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Formation of Initial Cellular Structures Through Thermodynamic Inversion

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According to the author's inversion concept of the origin of life, the transformation of prebiotic microsystems into primary cells proceeded through thermodynamic inversion [1]. Transformation of the kind was related with inversion of the balance **free energy to entropy contributions** from negative to positive. Since this moment, continuous inflow of the 'over-entropy' free energy (as well as information) into the microsystems provided rise of inner energy gradients and formation of primary cellular structures. This process took place in rising hydrothermal fluid, where combination of regular oscillations of pressure/temperature and irreversible fall of their absolute values with approaching to the surface maintained incessant recombination of molecules in the microsystems. Such conditions sustained the initial circulation of free energy and information in randomly synthesized nucleoprotein complexes (Figure 1, A). After the inversion, continuous increase of the 'over-entropy' surplus of free energy and information step by step led to expansion of the circulation and synthesis of the biologically organized (non-random) macromolecules, along with formation of (proto) nucleoid, ribosomes, membrane, and other cellular structures (Figure 1, B).

References:

[1] Kompanichenko VN (2017) *Thermodynamic Inversion: Origin of Living Systems*, Springer International Publishing. <https://link.springer.com/book/10.1007/978-3-319-53512-8>

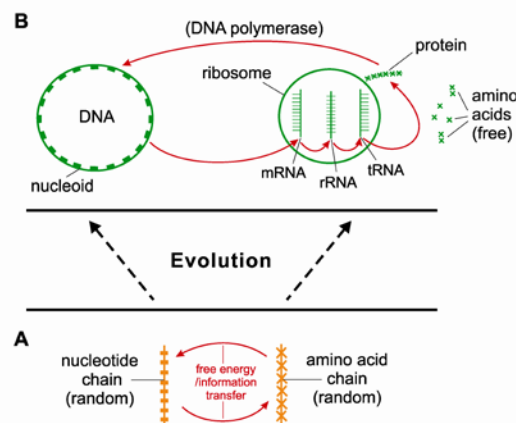


Figure 1 Expansion and divergence of nucleoprotein interaction from a nonequilibrium (oscillating) prebiotic microsystem to a prokaryotic cell through the thermodynamic inversion. Arrows – directions of transfer of information (primarily from left to right) and free energy (primarily from right to left) in course of recombination of nucleoprotein(oid) complexes and their complication. (A) Before the inversion - oscillating prebiotic microsystem: initial interaction (through circulation of free energy and information) between random chains of nucleotides and amino acids (proteinoids); (B) After the inversion – evolved prokaryotic cell: branching of functional nucleotide chains into DNA and RNA, then divergence of RNA sequences into mRNA, rRNA, and tRNA; initiation of proto-ribosomes with the function of organized biosynthesis of proteins on basis of bioinformation contained in DNA and RNA sequences, then transformation of proto-ribosomes into prokaryotic ribosomes; formation of ring double-stranded DNA macromolecule (nucleoid); catalyzing of DNA replication with DNA polymerase.