Review of: "Evidence for the Early Origin of Genes Leading to the Development of Biogeochemical Homeostasis at Planetary Scale"

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Potential competing interests: No potential competing interests to declare.

V4: Evidence for the Early Origin of Genes leading to the development of Biogeochemical Homeostasis at Planetary-Scale

V1: Phylogenetic Evidence for the Early Origin of the Homeostatic Influence of the Biota on Planetary-Scale Geophysical Processes

Revied by Vladimir F. Niculescu, cellbiologist

This work could be an interesting contribution in the framework of evolutionary cell biology (ECB). For that, the authors would have to restructure it, throw off balast and apply a modern cell biology vocabulary, without superfluous terms like “Gaja“ or less meaningful sentences like “ Development of biogeochemical homeostasis at Planetary-Scale” The V-4 version is full of craft flaws and **not ready for publication.**

It needs a further major revision

Also in the V4 variant the revised text remainsrather confused. The authors insist on a 50 years old (today not very meaningful) terminology and refer to the "homeostatic influence of the biota on planetary-scale biogeochemical processes". What should readers who are familiar with modern biological terminology (*https://doi.org/10.1038/s42003-021-01918-4 | www.nature.com/commsbio*) understand from this? And: how should ancient LUCA and LBCA genes influence the biogeochemical homeostasis at planetary-scale (i.e. the environment)? And what does biogeochemical homeostasis actually mean? Is it a state of equilibrium that has an evolutionary history? The authors have to revise all this in the Abstract and Introduction.

In modern cell biology there is an unchallenged thesis that the environment on which phenotype acts causes phenotype changing or cell plasticity due to gene modulation (down-, or uploading) and cell plasticity. Evolution and development has been controlled in the last 2400 My and also today by oxygen levels and it is mostly very old genes (unicellular genes, UG) that are reactivated, while newer genes (MG, multicellular genes) are shut down in metazoans (e.g. in cancer).

Evolution, development and gene changing were environmentally controlled.
The authors have to show already in the abstract how genes can control the medium homeostatically.

I strongly recommend:

1. The **huge abstract of 565 words** should be reduced to a maximum of 200 words. Unusual expressions like "Gaia", "Biogeochemical Homeostasis", "Planetary-Scale", "necessary attributes of Gaia", "there is one Gaia on Earth" should be avoided if they cannot be explained in terms of modern evolutionary and molecular biology. References to previous authors are not necessary in the abstract.

2. **Change the title and abstract** to make clear to the reader the meaning and purpose of this work. At present, the title and abstract are not very informative, and in some cases even misleading. Purpose and meaning of the work are only recognizable in Conclusion and Disscussion. However, they must already appear in the Abstract. Details about LUCA and LBCA belong in the Introduction.

3. T**he introduction and aim to the study containing 2343 words** is also too long. It does not need to be divided into several subchapters. It must be fluent to read, without the multiplicity of citations and authors' names.

4. This work is a **review work** and not a research paper. It does not require main text division into material, results, and discussion. The data presented here can be distributed partly in the introduction and partly in subsequent chapters with strong statement titles. In the new revised chapters, the authors must show how they process the statements and ideas of the previous researchers and how they interpret these ideas in an own opinion. It is not sufficient to mechanically pass on external statements. Use meaningful titles and subtitles and never "cases".

5. **Apendix A1** (but only first paragraph) must be included in Introduction. The second sentence of Appendix 1 should be omitted completely. It has no place in a modern paper about gene and molecular cell mechanisms.

6. Write a new chapter on old ancestrale genes that play an important role in the **transition period to multicellularity and cancer.**

7. Avoid labeling of each reference with authors' names. This make the MS difficult for reading **Introduce a numerical reference list** from (1) to (n) without separating A1 references from non-A1 references that is unusual.

8. Pick **better keywords,** it can be more than six and even related words (sentences)

Post scriptum (PS): **In some European languages, the Gaia term is even used in a very negative way. Gaia shall fetch you, or Gaia has fetched him. That is, the earth and the dark spirits from the depths devoured him.**