The pentose phosphate pathway of cellulolytic clostridia relies on 6-phosphofructokinase instead of transaldolase

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Background

- Most cellulolytic clostridia do not contain transaldolase genes, which help connect pentose metabolism to the rest of metabolism
- Here we show that the PPi-dependent phosphofructokinase (PPi-Pfk) can fill in for the transaldolase in two cellulolytic clostria species

Approach

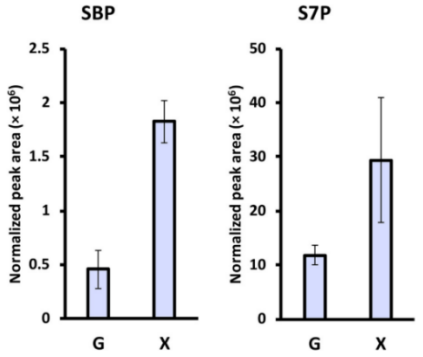
- Formation of sedoheptulose-1,7-bisphosphate (SBP) would provide evidence for the existence of this pathway
- Hence, we sought to document formation of SBP, both in batch cell cultures, and also with *in vitro* assays using purified PPi-Pfk protein

Outcome

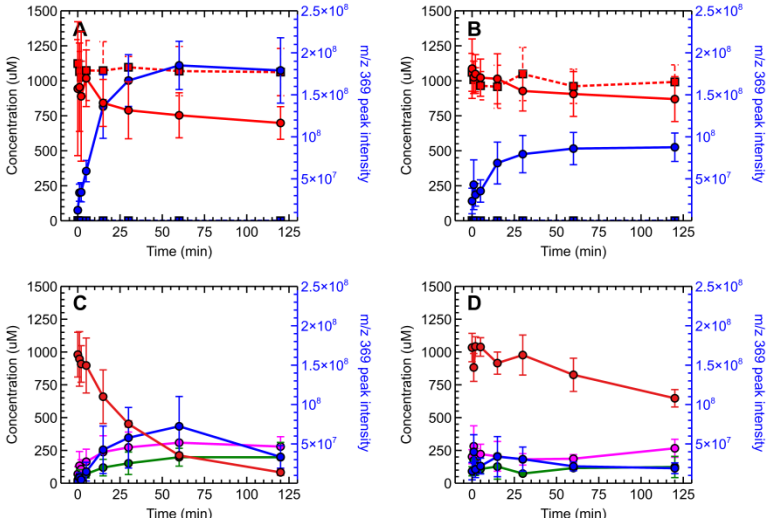
- *C. thermosuccinogenes* were shown to accumulate SBP; accumulation of SBP was much higher when grown on xylose
- Purified PPi-Pfk proteins from *C. thermosuccinogenes* and *C. thermocellum* were shown to be able to phosphorylate sedoheptulose-7-phosphate (S7P) to SBP.

Significance

- We provide experimental evidence supporting the theory that the PPi-dependent phosphofructokinase participates in the non-oxidative pentose phosphate pathway in addition to glycolysis
- This finding should help improve the engineering of glycolysis.



SBP and S7P accumulate in cells of *C. thermosuccinogenes* grown on glucose (G) and xylose (X)



Purified PPi-Pfks (solid lines) can convert S7P to SBP *in vitro*; without the added protein (dashed lines) no conversion happens

Koendjbiharie JG, et al. 2020. The pentose phosphate pathway of cellulolytic clostridia relies on 6-phosphofructokinase instead of transaldolase. J Biol Chem 295:1867–1878.

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