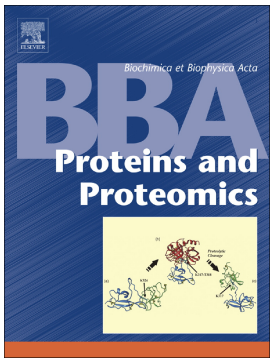


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# D-Amino Acids in Molecular Evolution in Space – Absolute Asymmetric Photolysis and Synthesis of Amino Acids by Circularly Polarized Light

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Living organisms on the Earth almost exclusively use L-amino acids for the molecular architecture of proteins. The biological occurrence of D-amino acids is rare, although their functions in various organisms are being gradually understood. A possible explanation for the origin of biomolecular homochirality is the delivery of enantioenriched molecules via extraterrestrial bodies, such as asteroids and comets on early Earth. For the asymmetric formation of amino acids and their precursor molecules in interstellar environments, the interaction with circularly polarized photons is considered to have played a potential role in causing chiral asymmetry. In this review, we summarize recent progress in the investigation of chirality transfer from chiral photons to amino acids involving the two major processes of asymmetric photolysis and asymmetric synthesis. We will discuss analytical data on cometary and meteoritic amino acids and their potential impact delivery to the early Earth. The ongoing and future ambitious space missions, Hayabusa2, OSIRIS-REx, ExoMars 2020, and MMX, are scheduled to provide new insights into the chirality of extraterrestrial organic molecules and their potential relation to the terrestrial homochirality.

**Key words:** Homochirality, Asymmetric Photolysis, Asymmetric Synthesis, Circularly Polarized Light, Amino acids, Extraterrestrial delivery