

【Grant-in-Aid for Young Scientists(S)】

Biological Sciences (Biology)



Title of Project : Study on the signal communication systems related to the social organization in termites

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Research Area : biology, basic biology, ecology and environment

Keyword : sociality, hormone, pheromone, self organization, sociogenomics

【Purpose and Background of the Research】

Among many biological systems, there are mechanisms that make up highly organized structures. Underlying these systems, there should be some principles shared by all living systems. To understand them, I aim to reveal the molecular mechanisms of signal communications and the evolutionary processes in social insects. In this study, two major systems are focused; hormonal systems that integrate extrinsic information to regulate development, and pheromonal systems that contribute to organize social systems. In addition, the molecular evolution of important factors for the social systems will also be elucidated. Then, I would like to construct self-organizing models by incorporating all the factors identified in this study.



Fig. 1. The focal species in this study: the damp-wood termite *Hodotermopsis sjostedti*.

【Research Methods】

Developmental reprogramming during caste differentiation: In termite caste differentiation, juvenile hormone (JH) plays an important role. According to the JH titer, which mediates environmental conditions, the developmental fate is determined. Factors related to this endocrine system will be investigated.

Expression analyses on caste-specific genes in the exocrine glands: Several caste-specific exocrine glands were recently discovered, so that the specific gene expressions will be identified by molecular approaches. Candidate genes are expected to include pheromone-related factors.

Functional analysis of pheromone molecules: The identified candidate pheromone molecules will be analyzed based on behavioral assays. Pheromones are classified into primer and releaser pheromones, so that the physiological regulations by those genes will also be evaluated.

Modeling for caste differentiation and social evolution: Incorporating the factors identified and investigated in this study, mathematical models will be constructed, and simulations will be carried out to evaluate the models. By such constructive approaches, I will try to identify the principles underlying the social and self-organizing systems.

【Expected Research Achievements and Scientific Significance】

In this study, at various levels from molecular to ecological levels, the regulatory factors that are engaged in physiological and social interactions will be identified. The multilevel study approaches that feed back to one another are expected to discover novel mechanisms coordinating elaborate social systems in termites. In addition, this study will provide us insights into the mechanisms of phenotypic regulations in response to unstable environments. By the series of these study approaches, I hope to understand the shared principles of self-organizing systems like social insect colonies.

【Publications Relevant to the Project】

- Cornette R, et al. (2008) J Insect Physiol: 54: 922-930.
- Miura T (2005) Evol Dev 7: 122-129.
- Miura T, et al. (1999) PNAS 96: 13874-13879.

【Term of Project】 FY2009-2013

【Budget Allocation】 57,700 Thousand Yen

【Homepage Address and Other Contact Information】

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