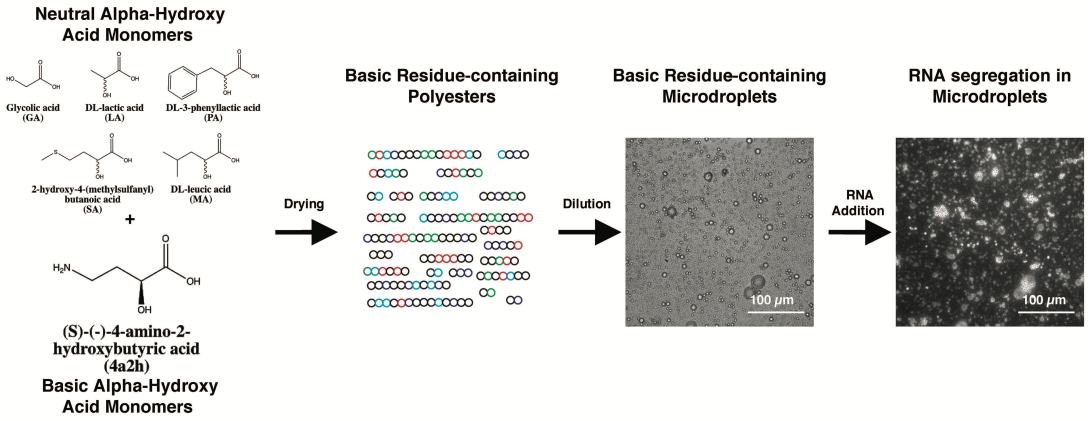
Incorporation of Basic α-Hydroxy Acid Residues into Primitive Polyester Microdroplets for RNA Segregation

(1. Earth-Life Science Institute, Tokyo Institute of Technology, 2. Blue Marble Space Institute of Science, 3. Department of Biology, Indian Institute of Science Education and Research, 4. Institute for Advanced Study, 5. Department of Physical Chemistry, University of Chemistry and Technology, Prague, 6. Space Science Centre (ANGKASA), Institute of Climate Change, National University of Malaysia)
○Tony Z Jia[1,2], Niraja Bapat[1,3], Ajay Verma[3], Irena Mamajanov[1], H. James Cleaves[1,2,4], Kuhan Chandru[5,6]

Keywords: Origins of Life, Prebiotic Chemistry, Chemical Evolution, Protocells, Liquid-Liquid Phase Separation

Nucleic acid segregation and compartmentalization were likely essential functions that primitive compartment systems resolved during evolution. Recently, polyester microdroplets generated from dehydration synthesis of various α-hydroxy acids (αHA) were suggested as potential primitive compartments. Some of these droplets can differentially segregate and compartmentalize organic dyes, proteins, and nucleic acids. However, the previously studied polyester microdroplets included limited αHA chemical diversity, which may not reflect the chemical diversity available in the primitive Earth environment. Here, we increased the chemical diversity of polyester microdroplet systems by combinatorially adding an αHA monomer with a basic side chain, 4-amino-2-hydroxybutyric acid (4a2h), which was incorporated with different ratios of other αHAs containing uncharged side chains to form combinatorial heteropolyesters via dehydration synthesis. Incorporation of 4a2h in the polymers resulted in the assembly of some polyester microdroplets able to segregate fluorescent RNA or potentially acquire intrinsic fluorescent character, suggesting that minor modifications of polyester composition can significantly impact the functional properties of primitive compartments. This study suggests one process by which primitive chemical systems can increase diversity of compartment "phenotype" through simple modifications in their chemical composition.



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