Last week, the Program for Evolutionary Dynamics at Harvard University, announced to a panel of scientists and to The Jeffrey Epstein Foundation, its main sponsor, that its staff were one step closer to understanding the link between chemical kinetics and when life takes over.

"Prelife morphs into life when replication occurs," Martin Novak asserted, Director of the Program for Evolutionary Dynamics and Professor of Mathematics and Biology at Harvard. "There are many attributes necessary for life," he explains, "and it's not clear whether metabolism came first or replication. What is clear, is that replication sets evolution into full motion, dramatically distinguishing life from prelife. It's the mechanism that allows for efficiency and complexity to develop."

"Replication is the ultimate catalyst for life," Jeffrey Epstein adds, founder of The Jeffrey Epstein Foundation. "The fittest molecules dominate quickly, then on an exponential level and then are selected again."

To illustrate this, Novak and his team use a synthetic approach to recreating life. Specifically, their model of prelife consists of activated ribonucleotides (the building blocks for DNA and RNA) and an environment conducive to their polymerization (the process by which molecules combine to form chains).

Novak explains that this synthetic approach is favorable for a host of reasons. Firstly, it's virtually impossible to recreate the atmosphere that existed when life began four billions years ago. Secondly, simple compounds, such as ribonucleotides, can more clearly reveal the steps towards life. Thirdly, polymerized nucleotide molecules can form replicating templates. Lastly, the famous 1952 Miller_Urey experiment and derivatives of that, established that amino acids and other organic compounds could well have emerged from the atmosphere of early earth.

After creating polymer chains from activated ribonucleotides, Novak shows how the environment, such as nucleotide concentration, affects chain sequence, their lengths, abundance and durability. The presence of certain sequences also affects the generation of other sequences. But despite these changes, Novak shows how prelife sequences always reach an equilibrium distribution with different chemical species coexisting.

Novak then looks at nucleotide chains with some capacity to replicate. (Chains replicate by attracting corresponding nucleotides, which eventually form a duplicate chain and break off). Replication rates only need to reach a low threshold for the fittest sequences to quickly dominate. Furthermore, templating capacity doesn't have to be fully formed for selection to quickly evolve. Even base pairs are sufficient. "In prelife, many events need to occur for molecules to become more sustainable. But as soon as any replication happens, one event can lead to competitive exclusion."

Intriguingly, Novak also shows how certain chemicals, clay montmorillonite, for example, can induce nontemplated nucleotides to polymerize into sequences capable of templating after purification. The introduction of wet-dry cycling in the presence of lipids can also promote the template-directed synthesis of deoxyribonucleotide monophosphates.

The fact that replicating templates can arise from a single chemical reaction, suggests that life did not just evolve from prelife but could have literally sparked into being: a chemical anomaly that led to a unstoppable evolution of itself; an anomaly that could have occurred in various places around the earth, perhaps in a series of fits and starts but quickly proliferated with ever growing efficiency.

This synthetic approach for polymerization and replication is certainly controversial. Many argue that the components are too removed from those of early earth. For example, very specific activation agents are used to encourage replication (ImpA for adenine or ImpG for guanine). And the concentration of chemicals (especially cytosine and ribose) is billions of magnitude higher than what one would expect under prebiotic conditions.

Despite these limitations, Novak argues that the simplicity of the ribonucleotide model and its susceptibility to chemical reactions allows the scientist to "crystallize intuition, outline the dynamical transition caused by replication and point toward counterintuitive ideas like the dominance of long sequences."

Many questions remain, for example, were other forms of replication evolving at the beginning of life? But in the meantime, if Novak reveals that life is in part, a chemical anomaly that rapidly evolved from selection, one could derive that life, is not so much a force as it is a consequence, a by-product of ever increasing capacity for sustainability; and no matter how complex its tentacles or synapses, it should not be mislabeled as a desire for survival.