# Experimental progress begins to fill gaps in hypotheses for life's emergence

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SFI Omidyar Fellow Rogier Braakman, in a commentary in *PNAS*, reviews two scientists' recent progress in simulating prebiotic chemistry at deep-sea hydrothermal vents and puts the research in the context of what we know, and what we still need to learn, about life's beginnings.

Scientists have long wondered whether deep-see hydrothermal vents—where unique geochemistry, temperatures, and pressures combine to form extreme environments seen nowhere else on Earth—might have been the crucibles for the earliest life.

Under one set of hypotheses known as "metabolism first," explains Braakman, life arose near these vents from combinations of self-reinforcing and increasingly complex energetic geochemical reaction networks that eventually became metabolism. Another set of hypotheses known as "genes/replication first" proposes that life arose from self-replicating polymers or clusters of lipids that gradually created metabolic reactions as a way to replace depleting supplies of interstellar or

atmospheric chemical inputs.

Recent experiments by Yehor Novikov and Shelley Copley of the University of Colorado Boulder are filling in key gaps in the hypotheses involving self-reinforcing metabolic reactions emerging from geochemistry, notes Braakman in a two-page review. He then assesses the state of knowledge for "metabolism first" and points to needed areas of study for origin of life research generally.

"Systematic studies of classes of natural organic chemistry, such as pursued by Novikov and Copley for hydrothermal vents, may thus help us not just in asking why life selected the forms of organic chemistry that it uses, but also to identify fundamental constraints in biology that result from that choice of chemistry," Braakman concludes.

Read Braakman's commentary in the *Proceedings of the National Academy of Sciences* (August 1, 2013, subscription required for full access).

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