

Newly proposed “Bacteria-first” phylogenetic tree of life with landmass and not ocean being the mother of life

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Progenote, LUCA, and Commonote are the terms commonly used for the ancestral life, whose definition slightly differs among the authors. Ancestral life is no longer present on Earth now, but most biologists have long believed that traces of the ancestral biomes remain in their genomes. The first successful tracing of ancestral life was through the structure of ribosomal RNA, showing three different domains such as Archean, Bacteria, and Eukaryote (Woese, 1998). Which one is the oldest life, Archaea, Bacteria, or an intermediate one?

Generally, Archaea is thought to be older or more primitive life than Bacteria, because Archaea prefers reductive conditions, such as observed for the Hadean contrasting with the oxidized environmental conditions of modern Earth. In addition, Archaea predominates in the mid-oceanic hydrothermal ecosystem, and hyperthermophiles are located near the bottom of the phylogenetic tree of Archaea. Especially after the discovery of a H₂-producing (reductive) peridotite hydrothermal system, most people came to imagine that the birth place of life was a mid-oceanic ridge, and as such, Archaea being older than Bacteria; after all, Bacteria live under oxygenic environmental conditions and dominate on landmass. However, current habitat does not necessarily indicate the birth place of life, because it is possible to think life had migrated to a mid-oceanic ridge from a reductive on-land environment. Actually, a Hadean primordial continent could provide reductive circumstances like a nuclear geyser system where reducing gas could be concentrated along the ceiling of an underground cave, suggesting the possibility that the first life had emerged in an on-land reductive environment. Indeed, the bottom of the phylogenetic tree of Bacteria has a branch of hydrogeno- and sulfur bacteria (Woese, 1998), which means that they lived under highly reduced environmental conditions such as in a serpentinized peridotite hydrothermal system, corresponding to OD1 microbes which survive in such modern on-land environments. Considering the requirements to emerge life, some key conditions are the supply of clean water, nitrogen, nutrients like phosphorus, and cyclic environmental conditions such as a dry/wet cycle. The Hadean ocean was too toxic for life due to ultra-acidity, abundant heavy metal elements, and high salinity. In addition, there was no supply of nitrogen from magmatic gas to create the life body. Thus, life could not emerge from the ocean, but rather much more likely in an on-land nuclear geyser system.

I propose a new model of the phylogenetic tree of life as the Bacteria-first model, which emerged through three-step evolution (Maruyama et al., 2017). Consistent with my new model, Petrov et al. (2014) have speculated the ribosome-evolution model, based on the structural growth outwards of ribosome, suggesting that Archaea is secondary after Bacteria. The next target is to discover the core of RNA ribosome in Archaea from MOR is similar to ribosomal RNA of Bacteria. Or, we need to apply the retroposon (SINE) method to micro-organisms to determine whether Bacterial is older than Archaea, to avoid the lateral transfer of gene afterward.

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