

Is a new form of life really so alien?

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The idea of discovering a new form of life has not only excited astronomers and astrobiologists for decades, but also the wider public. The notion that we are the only example of a successful life form in the galaxy has, for many, seemed like an unlikely statistic, as we discover more and more habitable planetary bodies and hear yet more evidence of life's ability to survive in extreme conditions. A new essay, published May 8 in the online, open-access journal *PLoS Biology*, examines what really constitutes 'life' and the probability of discovering new life forms.

Professor Gerald Joyce, from The Scripps Research Institute in La Jolla, California, discusses in the essay the basic requirements for a life form to exist. He says, "Life self-reproduces, transmits heritable information to its [progeny](#), and undergoes Darwinian evolution based on [natural selection](#)." He refers to this heritable information as 'bits' (for life as we know it, this includes the four bases of DNA), and explains that although [Darwinian evolution](#) results in new combinations of these bits, this does not define a new or alien form of life. Indeed, to date no truly new life form has been discovered—either in extreme environments on Earth or on other planets—that contains new bits, despite evidence suggesting life on meteorites recovered in Antarctica, or on any of the so-called 'habitable' planets discovered in our galaxy.

How could a truly new life form arise? Joyce explains that an organism could either arise directly through chemistry, or spin off from existing biology. For the former, a life form would self-organize "into a bit-generating system." It's thought that this is how life originated on Earth; from a primordial soup of chemicals in an aqueous environment that

generated self-replicating molecules, which then mutated and evolved. Joyce argues, "A life form that arises directly from bit-free chemistry would be considered 'new' from the outset, while one that derives from a biological cell would have a long way to go before reaching the threshold."

It is in these differences between chemical or biological initiation—that is to say, whether the life form has developed from an existing life or seemingly independently—that confusion and misinformation occurs surrounding the probability of a new life being discovered or created. Given that we only know of one life form—our own—we can't meaningfully estimate the probability of new life arising, either on Earth or elsewhere.

"I think humans are lonely and long for another form of life in the universe," says Joyce, "preferably one that is intelligent and benevolent. But wishing upon a star does not make it so. We must either discover alternative life or construct it in the laboratory. Someday it may be discovered by a Columbus who travels to a distant world or, more likely in my opinion, invented by a Geppetto who toils at the workbench."

In the accompanying [PLoS Biology](#) Podcast, Joyce discusses in more depth the ability of scientists to discover the origin of novel life forms, and whether the emerging field of synthetic biology can actually lead to new forms of life.

More information: Joyce GF (2012) Bit by Bit: The Darwinian Basis of Life. *PLoS Biol* 10(5): e1001323. [doi:10.1371/journal.pbio.1001323](https://doi.org/10.1371/journal.pbio.1001323)

The accompanying podcast will be available here:

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