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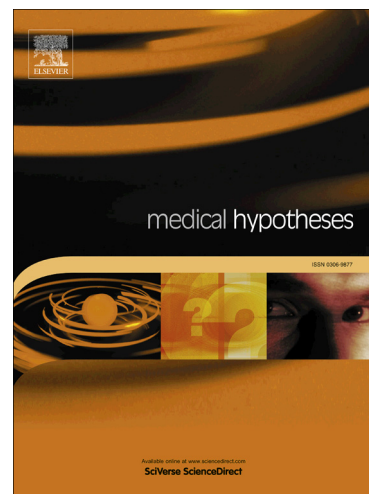
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1 *Hypothesis paper*

2 **Conceptual challenges for the emergence of the** 3 **biological system: cell theory and self-replication**

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13

14 **Abstract**

15 We re-evaluate research relating to the current theories of the emergence of biological
16 systems. The challenge being that research programmes concerning the emergence of these
17 systems are viewed as the same as those relating to the origin of cells. Cells are strikingly
18 important biological entities, hard wired into the entire field of biology. The development of
19 biological systems took place much earlier than the origin of cells and even before the
20 existence of the Last Universal Common Ancestor (LUCA); a period which could be
21 construed as being preLUCA and which would have taken place during in a
22 ribonucleoprotein world. This latter entity was named FUCA (First Universal Common
23 Ancestor) and could be viewed as a “great-grandmother” to LUCA, from which the three
24 domains of life, namely Archaea and Bacteria, and Eukarya (emerging as a chimera of the
25 latter two) evolved. RNA-world theories are the focus of mainstream research programmes
26 for the origin of life *stricto sensu*. In the RNA-world view, self-replication of nucleic acids
27 is seen as one of the most relevant events in the pre-biotic world. Without denying the
28 relevance of self-replication, we argue here that the most germane event which occurred in
29 the pre-biotic world was the crosstalk between nucleic acids and peptides. When these two
30 macromolecules started to interact, the singularity that aggregated the complexity required
31 to produce life began to emerge. Thus, comprehension of the early origins of the translation
32 machinery and the assembly of the genetic code is key. Therefore, the relevance of cell
33 theory and self-replication should be re-evaluated as well as the concept of life itself.

34 **Keywords:** Cells; LUCA; nucleic acid; RNA World; Bacteria; Archaea; translation system

35

36 **1. Historical background**

37 During the mid-nineteenth century, biology experienced an exponential structural and
38 conceptual revolution whereby new ways of understanding biological processes were

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