# Scenario from interstellar complex organic compounds to terrestrial life

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Complex organic compounds have been found in carbonaceous chondrites and comets. It is hypothesized that these compounds are originally formed in ice mantles of interstellar dusts(ISDs) in molecular clouds by cosmic rays and ultraviolet light. Formation of amino acid precursors by proton or UV irradiation of simulated ISDs was reported. The amino acid precursors were, however, not well characterized.

We irradiated a frozen mixture of methanol, ammonia and water with carbon beam (290 MeV/u) from HIMAC of National Institute of Radiological Science (NIRS), and characterized the products. Molecular weight of the product was ca. 2300, and nitriles, aromatic compounds and heterocyclic compounds have been detected when the products were analyzed by pyrolysis-GC/MS. Amino acids such as glycine were detected when the products were acid hydrolyzed. The present results suggest that complex organic compounds with large molecular weights, which are precursors of amino acids, can be formed in low temperature environments like molecular clouds by the action of cosmic rays.

Complex amino acid precursors formed by radiation are much more stable than free amino acids. Enantiomeric excess (e.e.) of amino acids were detected when such complex amino acid precursors were irradiated with circular polarized light (CPL).

The following scenario can be illustrated. At first, complex organic compounds were formed from interstellar media in molecular clouds by cosmic rays. They were denatured when they were irradiated with UV light: Biochirality may have been originated when ISDs were irradiated with circular polarized light from a neutron star. These organic compounds were accumulated into planetesimals and comets, which would bombarded into primitive Earth. They were modified in terrestrial hydrothermal systems and, at last, molecular systems with biological functions were born.