

Insect-Robot Hybrid System for Understanding the Neural Basis of Adaptive Behavior

Ryohei Kanzaki¹, Ryo Minegishi¹, Atsushi Takashima², and Daisuke Kurabayashi²

¹Research Center for Advanced Science and Technology, The University of Tokyo, Japan,

²Department of Mechanical and Control Engineering, Tokyo Institute of Technology, Japan

Adaptability, the capability to behave properly in accordance with ceaselessly changing environments, is an excellent feature of animals. Insects display a diversity of sophisticated behaviors adapted to their environments by the processing of a simple nervous system. Once released from their source, odor molecules float through the air, continuously changing their spatial distribution in complex patterns. Under such conditions, insects can trace and orient toward the pheromonal odor of a mating partner. In order to understand the neural basis of the adaptive behavior, we perform our research in many ways, from genes, single cells of the neural system to the actual behavior. To examine the neural basis of the behavior, we made a model of the neural circuit, and integrated it in a mobile robot circuit. Moreover, in order to understand the dynamics of the neural circuit, we have been developing an "insect-robot hybrid system" in which the insect or an isolated insect brain controls a robot. By comparison between the hybrid system and the model of the neural circuit of the insect, we can improve the insect-brain model, and finally we could understand the insect brain if the model-based system shows the same adaptability as the hybrid system.