# Spontaneous autocatalysis in a primordial broth

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Driven non-linearities lead to pattern formation. Here we study the dynamics of a complex chemical system, driven by electric discharge that forms from a gas mixture of methane and ammonia in the presence of water. Using real-time mass spectrometry, we observe the generation of a primordial broth composed of thousands of different molecules in a mass range from 50 to 1000 Dalton. The temporal development of the primordial broth reveals the spontaneous emergence and disappearance of oligomeric surfactants [1]. Strong non-linearities are required for these aperiodic chemical oscillations. The phenomenon is robust against different gas compositions and concentrations, temperatures and many details of the experimental set-up. We analyze the chemical composition of the solution by different methods like (high-resolution) mass spectrometry, NMR and gas-chromatography to find high-reactive molecules and possible catalysts. We find that oxidation and doping with small amounts of an active broth can trigger the production of the oligomers. We suggest that surface active molecules lead to phase transfer catalysis in the oil/water mixture and self-organize to a spontaneously emerging autocatalytic network.

[1] Wollrab et al., Orig Life Evol Biosph 46:149-169 (2016).