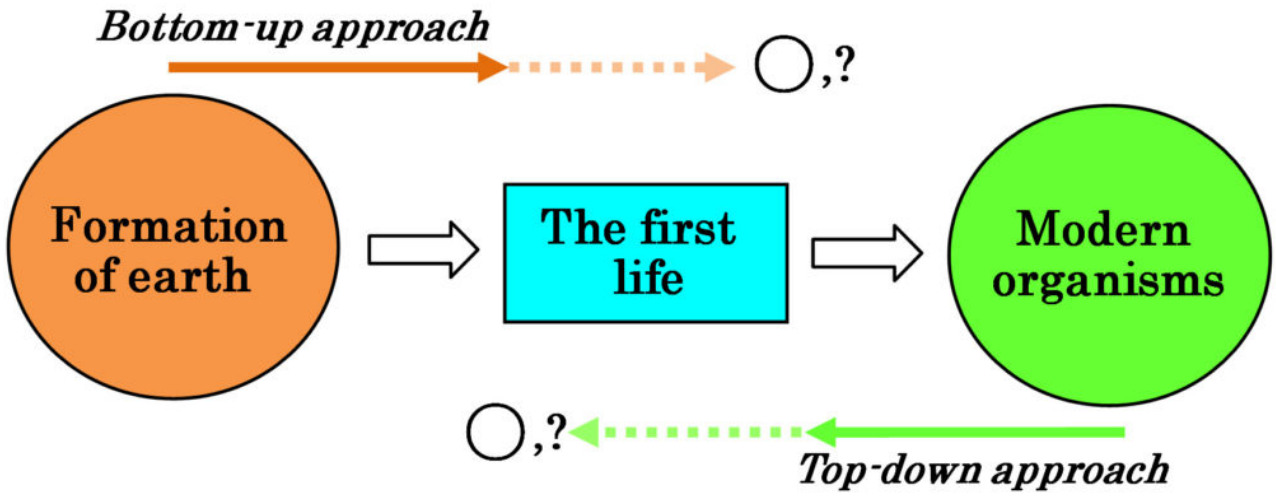
Evolutionary steps in the emergence of life have come into view

Human beings have had a keen interest for many years, on the way how life emerged and the reason why we are on the Earth. When researchers face up to the problem on the origin of life, they, generally, would try to understand what happened on the primitive Earth, where the first life emerged, according to bottom-up approach. Actually, many researchers have carried out chemical analysis of extracts from old rocks and meteorites, physical, chemical and biochemical evolution experiments, planetary exploration, astronomical observation and so on. In parallel, RNA world hypothesis was also proposed for solving the riddle on the origin of life, after catalytic RNAs or ribozymes were discovered. However, the riddle still remains unanswered.

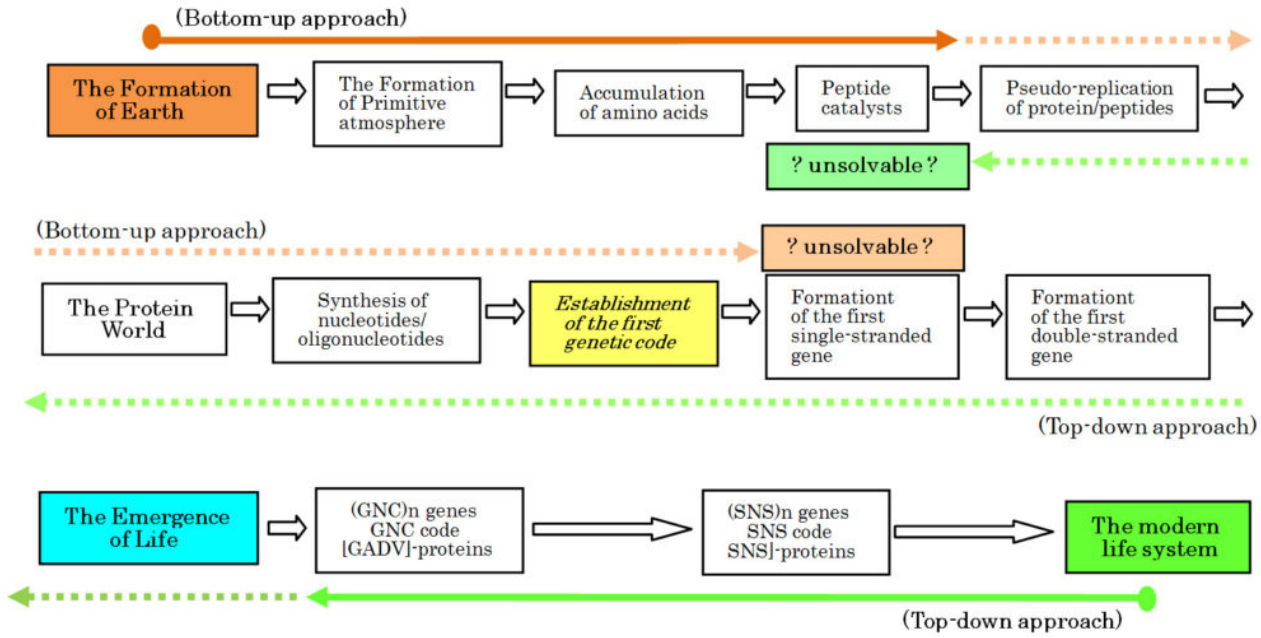


Since all organisms on this planet live under the fundamental life system, which is composed of gene, genetic code and protein, it must be the most important point for solving the riddle to make clear formation process of the system. However, the process could not be, principally, made clear with both the bottom-up approach and RNA world hypothesis.

Contrary to that, I have proposed [GADV]-protein world hypothesis (GADV hypothesis) on the origin of life, independently of them. [GADV] means four amino acids, Gly [G], Ala [A], Asp [D] and Val [V]. The hypothesis has been obtained during the studies from the formation process of entirely new genes in extant microorganisms in the direction to the past or to the first genetic code as going back the time lapse with top-down approach. However, the riddle on the origin of life would not be totally solved only with the GADV hypothesis, because it would not get a clear answer for what kinds of organic compounds having catalytic activities were produced on the primitive Earth.

Then, how should we solve the riddle on the origin of life? One of the powerful ways would be to deduce the consecutive evolutionary steps in a timeline by using a common event as a juncture,

which is obtained by two counter-directional bottom-up and top-down approaches.



Consequently, plausible evolutionary steps from the formation of the Earth through the emergence of life to the modern life system was obtained by using the establishment of the first genetic code, GNC, as a juncture: (1) Primitive atmosphere composed of CO_2, H_2, H_2O, N_2, CH_4, NH_3 etc. was formed. (2) Simple amino acids were physically and chemically synthesized and accumulated on the primitive Earth. (3) Peptide catalysts were produced. (4) The [GADV]-protein world was formed by pseudo-replication with [GADV]-peptide aggregate(s) or protein(s). (5) Nucleotides and oligonucleotides were synthesized and accumulated in the protein world. (6) The first GNC genetic code encoding [GADV]-amino acids was established. (7) Single-stranded $(GNC)_n$ gene(s) were produced. (9) Successively, double-stranded $(GNC)_n$ gene(s) were formed. (8) Finally, the first life emerged on the primitive Earth.

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