Dissolution of Iron Minerals and Metabolic Hierarchy in Labile Organic Substrate Utilization by Iron-Limited *Pseudomonas putida*

HUA WEI , SAMANTHA S. SASNOW, SHO YOSHITAKE, AND LUDMILLA ARISTILDE[1] *

[1]Department of Biological and Environmental Engineering, College of Agriculture and Life Sciences, Cornell University (*correspondence: ludmilla@cornell.edu)

Pseudomonas species, which include plant growth-promoting bacteria, can thrive in diverse nutritional environments due to their extensive metabolic capabilities. Of special interest is how beneficial soil *Pseudomonas* tune their intracellular carbon metabolism in response both to crop-specific root exudates and soil nutritional content. A fundamental understanding of the underlying metabolic response mechanisms will advance our knowledge of belowground carbon dynamics mediated by these bacteria.

Here we investigated the order of preferential metabolism (i.e. metabolic hierarchy) of common root exudates (glucose, succinate, citrate) in *Pseudomonas putida* KT2440 in response to iron (Fe) limitation. As expected, in contrast to Fe-replete *P. putida*, Fe-limited *P. putida* produces secretions that can mobilize μmolar Fe from Fe-bearing minerals common in soils. The extent of this promoted dissolution, however, was dependent on the growth substrate. Intracellular metabolite labeling following ^{13}C tracer experiments with the mixed substrates revealed that, in response to Fe limitation, *P. putida* reprograms metabolic pathways to ahieve specific substrate hierarchies: glucose over succinate and citrate over glucose (Figure 1). We elucidated two potential consequences of these metabolic switches: (1) enhanced carbon fluxes towards metabolite precursors for siderophore biosynthesis and (2) a coupling between substrate-dependent Fe scavening and preferential substrate uptake.

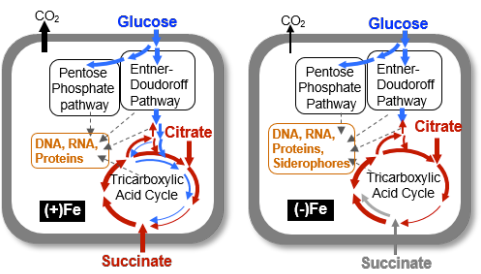

Figure 1. Schematic illustration of the Fe-dependent metabolic routing of mixed-substrate utilization in *P. putida KT2440.*