

# Evolution by loss of genes that have become redundant in relation to changing environments

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## 【 Outline of survey 】

Evolution is driven by changing environments in which organisms live. The physiological and morphological specificity of a species is a reflection of the environment unique to that species. The tempo and mode of such environmentally dependent and driven evolution may be associated with gain of new genes, but this can happen only when environments change so slowly as to permit organisms to acquire new genes. Unless otherwise, organisms cannot genetically respond and may become extinct under rapid and dramatic environmental changes. It follows that genetic changes that develop and characterize species specificity must result from some other changes than gain of new genes in the genome. It is therefore hypothesized that such genomic changes are likely alternations of expression of existing genes and, in an extreme case, loss of genes that are no longer indispensable under new environments. In this project, we attempt to substantiate our working hypothesis, focussing on some of physiological and morphological characteristics in humans that have evolved over million years. Likewise, to support our working hypothesis further, we investigate genetic responses of domestic fowls to artificial selection over ten thousands of years.

## 【 Expected results 】

We attempt to demonstrate that species specificity of humans or domestic fowls which is acquired during a relatively short period of evolutionary time results from loss of genes rather than gain of new genes in the genome. Since changes in the genome are irreversible and can occur only slowly, we argue that organisms including humans themselves are genetically intolerant to rapid environmental changes. We also hope that our research will provide some basic knowledge in considering the global environmental problem which all the organisms on this planet now face.

## 【 References by the principal researcher 】

HAYAKAWA, T., Y, SATTA, P. GAGNEUX, A. VARKI, and N. TAKAHATA, 2001

Alu-mediated inactivation of the human CMP-N-acetylneuraminic acid hydroxylase gene. Proc. Natl. Acad. Sci. USA 98: 11399-11404.

Jan Klein and Naoyuki Takahata, 2002, Where do we come from? The molecular evidence for human descent., Springer, Berlin.

【 Term of project 】 FY 2004 - 2008

【 Budget allocation 】 80,200,000 yen

【 Homepage address 】

<http://sendou.soken.ac.jp/satta/open.html>