

Artificial chemistry as a method to find the connection between chemical evolution and the origin of life

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Life was still not found outside Earth and therefore we still cannot make any kind of empirical generalization about the main features a chemistry must have to evolve into life or about the necessary environmental conditions. We are also still far from obtaining a life form in the laboratory beginning with relatively small carbon compounds like aminoacids, monosaccharides and fatty acids.

Simulation is a parallel and more practical method to explore the path to life. Many hypotheses about chemical evolution and life can be tested with a computer if the underlying model or formal system can be transposed to a program. Simulating a whole planetary environment is, of course, out of the question and so the problem must be addressed in small parts. The “small” question we ask is then: “Is it possible to design an artificial chemistry that is capable to evolve an artificial life instance?”. Life on Earth is carbon based, presenting four major features: acid-base reactions (polymerization), redox reactions (energy), molecular recognition (specificity) and catalysis. An artificial chemistry tool is being developed which is based on this model. A “well stirred reactor” dynamic is applied to a large set of agents, equivalent to atoms, with different types of interaction abilities. These atoms can react to give molecules defined in a 2D molecular plane. Specific interactions, catalysis and Lewis acid-base like reactions, S_N1 and S_N2 types, were observed. Different initial conditions are now being tested and the evolution of the system is being analysed to find metabolic pathways.