

# Confirmation of role for malate shunt in *Clostridium thermocellum* glycolysis

## Background

- *Clostridium thermocellum* is notable in that it assimilates sugar via the Embden-Meyerhof-Parnas (EMP) pathway, but does not possess a pyruvate kinase enzyme.
- Previous work has suggested that pyruvate is generated by a 3-gene pathway called the 'malate shunt'.
- This pathway, however, had not been confirmed to function *in-vivo*.

## Approach

- Techniques of gene deletions, enzyme assays, and <sup>13</sup>C labeling experiments were combined to determine flux through the malate shunt.

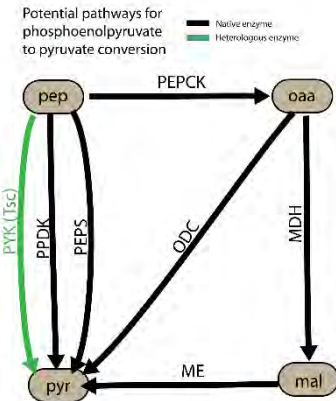
## Outcome

- Based on the <sup>13</sup>C labeling data, it was determined that about 1/3 of the metabolic flux from phosphoenolpyruvate to pyruvate is mediated by the malate shunt in the wild type strain.
- The remainder of the flux is mediated by the pyruvate phosphate dikinase enzyme.
- The oxaloacetate decarboxylate pathway is not present.

## Significance

- The unique metabolism of *C. thermocellum* has presented difficulties in engineering it for improved ethanol production.
- Improved understanding of the malate shunt will allow the design of strains for improved ethanol production.

## Metabolic network



## Flux diagram of wt strain

