Researchers move one step further towards understanding how life evolved

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A fundamental problem for biology is explaining how life evolved. How did we get from simple chemical reactions in the prebiotic soup, to animals and plants?

A key step in explaining life is that about 4 billion years ago, all we had was just the simplest molecules that could replicate themselves. These are called 'replicators' - the earliest form of life, so simple that that they are almost chemistry rather than biology. Somehow they joined together to cooperate to form more complex things. This was the basis of the genome that builds us today.

But why did they join together? Why did they cooperate? Any cooperation could be easily exploited by 'cheating' replicators that didn't cooperate. Did it require special environmental conditions?

Today, researchers from the Department of Zoology at the University of Oxford show, in Nature Ecology & Evolution, that replicators could have solved this problem themselves. If some replicators were a bit cooperative, and some were a bit 'sticky' then this would lead to clumps of cooperating replicators that would evolve to become more and more cooperative, eventually producing simple genomes, and then eventually, all of life that we see around us today.

Lead researcher, Samuel Levin, at the Department of Zoology, Oxford, said: "As humans, we care about how things start. Our results help to solve some of that puzzle and are also relevant for trying to figure out how common we might expect complex life in the universe to be: how easy are these early steps?

"I was surprised by the jump in cooperation you get when you allow coevolution—it was higher than I expected. There seems to be some sort of cyclical feedback."

Co-author, Professor Stuart West, at the Department of Zoology, Oxford, said: "Our results show us that the same issues that we think about today, with humans (cooperating and cheating) can help explain how life evolved. Life evolved as societies of cooperating replicators /

molecules."

Authors tested their hypothesis using mathematical models. They wrote equations which distilled down evolution in early life, and then added stickiness and cooperation to see what happened. They showed, mathematically, that more complex life could evolve only when stickiness and cooperation were allowed to coevolve at the same time.

The study, titled "The social coevolution hypothesis for the origin of enzymatic cooperation," is published in *Nature Ecology & Evolution*.

More information: Samuel R. Levin et al. The social coevolution hypothesis for the origin of enzymatic cooperation, *Nature Ecology & Evolution* (2019). DOI: 10.1038/s41559-019-1039-3

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