SPACE LIFE SCIENCES SYMPOSIUM (A1)
Astrobiology and Exploration (5)

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PHOSPHORUS CHEMISTRY AND EVOLUTION OF BIOLOGICAL MOLECULES

Abstract

Regarding to the origin of biological molecules, in 1971, Nobel Prize winner Manfred Eigen proposed that the evolution might start from random events and the instructions for evolution required information. However, this specific information should originate from unique chemical structures. Our ongoing interest in origin of life and phosphorus chemistry has led us to think of some interesting questions. These include the following: (1) How the nature selection related to the chemical selection? (2) Why did nature choose -amino acids and ribose? (3) What came first, amino acids or ribose? Answers to these questions not only improve understanding of evolution of biological molecules but also may shed light on how prebiotic chemical processes taken place. In our research, we found some phosphorous compounds played a crucial role in origin of life, especially for the magical moleculars named N-phosphoryl -amino acids. Although prebiotic formation path for N-phosphoryl -amino acids is still a hypothesis, they have been studied extensively to introduce a series of biomimetic reactions. It was found that when -amino acids were phosphorylated, peptide formation, ester formation, ester exchange on phosphorus, N to O and N to S migration, and oligonucleotide formation were observed at room temperature or even in the frozen conditions. According to the chemical reactivities of N-phosphoryl -amino acids, we have proposed a model for the co-evolution of protein, nucleic acid and membrane. In addition, at present, the study on origin of genetic code is currently underway by means of the combination of high performance liquid chromatography - mass spectrometry and quantum chemical calculations.

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