

## Comment

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### On the Misgivings of Anthropomorphic Consensus Polling in Defining the Complexity of Life

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In a recent paper (1) Edward N. Trifonov has turned his statistical expertise on one of the most enigmatic questions still vexing our scientific conceptions of the universe: *What is life?* – If applied ingeniously, statistical methods are marvelous tools indeed, but yet, they hardly breed miracles on their own. To be sure, professor Trifonov has done wonderful work before, scrutinizing the system of coded protein synthesis for innate secrets by sophisticated statistical analyses (2-4).

To start with, many others have put forth various *definitions* of the living state as such – in contrast to non-living matter, which pervades most of the observable universe. By tabulating 123 versions of such learned statements (partly overlapping, that is, but slightly or distinctly different from one another), and to simplify matters, Trifonov (1) has now applied his statistical tools on the wording of these definitions. – Would the grouping of major terms by related meaning, as followed by word counts of occurrence in the major groups, yield any superior, canonical relationship? – Nota bene, not just a meaningful concept at a superior level, but a universally applicable, novel and *minimalistic definition of life* as such, to the inclusion of “*any forms of life imagination may offer*”? – Although he does not meticulously discern what properties should be required of such a universal definition, Trifonov proposes to have found exactly that, as merely based on just two terms: “*Life is self-reproduction with variations*”. In fact, this punchline was put forth earlier (4), as an aphoristic rephrasing of Darwin’s principle.

The author must have found it reassuring that an earlier hunch of his could be extracted as a consensus from a much larger sample from the expert literature, although only ~15% (18 of 123) happened to contain a pair of terms related to his condensate. Moreover, by explicitly referring to Oparin [as cited in (5)] – “*Any system capable of replication and mutation is alive*” – Trifonov moves close to implying that his minimalistic definition may not only be necessary but even sufficient for sorting out the living state from non-living matter. On the other hand, he likens his statistical vocabulary approach to a “*Principal Component Analysis*” (aimed to reduce a complex data set to an array of subsets that vary independently of one another) – with the “*extraction of a single principal component*” (the *major* one, covering most of the data), which might serve as the main characteristic of the living state – so far, so good.

Yet, as the author himself is quite aware, “*Even most primitive forms of observable life are still too complex, to claim that they can be reduced to the above simple formula*” (1). Hence, it is rather premature to adopt his simple formula as the defining principle of “*any forms of life imagination may offer*”. As to my personal imagination, for that matter, I should not hesitate to subsume *frost*

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tracery on a window pane or frostwork-type mineralizations in cave deposits under this generally defined set of natural phenomena. They actually replicate certain preexisting patterns, and do so with many variations, but calling them *life-like* for more than a rather superficial resemblance should be besides the point, I guess.

There are good reasons to suggest, therefore, that Trifonov should not stop at the very first *principal component* of his statistical vocabulary filtering approach. Additional components, likewise both principal and indispensable for zooming in on the *essence of life*, should not lightly be dismissed beforehand. Alternatively, the intended meaning of the main part in his favorite component – *self-replication* – should be specified so distinctly and concisely that “*no form of non-living matter imagination may offer*” might ever qualify for having that capacity. If, and only if this precondition has been met can self-replication be considered equivalent conceptually and empirically to life as such. – And what a big *if* that is, since now the burden of defining the *complexity of life* in simple terms has shifted to defining *self-replication* and its preconditions at the same level of life-like complexity.

In this brief discourse I have deliberately focused on the main part of the composite formula, “*Life is self-reproduction with variations*”, since the secondary part does not add a new dimensionality to the problem at all. To be precise on this, “*self-reproduction without variation*” would be entirely fictitious, in that it can never be realized as a natural process. In fact, in the course of biological evolution – of earthly life as we know it – the multiple sources of stochastic variation in reproductive processes have progressively been narrowed down to acceptable and affordable levels, but eliminating each of such sources once and for all is beyond the bounds of possibility.

Why should the *essence of life as such* be defined in idealistic or anthropomorphic terms in the first place? Who would actually benefit from such a canonical definition if it ever existed? – While most biologists in general do not care, it is foremost some non-biologists trying to comprehend the enigmatic origins of life from non-living matter who are convinced that their goal cannot be reached without having defined life as such beforehand. Yet, not all such scholars share this conviction, and personally I very much tend toward the sceptical side on this dividing issue (6). In defence of this sceptical stance, I consider it more relevant for a comprehension of biological complexity to familiarize with

the principles of *fuzzy sets* and *fuzzy logics* (7). This should not be denounced as *fuzzy thinking* in a pejorative sense. Rather, it is to appreciate the appropriateness of variance-loaded terms and categories for about every aspect of the natural world, including life with all its intrinsic complexity and evolutionary history. At the initial stages, life’s emergence had to cope with much higher degrees of variance than what is presently observed in the current biosphere. Hence, putting coordinate restraints on stochastic variance in ever so many independent categories by natural selective processes should be at the forefront of how to understand the living state.

To illustrate the anthropomorphic character of certain unreflected definitions, I should like to draw on a comparison of German and English conventions concerning food intake. While it should sound sensible enough in German to “define” the human species as “*das ‘essende’ Wesen*”, the direct translation into English would make no sense: “*the ‘eating’ creature*” would cover most animals alike. British pragmatism, at least on this issue, allows animals at large to *eat* their food as well, whereas “*essen*” in German is a decidedly human privilege, in contrast to “*fressen*”, as used for the equivalent activity in animals. Such a pseudo-definition, however, would be rather trivial indeed, “*a human being is a human being, Period!*”.

In summary, the statistical vocabulary approach of Trifonov (1) to extract a simple defining formula for the intrinsic complexity of life amounts to an enchanting exercise on the border between basic science and aphoristic poetry. I was somewhat reminded of my first visit to the United States in the mid sixties, when a frenzy flourished among high school kids to come up with the most fanciful variation on “*Happiness is ...*”.

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