

July 16-21, 2017 at UC San Diego, CA, USA

Can Autotrophic Carbon-Fixing Pathways Be Catalyzed Without Enzymes?

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Carbon-fixation pathways used by chemoautotrophs have received much attention as potential prebiotic synthetic pathways that would provide a parsimonious explanation for the organization of biochemistry. The pathways of greatest interest are the reductive tricarboxylic acid (rTCA) cycle,^[1-2] the AcCoA pathway (also known as the Wood-Ljungdahl pathway)^[1] or even a hypothetical combination of both (Figure 1).^[3] However, experimental work to assess the plausibility of these pathways in the absence of enzymes has been limited.^[4-7] This presentation will summarize our efforts to identify simple non-enzymatic catalysts for the two pathways and assess productive and parasitic off-cycle reactions.^[8]

References:

[1] Wächtershäuser G (1990) *Proceedings of the National Academy of Sciences USA* 77:200–204. [2] Morowitz H J et al. (2000) *Proceedings of the National Academy of Sciences USA* 97:7704–7708. [3] Braakman R and Smith E (2012) *PLoS Computational Biology* 8:e1002455. [4] Huber C and Wächtershäuser G (1997) *Science* 276:245–247. [5] Huber C and Wächtershäuser G (1997) *Science* 276:245–247. [6] Cody G D et al. (2001) *Geochimica et Cosmochimica Acta* 65:3557–3576. [7] Cody G D et al. (2004) *Geochimica et Cosmochimica Acta* 68:2185–2196. [8] Zhang X V and Martin ST (2006) *Journal of the American Chemical Society* 128:16032–16033. [8] Muchowska K B et al. (2017) *submitted*.

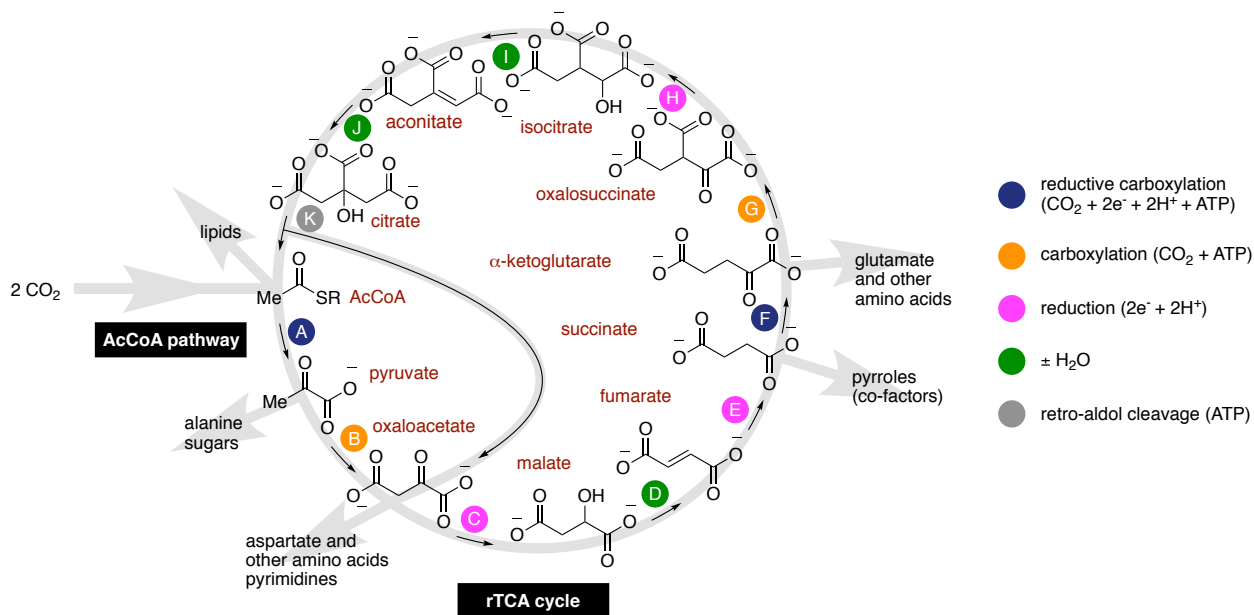


Figure 1 –Hypothetical stabilized autocatalytic network consisting of the AcCoA pathway and the rTCA cycle.