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THE ORIGIN STUDY OF AMINO-ACID HOMOCHIRALITY BY THEORETICAL MODEL AND HYDROTHERMAL MATERIAL ANALYSIS

Abstract

Purpose: Homochirality means that the monomer units of proteins are made up exclusively of L-enantiomers, whereas the monomer units of the nucleic acid polymers DNA and RNA as well as those of the biologically important polysaccharides are associated with D-sugars. It is now recognized that all of the crucial biopolymers associated with life are homochiral. Therefore, to explore the source of homochirality, we studied the origin of chiral selection for amino-acids.

Methodology: we investigate the topic of the homochirality origin through theoretical and experimental methods.

Results and conclusions: In the present study, we demonstrate that amino-acid homochirality, as a unique feature of life, might have originated synchronously with the Genetic Code. And the emergence of phosphoryl amino-acid 5'-nucleosides having a P-N bond is described as a model of the origin of amino-acid homochirality and Genetic Code. Based on our calculations, the chiral selection of the earliest amino-acids for L-enantiomers seems to be determined by a clear stereochemical and physicochemical relationship. As later amino-acids developed from the earliest amino-acids, we deduce that the chirality of these late amino-acids was inherited from that of the early amino-acids. This idea reaches far back into evolution, and it should be further verified. Thus, in this study, we analyzed the components of two hydrothermal sediment samples (TMG-11 and TVG-6) in the extreme environment through LC-MS. The samples were collected in the site located in Pacific Ocean and Indian Ocean on 19th Oct, 2007, the first Global Oceanic Scientific Expedition of China. Then we determined the phosphorous concentrations through ICP-MS and traditional chemical methods of phosphorus molybdenum blue. And we analyzed the hydrothermal materials through SEM (scanning electron microscope). The experimental results demonstrated that there indeed existed some degree of phosphorous material in the samples. In addition, combining with molecular modeling, we investigated the interaction between amino-acids and nucleotide and explored the chemical basis of the origin.