Review of: "Phylogenetic Evidence for the Early Origin of the Homeostatic Influence of the Biota on Planetary-Scale Geophysical Processes"

Toby Tyrrell[1]

1 University of Southampton

Potential competing interests: No potential competing interests to declare.

The paper by Leggett and Ball could be an interesting contribution if not based on flawed premises and flawed logic.

An obvious instance of a flawed (or at the very least highly arguable) premise is that the Gaia hypothesis is true. Most scientists do not subscribe to this hypothesis. This is even stated on the Wikipedia page for the hypothesis: “the Gaia hypothesis continues to attract criticism, and today many scientists consider it to be only weakly supported by, or at odds with, the available evidence.[7][8][9][10]”. The fact that the Gaia hypothesis is not given credence by so many scientists is not acknowledged in the Leggett and Ball paper and none of the references just mentioned from the Wikipedia page are included in the reference list for the paper.

A second false premise is that “the planetary nature of Gaia is nonetheless merely contingent.” This is obviously false. Gaia is nothing if not a planetary-scale hypothesis. There are many, many examples of closely related individual organisms cooperating to control their local environment, but this is not enough. Examples are given, for instance, in chapter 2 of my (Toby Tyrrell)‘s book “On Gaia”: termite mounds, honeybee colonies, beaver dams, and the list could go on. However, none of these are more than local in effect. For Gaia to be real, there would need to be cooperation between the vast numbers of unrelated organisms that make up the global biota. While biologists are completely happy with the idea of kin selection leading to cooperation between closely-related organisms, they completely shy away from the idea that there is altruistic cooperation between non-related organisms, and thus that there is altruistic (self-sacrificing) cooperation between the multitude of species making up the global biota. There is no evidence that this is what actually happens.

There are other errors of logic. It is not correct to conflate biological impact on the environment with the idea that these are always beneficial and thus that the biota controls the global environment towards a favourable state (i.e. the Gaia hypothesis). I recommend the authors to chapter 6 of my book “On Gaia”. Scientists are very happy to accept that life can be a geological force, or in other words that the impacts of life can be sufficiently large to alter the global environment. I don’t think anyone doubts this; the evidence in favour is huge. The power of life is evident in the oxygen content of the atmosphere, the atmospheric methane, the regulation of nitrate levels in the ocean, and so on. But that is completely different from accepting that the large net impact of biology is necessarily somehow coordinated and inevitably favourable. The authors confuse co-evolution of life and environment with the Gaia hypothesis. Evidence for the former is not

evidence for the latter.

Suggestions of an early evolution of biofilms or of pine forests are thus irrelevant to whether or not the Gaia hypothesis held at those times (it is highly doubtful it ever has). Statements such as “the first successful cell can be seen as a Gaia itself” are unfortunate.