

July 16-21, 2017 at UC San Diego, CA, USA

## Two Gene Hypothesis for the Initiation of Life-like Systems towards the RNA World

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**Introduction:** In this study, the minimum number of genes for initiation of life-like systems was deduced on the basis of characteristics of RNA molecules and the characteristics of life-like systems [1]. RNA played important roles in the emergence of the first life-like system on primitive Earth since RNA molecules involve both genetic informational and catalytic functions. However, there are several drawbacks regarding the RNA world hypothesis. However, it is necessary to identify what kinds of elemental functions with RNA molecules were essential for the initiation of life-like systems. I have conducted a conceptual analysis of the characteristics of biosystems as a useful approach to deduce a realistic life-like system regarding the definition of life on the basis of comparative analysis of biosystems at different hierarchical levels [2].

**Inherent machinery for controlling information and metabolism at different hierarchical levels:** Most materials found in life-like systems on the Earth involve the same type molecules for replication, information flow. Although this is true in life-like systems, such as prokaryote, eukaryote, multicellular organisms, social insects, and human societies, these systems can be categorized on what types of inherent machinery for controlling information are present at different hierarchical levels. For instance, the machinery for replication and transformation in eukaryotes is indeed separately carried out inside and outside the nucleus, while prokaryotes do not possess the corresponding mechanism in the cell. The differences among these systems on controlling machinery of bio information was described in detail in the previous paper, and then the machinery for controlling information was named as the central controlling system for information (CCSI) [1]. At the same time, it was shown that these systems possess inherent machinery for controlling inflow/outflow and formation/deformation of energy, material, and information beyond the border of the system. This wide meaning of metabolism machinery is dictated by the CCSI. This was named as the central controlling machinery for the inflow/outflow and formation/deformation of energy, materials and information from environments (CMIO).

**Roles and importance of CCSI and CMIO for initiating life-like systems:** The characteristics of life-like systems are dependent on the quality of CCSI and CMIO at different hierarchical levels. According to the analysis of relationship between CCSI and CMIO, the requisite that a system possesses both inherent mechanism for CCSI and CMIO would be necessary for initiation of the system as alive beyond the hierarchical level of building blocks. This finding suggests that the establishment of CCSI and CMIO and a linkage between CCSI and CMIO should have been an essential event for emergence of most primitive chemical system resulting a life-like system. For the formation of CCSI, the assumption that the replicase should be essential is deduced on the basis of verification of the RNA world hypothesis. This is equated to that one gene is essential for emergence of CCSI. On the other hand, one gene is also essential for initiation of CMIO as details were discussed [1].

### References:

- [1] Kawamura K (2016) *Life* 6:29. [2] Kawamura K (2007) *BioSystems* 90:139–150.