

# Autocatalytic Sets: The Origin and Organization of Life

Wim Hordijk



*Life is a chemical reaction.* Or, more precisely, life is a functionally closed and self-sustaining chemical reaction network. In other words, living systems produce their own components, in such a way as to maintain and regulate the chemical reaction network that produced them.

During the 1970s, several researchers independently developed formal models of a minimal living system based on the above definition. However, most of these models do not explain how these systems could have emerged spontaneously from basic chemistry. They provide insights into the *organization* of life, but not necessarily its *origin*.

Now, a new mathematical framework, based on the original notion of autocatalytic sets, is able to shed more light on both of these aspects. *Autocatalytic sets* capture the functionally closed and self-sustaining properties of life in a formal way, and detailed studies have shown how such sets emerge spontaneously, and can then evolve further, in simple models of chemical reaction networks. Furthermore, this new framework has been applied directly and successfully to real chemical and biological networks. Thus, the autocatalytic sets framework provides a useful and formal tool for studying and understanding both the origin and organization of life.

In this talk, I will give a non-technical overview of the background, concepts, and main results of the formal framework, and how it can perhaps be generalized beyond chemistry and the origin of life to entire living systems, ecological networks, and possibly even social systems like the economy.

