

Selective chiral absorbency of amino acids in the crystalline structure of ice and hydrates?

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The virtual exclusivity of L-amino acids as the monomeric units of proteins is an interesting yet unexplained phenomenon. It is possible that this homochirality is the result of an excess of L-amino acids exogenously delivered by icy comets or meteorites billions of years ago. If this is true, there must have been some stereoselective process at work in these icy environments. One such selective factor could be that the L-enantiomer more effectively induces the formation of ice or that growing ice or hydrate (also found in comets) favours the incorporation of one enantiomer. In this study, ice nucleation assays (INAs) and water crystal affinity experiments were employed to test for possible stereoselectivity. None of the amino acid solutions (9 different amino acids were tested) showed ice nucleation activity. Furthermore, there was no significant difference in the absorption of L- or D- isovaline to polycrystalline ice. While there appeared to be a small degree of stereoselectivity by hydrates, this difference was not statistically significant. Molecular dynamics simulations with ice showed no difference in L- or D- forms with respect to calculated energies. Based on these results, we do not know the role, if any, that crystalline forms of water played in the L-amino acid homochirality on Earth.

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