Microbial attachment to cellulose substrate produces widespread gene expression changes

U.S. DEPARTMENT OF ENERGY | Office of Science

Background

- Unlike the majority of biofilm forming bacteria, *C. thermocellum* adheres to substrata that also provide its major carbon and energy sources. Before this study, discrete "omics" analyses of biofilm and planktonic cell populations had not been performed.

Approach

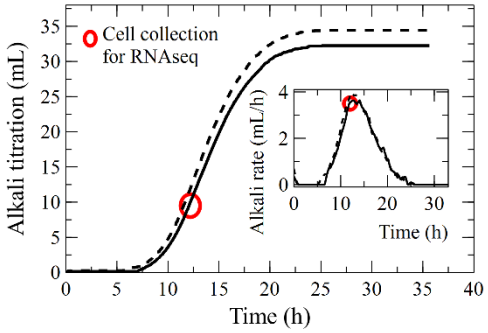
- Novel design to grow both planktonic and sessile cells in a bioreactor facilitating easy separation of both cultures, thus allowing transcriptomic (and proteomic) characterization of both populations separately.

Outcomes

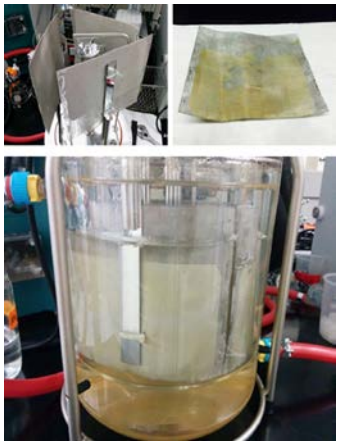
- Cellulolytic bacterial cells that evolved to thrive on solid carbon sources were shown to thoroughly alter expression of their central metabolism, anabolism, and homeostatic functions in response to the availability of solid attachment interfaces and solubilizable carbohydrates.
- The attached bacteria were functionally strong in growth and biomass conversion, while the planktonic cells were stressed and motile due to low available substrates.

Significance

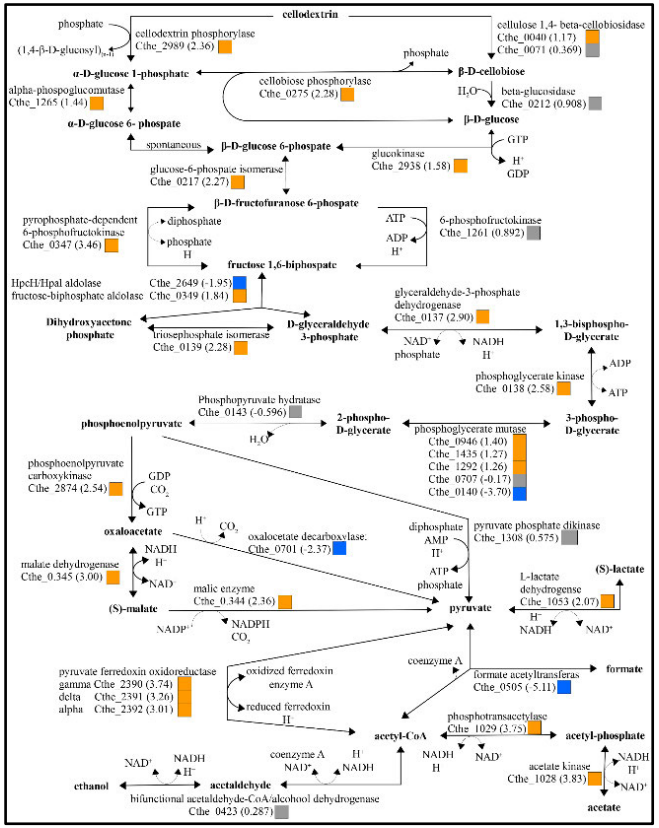
- Microbial attachment to cellulose substrate produces widespread gene expression changes for critical functions of this organism and provides physiological insights for dual cell populations relevant for engineering industrially-ready phenotypes.



Sampled at maximum activity



Novel bioreactor design



Physiological insights into sessile and planktonic cells

Dumitrache, A. et al., "Specialized activities and expression differences for *Clostridium thermocellum* biofilm and planktonic cells," *Sci. Rep.* 2017, accepted.

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