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Formation and Delivery of Exogenous Complex Organic Compounds and Their Relevance to Origins of Life

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A wide variety of organic compounds have been detected in such extraterrestrial bodies as carbonaceous chondrites and comets. Particularly, amino acids have been confirmed in extracts from carbonaceous chondrites and cometary dusts. It was suggested that these organics were formed in quite cold environments. Laboratory experiments showed that amino acid precursors with complex structures could be formed in simulated interstellar environments. Such complex amino acid precursors are much stronger than free amino acids against radiation. Seeds of homochirality could be formed after the complex amino acid precursors were irradiated with circularly-polarized UV light.

The complex precursors of amino acids of interstellar origin could have been delivered to primitive Earth by meteorites, comets and interplanetary dusts (IDPs). It is suggested that IDPs brought much more organics than meteorites and comets. However, nature of organics in IDPs are little known, since they have been collected only in terrestrial biosphere.

We are planning a space experiments named Tanpopo, where IDPs would be collected in aerogel equipped on the Exposure Facility of the International Space Station. In addition, amino acids and their relating compounds would be exposed to space environments for years to see their possible alteration processes.

Keywords: Origins of Life, Interstellar media, Cosmic rays, Homochirality, Complex organics, Interplanetary dust particles