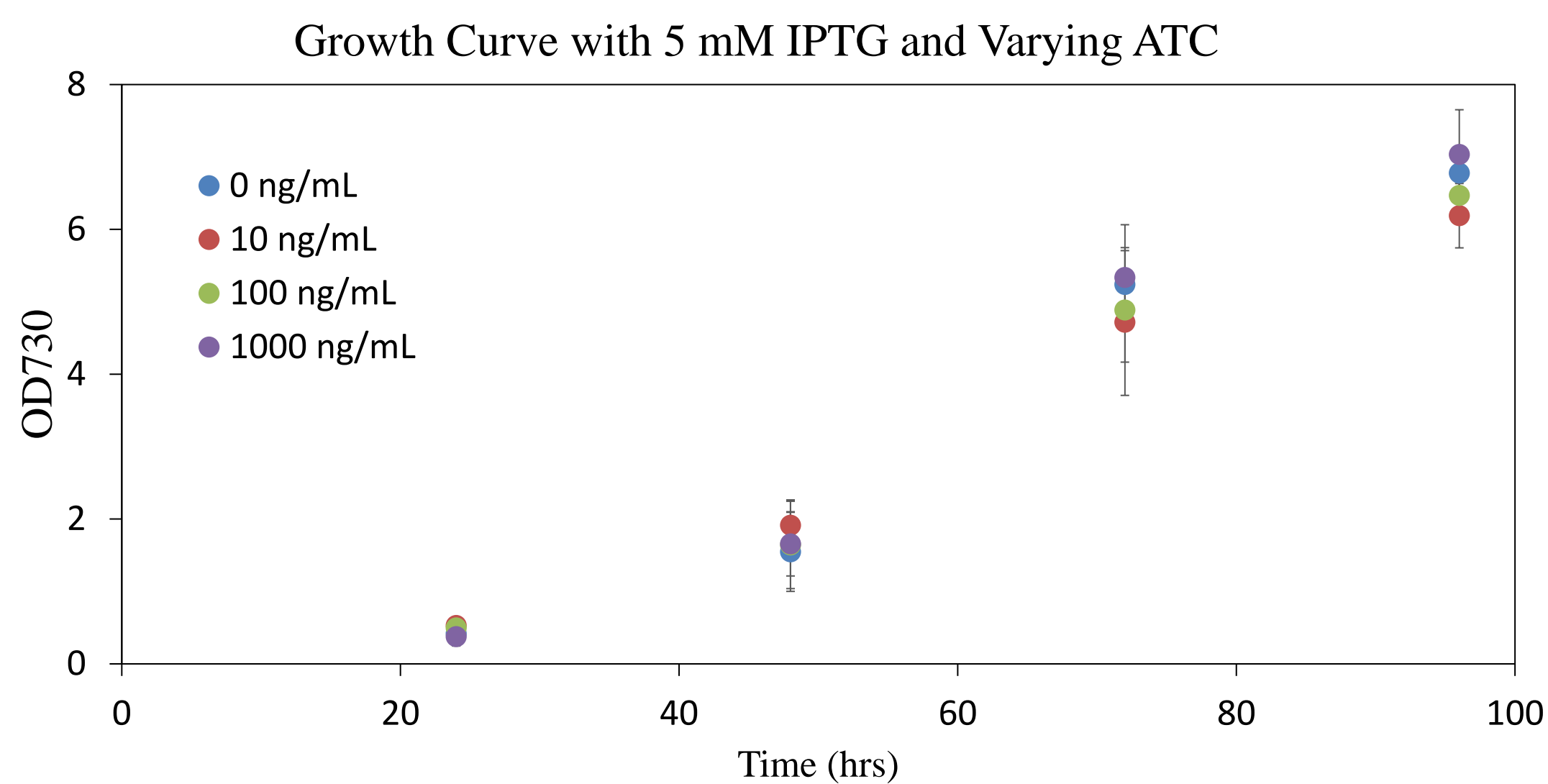
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Introduction

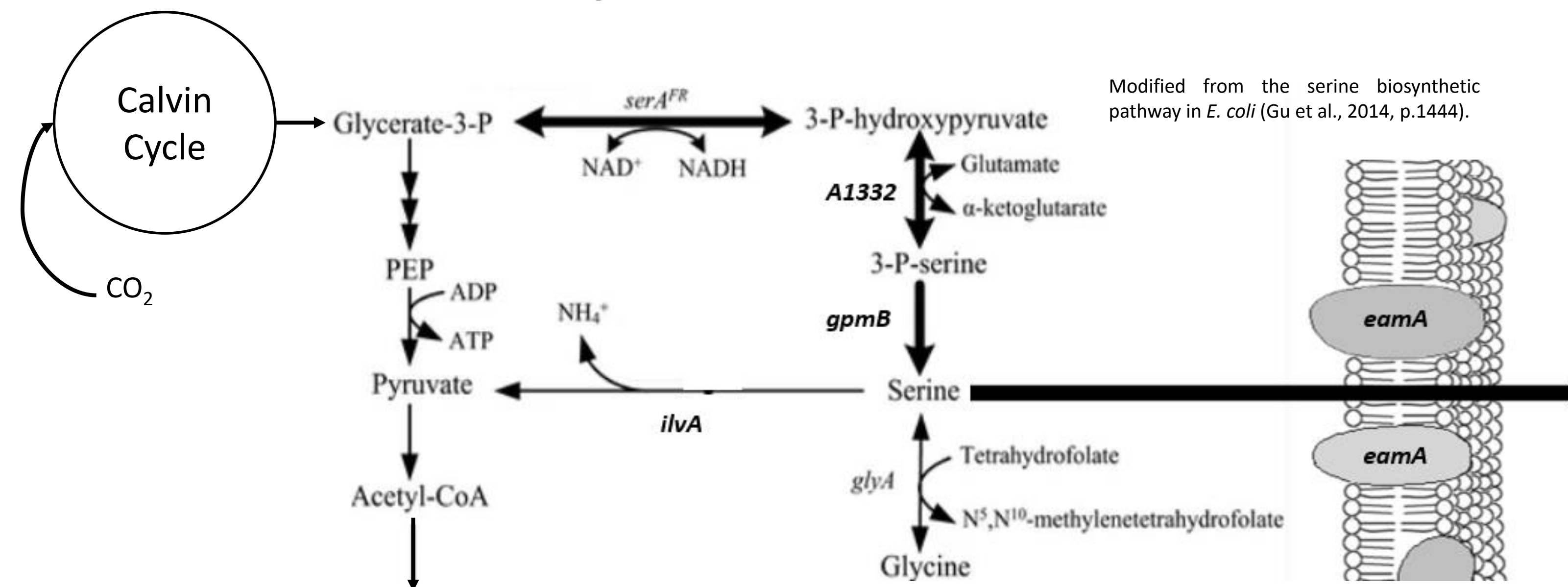
This research focusses on the production of renewable chemicals, specifically the amino acid L-serine, directly from CO₂ using engineered cyanobacteria. The *serA* gene was mutated to deregulate feedback inhibition caused by L-serine. Additionally, the *eamA* serine/cysteine transporter gene was introduced to export the amino acid from the cell, reducing possible toxicity or degradation. So far, this has not been enough, and further modifications are required.

Current Results



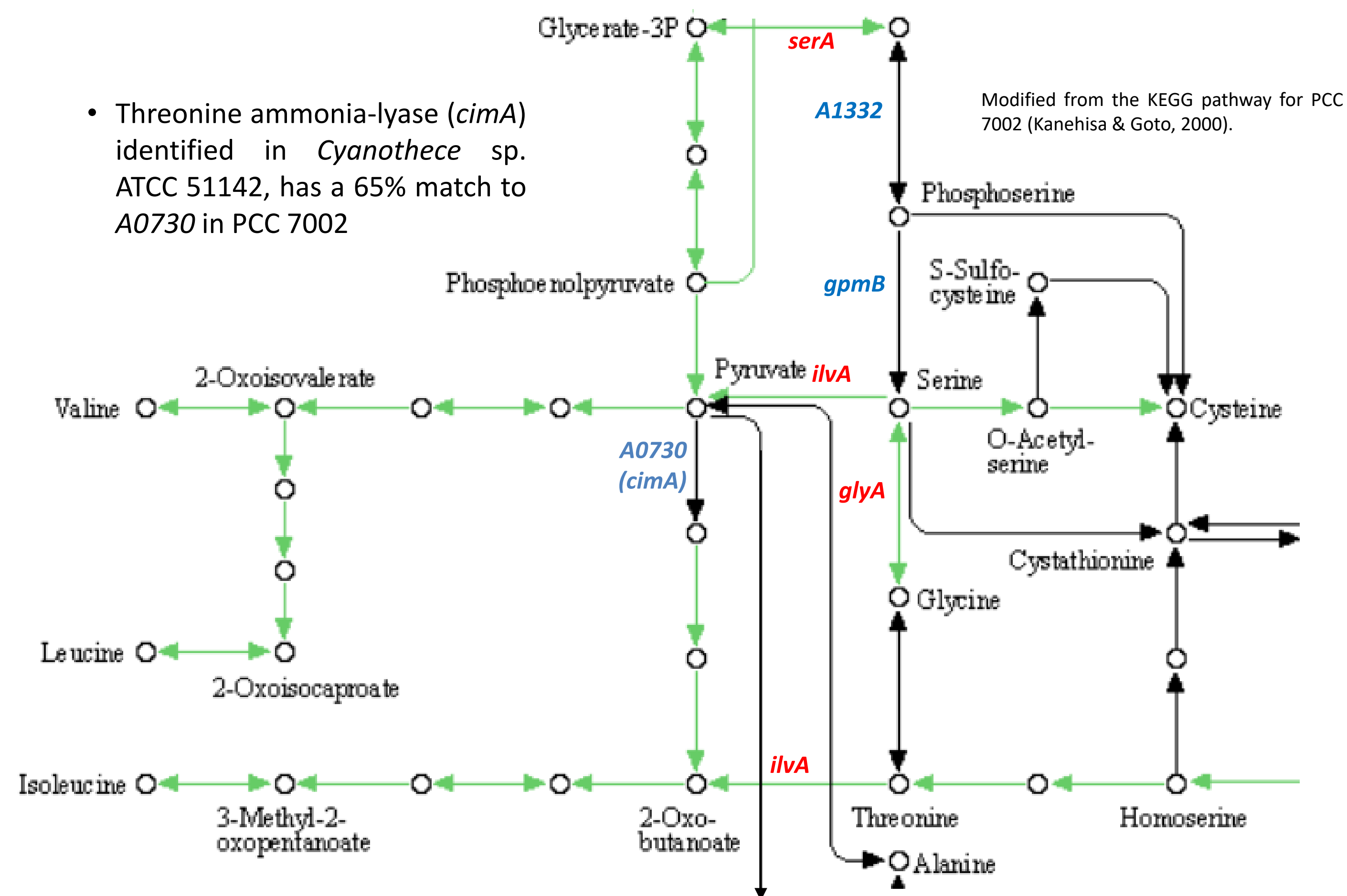
- IPTG induces *serA^{FR}*, ATC induces *eamA* exporter
- No visible growth defect
- No quantifiable L-serine titer detected using HPLC
- More metabolic engineering is necessary

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

- Test A0730 in *E. coli* with *ilvA* deletion to check for isoleucine production
- *E. coli* with *ilvA* deletion can grow in LB but not 0.4% glucose
- 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.