

Contributions to Chemical Questions in Origins of Life

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An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the Degree of

DOCTOR OF PHILOSOPHY

Major Subject: Chemistry

The original of the complete thesis is on file
in the Rensselaer Polytechnic Institute Library

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August 2006

Abstract

PAH World is a novel chemical structural model for the prebiotically plausible formation of proto-informational template-like oligomeric materials as the earliest conceivable *pre-RNA* progenitors of the now widely expected *RNA World* in chemical evolution theory. The model is based on the self-assembling discotic mesogenic behaviors of polynuclear aromatic compounds, their photochemical edge-derivatizations, and the selectivity of such stacked supramolecular ‘aromatic core’ scaffolds for the edge-on binding and *ca.* 3.4 Å plane-parallel spacing of essentially random collections of small prebiotic heterocycles, taken up and concentrated directly from the presumed and surrounding ‘dilute primordial soup.’ The constrained inter-base separation distance could select for oligomerizing ‘linkers’ of fairly specific size (*e.g.*, (HCHO)_{*n*}) that would be taken up from the prebiotic chemical environment to condense with the bound heterocycles and then link together to form flexible structural backbones for first generation pre-RNA oligomeric materials; being stabilized against both hydrolytic and photolytic degradations by association with the parent discotic mesophase. A transient local pH decrease (*e.g.*, volcanic SO_{2(aq.)}) would disrupt the hydrogen bond interactions anchoring the heterocyclic residues to the discotic scaffold, thereby releasing segments or portions of oligomeric material to explore intramolecular degrees of motional freedom out in solution, perhaps folding back on themselves to match up fortuitous base residue pairings via Watson-Crick-like complementarities. Segments rich in such chance complementarities would likely persist by virtue of the combined cooperative strengths deriving from (*a*) the intramolecular hydrogen bonding interactions existing between paired bases, and (*b*) the attractive ‘ π - π stacking’ electronic van der Waals interactions occurring between neighboring stacked basepairs. These interactions establishing the domains of essentially hydrophobic quasi-discotic mesophases in the ‘double backbone’ secondary structures of these oligomeric proto-informational materials, with base ‘mismatchings’ within such domains leading to point replacements towards minimizing conformational potential energies. The new model pleases scientific intuition in providing the first satisfying candidate theoretical answer to the problem of an ultimate chemical origin for life on Earth, and very likely elsewhere.