

**【Grant-in-Aid for Scientific Research(S)】**  
**Biological Sciences (Biology)**



**Title of Project : Emergence of new species: the molecular mechanisms of speciation and macroevolution**

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Research Area : Biology

Keyword : Evolution

**【Purpose and Background of the Research】**

Our question, “emergence of new species” can be divided into two categories. First category is the mechanism of speciation. This is a process that the reproductive isolation between two populations caused by continuous frequency alteration of alleles. C. Darwin proposed this process one hundred years ago by the observation of continuous morphological changes. In the first category, we are trying to elucidate the mechanism of speciation at molecular level. Second category is the mechanism of macroevolution. This mechanism will explain the emergence of new taxonomic groups (e. g. emergence of mammalian). The goal of our proposal is to elucidate the mechanisms of emergence of new species by the studies of these two categories.

**【Research Methods】**

**First category: speciation**

We will progress first category by the following four steps; 1) elucidation of the adaptation of photo pigments in cichlid fishes, 2) isolation of the genes responsible for nuptial color formation, 3) elucidation of the evolution of nuptial color to the sensitive color for the adaptive photo pigments, and 4) elucidation of the mechanism of sensory drive speciation by the analyses of nuptial color genes evolution and photo pigments evolution.

**Second category: macroevolution**

The following three projects will be carried out: 1) genome-wide exploration of mammalian-specific conserved elements for novel enhancers derived from SINEs, 2) elucidation of gene expression patterns directed by the enhancers and their expression cascades, and 3) functional analysis of the genes in vivo and developmental analysis of the mammalian-specific morphological features.

**【Expected Research Achievements and Scientific Significance】**

In this proposal, we are trying to elucidate the mechanisms of speciation and macroevolution. In the speciation category, we expect that our research will achieve to demonstrate the mechanism of sensory drive speciation by showing adaptation of photo pigments and the evolution of nuptial color in cichlids. In the macroevolution category, we expect that our research will achieve to demonstrate the acquisition of mammalian-specific morphological features by the enhancers and their expression cascades. These mechanisms indicate not only the mechanisms of speciation and macroevolution, but also the mechanism of biodiversity. This proposal will be a breakthrough of the research of the biodiversity, and will be a new research field started from Japan.

**【Publications Relevant to the Project】**

1. Seehausen O, Terai Y, Magalhaes IS, Carleton KL, Mrosso HD, Miyagi R, van der Sluijs I, Schneider MV, Maan ME, Tachida H, Imai H, Okada N. Speciation through sensory drive in cichlid fish. **Nature** (Article). 455:620-6 (2008)
2. Sasaki T, Nishihara H, Hirakawa M, Fujimura K, Tanaka M, Kokubo N, Kimura-Yoshida C, Matsuo I, Sumiyama K, Saitou N, Shimogori T, Okada N. Possible involvement of SINEs in mammalian-specific brain formation. **Proc Natl Acad Sci U S A**. 105:4220-5 (2008)

**【Term of Project】** FY2009-2013

**【Budget Allocation】** 113,800 Thousand Yen

**【Homepage Address and Other Contact Information】**

<http://www.evolution.bio.titech.ac.jp/index0.html>