【Science and engineering（Chemistry）】

The Origins of Chirality and Amplification in Asymmetric Autocatalysis

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【Outline of survey】

Biomolecules such as L-amino acids are known to exist as one of the enantiomers. The origins of chirality and amplification have attracted much attention ("What Remains to be Discovered," J. Maddox, Newton Press, 2000). They are also related to the origin of life. Soai (principal researcher) and co-workers discovered asymmetric autocatalysis of pyrimidyl alkanol with significant amplification of chirality in the enantioselective addition of diisopropylzinc to pyrimidine-5-carbaldehyde. This unique reaction is the automultiplication of chiral compounds. The present research focuses on the origins of chirality and amplification in the asymmetric autocatalysis. The mechanism of amplification of chirality in asymmetric autocatalysis will be elucidated. Asymmetric autocatalysis initiated by circularly polarized light, inorganic chiral crystals, chiral crystal of achiral organic compounds, chiral compounds due to isotope substitution, and the symmetry breaking by spontaneous absolute asymmetric synthesis are performed. It is planned to examine the spatiotemporal chiral propagation in asymmetric autocatalysis and to elucidate how chiral surface induces the chirality in asymmetric autocatalysis.

【Expected results】

Asymmetric autocatalysis is expected to be realized initiated by chiral inorganic crystal, chiral crystals of achiral organic compounds, circularly polarized light, chiral compounds due to isotope substitution. Symmetry breaking by spontaneous absolute asymmetric synthesis will be established by employing the present asymmetric autocatalysis. The mechanisms of amplification of chirality by asymmetric autocatalysis and of asymmetric induction on chiral surfaces will be elucidated. The research on asymmetric autocatalysis is expected to provide a chemical model for the elucidation of the origins of chirality and its amplification: which have been long-standing problems.

【References by the principal investigator】

- T. Kawasaki, K. Suzuki, Y. Hakoda, K. Soai, Achiral Nucleobase Cytosine Acts as an Origin of Homochirality of Biomolecules in Conjunction with Asymmetric Autocatalysis. *Angew. Chem. Int. Ed.*, **2008**, *47*, 496-499.
- K. Soai, T. Kawasaki, "Asymmetric Autocatalysis with Amplification of Chirality," in "Topics in Current Chemistry: Amplification of Chirality," Ed. by K. Soai, Springer, Berlin, **2008**.

【Term of project】 FY2008－2012	【Budget allocation】 **159,200,000 yen** (direct cost)

【Homepage address】 http://www.rs.kagu.tus.ac.jp/soai/