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HYPOTHESIS

# A Model for the Origin of Life through Rearrangements among Prebiotic Phosphodiester Polymers

**Alexander V. Yakhnin**

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**Abstract** This model proposes that the origin of life on Earth occurred as a result of a process of alteration of the chemical composition of prebiotic macromolecules. The stability of organic compounds assembled into polymers generally exceeded the stability of the same compounds as free monomers. This difference in stability stimulated accumulation of prebiotic macromolecules. The prebiotic circulation of matter included constant formation and decomposition of polymers. Spontaneous chemical reactions between macromolecules with phosphodiester backbones resulted in a non-Darwinian selection for chemical stability, while formation of strong structures provided an advantage in the struggle for stability. Intermolecular structures between nucleotide-containing polymers were further stabilized by occasional acquisition of complementary nucleotides. Less stable macromolecules provided the source of nucleotides. This process resulted first in the enrichment of nucleotide content in prebiotic polymers, and subsequently in the accumulation of complementary oligonucleotides. Finally, the role of complementary copy molecules changed from the stabilization of the original templates to the de novo production of template-like molecules. I associate this stage with the origin of life in the form of cell-free molecular colonies. Original life acquired ready-to-use substrates from constantly forming prebiotic polymers. Metabolism started to develop when life began to consume more substrates than the prebiotic cycling produced. The developing utilization of non-polymeric compounds stimulated the formation of the first membrane-enveloped cells that held small soluble molecules. Cells "digested" the nucleotide-containing prebiotic macromolecules to nucleotide monomers and switched the mode of replication to the polymerization of nucleotide triphosphates.

**Keywords** Random prebiotic polymers · Selection without replication · Spontaneous rearrangements

A. V. Yakhnin (✉)
Department of Biochemistry and Molecular Biology, Pennsylvania State University, University Park, PA 16802, USA
e-mail: avy1@psu.edu