

## SUMMARY OF Ph.D. DISSERTATION

School of Fundamental Science and Technology Keio University	Student Identification Number	SURNAME, First name Sugimori, Takeshi
Title Fluctuation Effect on Chiral Symmetry Breaking -Stochastic Models-		
<p>Life on earth utilizes only one type of enantiomers, namely, L amino acids and D sugars. How this complete chiral symmetry breaking called homochirality was realized is still an unsolved problem. There have been many studies using various models. However, the degree of excess of one enantiomers to the other is expected very small, and the amplification of enantiomeric excess (ee) is indispensable. Frank proposed a chemical reaction model that allows homochiral asymptotics. Recently, an experimental realization of ee amplification in organic reaction was achieved by Soai and his coworkers. The temporal evolution of this reaction was explained by the second-order autocatalysis.</p> <p>In this dissertation, we study the stochastic aspects of the chiral molecule production. Thus far, the reaction is treated by the rate equations. However, in the rate equation approach, fluctuations and thus correlations in the population number of reactant are neglected. Therefore, in order to include fluctuation effect, we use a stochastic master equation.</p> <p>In chapter two, we investigate the fluctuation effect on autocatalysis reactions. It is shown that by including a recycling back reaction in addition, the system relaxes to a unique final state, and the final probability distribution are obtained by assuming a detailed balance between production and recycling reaction. With a quadratic autocatalysis, the distribution has a double-peak profile, which indicates the appearance of the chiral symmetry breaking.</p> <p>In chapter three, we proposed a simple model which realizes complete chiral selection due to fluctuation effect in a closed small system. This system has two absorbing states corresponding to homochiral states and fluctuations drive the system to one of these states.</p> <p>Furthermore, in chapter four, we propose a similar system in an open system. We have demonstrated that even in this system, fluctuations play a decisive role to drive the system toward homochiral states.</p>		