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A Possible Pathway of Homochirality Accumulation by Oligopeptides

Toratane Munegumi[1]*

[1]Department of Science Education, Naruto University of Education

Although numerous hypotheses have been proposed for chemical-evolutionary explaining the homochirality of biomolecules, most of them have discussed the homochirality of only monomeric compounds like amino acids or monosaccharides. However, the homochirality of monomeric compounds do not always guarantee the homochirality of polymers, because there had been many energy sources which made the chiral compounds decompose in the primitive earth or extraterrestrial environments. The processes or environments to conserve the homochirality must have existed.

This research focuses the homochirality accumulation in polypeptides by oligopeptides. Dimerization of racemic amino acids usually produces diastereomeric dipeptides. If the amino acid is DL-alanine, the condensation reaction gives cyclic and acyclic LL-, LD-, DL-, and DD-diastereomers of Ala-Ala. The total seven diastereomers can be yielded, because cyclic D-Ala-L-Ala and cyclic L-Ala-D-Ala are same compounds (meso-type isomers). The diastereomers are different in the hydrophobicity, decomposition rate, epimerization rate, as well as stereochemistry. Hydrophobicity difference reflects a difference in water solubility to lead the segmentation of the diastereomers in aqueous media. Acylclic heterochiral (LD- and DL-) oligopeptides are usually more hydrophobic than acyclic homochiral (LL- and DD-) oligopeptides.

In the presentation, a scheme of the homochirality accumulation in polypeptides by oligopeptides will be shown with the processes of the segmentation, epimerization, decomposition, and stereospecific condensation of oligopeptides.

Keywords: homochirality, condensation, oligopeptides