

**Mechanisms underlying the deep brain photoreception and
seasonal time measurement in vertebrates**

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【Outline of survey】

The appropriate timing of various seasonal processes, such as molting, migration, hibernation, and reproduction, is crucial to the survival of animals. To detect seasonal changes in daylength, non-mammalian vertebrates use deep brain photoreceptors. Although these phenomena attracted tremendous general interest, its underlying mechanism remains unknown. Birds have evolved especially sophisticated seasonal mechanisms, and among them, the Japanese quail (*Coturnix japonica*) has proved to be the best model for studying these phenomena. Using quail, we have recently uncovered that the local thyroid hormone activation within the brain is crucial in this biological process. In addition to this, we have identified gene network for seasonal time measurement by systems biology approach. Based on these results, we will clarify the underlying mechanism of deep brain photoreception and seasonal time measurement in vertebrates.

【Expected results】

Non-mammalian vertebrates perceive light directly within the brain and measure seasonal alteration of the earth, and the mechanism used for this process is one of the great mysteries in biology today. This project is intellectually meritorious in that it is the first significant effort to clarify the molecular mechanism of deep brain photoreception and seasonal time measurement. In addition, seasonal reproduction is a rate-limiting factor for animal production. The results of this project will contribute to the improvement of animal production and may reduce the impact of food crisis in the future.

【References】

Yoshimura *et al.*, Light-induced hormone conversion of T₄ to T₃ regulates photoperiodic response of gonads in birds. *Nature* 426, 178-181 (2003)

【 Term of project 】 FY2007 - 2011

【 Budget allocation 】 14,000,000 yen
(2007 direct cost)

【Homepage address】

<http://www.agr.nagoya-u.ac.jp/~yosimura/>