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Using A Metabolic Model Of *Acetobacterium woodii* For Insights Into Its Utility For Biotechnological Purposes

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Acetogens are microbes which produce acetate as a fermentation by-product. They are diverse in their phylogeny but have a metabolic feature in common called the Woods-Ljungdahl Pathway (WLP), which confers the ability to fix carbon dioxide via a non-photosynthetic route. Electrons for this process are derived from diverse substrates including molecular hydrogen and carbon monoxide. The ability of acetogens to utilise components of syngas (H₂, CO, CO₂) make them an attractive target for metabolic engineering for industrially relevant products such as 3-hydroxypropionic acid (HPA). We have previously reported the construction of a genome-scale metabolic model of the model acetogen *Acetobacterium woodii* using a recently sequenced and annotated genome of strain DSM1030. The model consists of 836 metabolites, 909 reactions and 84 transporters and can account for growth on diverse substrates reported in the literature. We identified the reactions used to catabolise fifteen single substrates and 121 substrate pair combinations, and used this to construct a sub-model representing a core set of energy producing catabolic pathways. We then introduced heterologous reactions to allow for production of HPA. Elementary modes analysis of this extended sub-model was applied to further decompose the metabolic network into unique sets of the smallest functioning sub-networks. With CO₂ and H₂ as substrates, we find six elementary modes which produce HPA. One elementary mode produces HPA as a sole by-product with a net positive ATP yield representing growth supporting HPA production. Our analysis provides evidence for the potential of non-acetate dependent growth of *A. woodii*.