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

# A Prebiotic Pyruvate Reaction Network that Leads to a Continuous Production of Metabolic Compounds: Evidence from Carbonaceous Chondrites?

A.C. Rios[1] and G. Cooper[2],
[1]NASA Ames Research Center and Blue Marble Space Institute of Science,
[2]Exobiology Branch, NASA-Ames Research Center
* andro.c.rios@nasa.gov

At the heart of central carbon metabolism lies pyruvate, a small keto-acid that is generated from glycolysis and used as the carbon source for the construction of lipids, amino acids, gluconeogenesis and the citric acid cycle [1]. How did this small organic come to occupy a vital position in extant biochemistry? One hypothesis is that pyruvate naturally exhihited the chemistry that facilited its incorporation into a proto-metabolism. Previous investigations on the chemistry of pyruvate have demonstrated its versatility and scenarios for the prebiotic synthesis of pyruvate or closely related compounds have also been recently reported [2–7]. The detection of pyruvate and related citric acid cycle compounds in carbonaceous chondrites has also provided strong evidence for its prebiotic relevance [8]. In attempts to understand the survival of these sensitive compounds in uncontrolled meteoritic environments, we have found that pyruvate can serve as a single-source reactant and continuously generate even labile compounds such as oxaloacetate. The production of these metabolites appear to result from facile isomerization, hydration, fragmentation, and decarboxylation reactions of subsequent pyruvate aldol-type polymers. Importantly, compounds such as oxaloacetate and other (larger) products replenish the starting material as they readily degrade to pyruvate. We have searched meteorite samples to find additional evidence of this reaction network that took place before the origin of life. Additional results from these studies, proposed mechanistic pathways, and implications for prebiotic chemistry will be presented.

**References:** [1] Berg JM et al.(2007) *Biochemistry*; 6th ed. [2] Cody GD et al.(2000) *Science* 289:1337–1340 [3] Hazen R and Deamer D (2007) *Origins of Life and Evolution of Biospheres* 37:143–152. [4] Novikov Y and Copley SD (2013) *Proceedings of the National Academy of Sciences of the United States of America* 110: 13283–13288. [5] Griffith E et al. (2013) *Origins of Life and Evolution of Biospheres* 43:341–352 [6] Bryant DE et al (2010) *Chemical Communications* 46: 3726–3728. [7] Coggins AJ and Powner MW (2016) *Nature Chemistry* 9: 310–317.[8] Cooper G. et al. (2011). *Proceedings of the National Academy of Sciences of the United States of America.* 108:14015–14020.

.