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Using Reaction Kinetics to Assess Chemistry of Prospective Importance to the Origin of Life

P. J. Bracher^{1*}, T. D. Campbell¹, M.L. Cheneler¹, C.T. Devall¹, R. Febrian¹,
C.A. Hart¹, and J.P. Roddy¹

¹Department of Chemistry, Saint Louis University, St. Louis, MO, USA

* Correspondence Author: bracher@slu.edu

Determining how the mixture of abiotic chemicals present four billion years ago could have naturally assembled into an autoamplifying network of reactions is a challenge of extraordinary complexity, and it can be difficult to decide where to begin. When evaluating chemical reactions proposed as relevant to the origin of life on Earth, the universal importance of water to life necessitates the consideration of hydrolysis as a deleterious side reaction. This presentation summarizes two key thrusts of research in our group: (i) the influence of simple salts on the rates of coupling and hydrolysis of peptides and (ii) measurements of the rates of thiol–thioester exchange and thioester hydrolysis to assess the feasibility of a Thioester World—a period in early evolution where thioesters may have filled an important role as a kinetically stable, high-energy species like ATP does today.

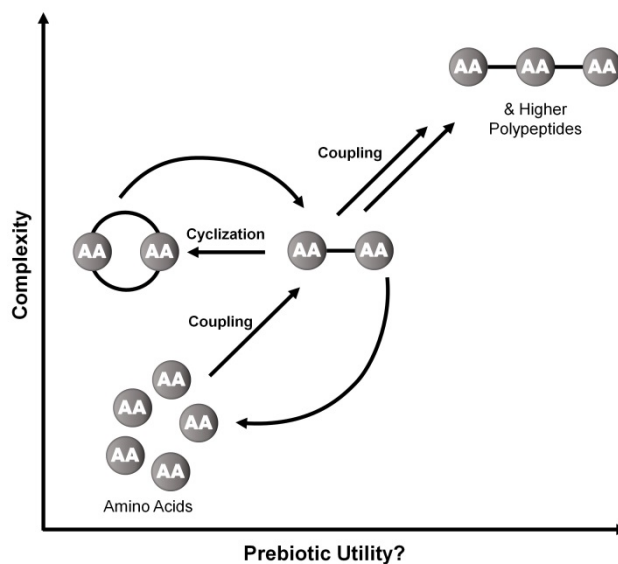


Figure 1 – As amino acids in a system couple to form higher oligomers, the competing rates of hydrolysis and cyclization (into DKPs) must be considered when evaluating the favorability of conditions to the development of complexity.