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143 Chemical Interaction among Individuals in *C. elegans* during Foraging

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The previous reports of interaction in *C. elegans* were categorized into two groups. One is social behavior; natural isolates were classified into social feeders that aggregate on the bacterial lawn and solitary feeders that disperse. The other is development of dauer larva induced by dauer pheromone produced by each individual. Although these reports showed interaction of individuals, the process of interaction among individuals has not been investigated. In this study, we discussed whether foraging behavior of individuals was modulated by other individuals. We assumed two types of interaction; physical contact and chemical stimulus. We focused on the interaction of chemicals, and developed a novel bio assay system for investigating the chemical interaction between worms; agar membranes that had several thicknesses (70 to 280 μm) were prepared, and a mass of worms were located on the one side of the membrane. We put one worm on the other side (test animal); the behavior of the test animal was analyzed with Markovian analysis. We found that the turning frequency increased with decreasing of thickness of agar membrane. Furthermore, in *che-13*, the sensory-defective ~~mutant for~~ chemicals, the turning frequency was constant regardless of the thickness. Our results suggest interaction exist during foraging: turning probability is modulated by diffusible chemicals produced by other individuals.

144 Motion Simulation with a *C. elegans* Model for Touch Stimuli

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In recent years, a new approach for analyzing functional mechanism of a living organism has been proposed, in which computer simulation of a mathematical model is fully utilized ['98 H.Ohtake, '01 H.Kitano]. In this analysis using a *virtual* model instead of the corresponding *actual* organism, it is possible to change environmental conditions easily and to analyze their behavior repeatedly under the same conditions. This is not only useful to the area of biology, but also possible to be applied to the area of engineering such as establishment of a new brain-like machine based on the mechanism of living organisms. In the approach using a *virtual* model, analysis of `simple' organisms is necessary to understand systems of higher organisms. Therefore, our group has developed computer models of two kinds of unicellular organisms, colibacilli and paramecium, based on the knowledge of both biology and engineering ['02 T.Tsuji *et al.*, '04 A.Hirano *et al.*]. This study deals with multicellular organisms as the next step of the above-mentioned approach. Among multicellular organisms, we focus on *Caenorhabditis elegans* (*C. elegans*), and aim to develop a computer model of this organism based on the previous studies at the nervous level. So far, many studies of the *C. elegans* model have been reported [for example, '99 T.C.Ferree *et al.*, '01 K.Kawamura *et al.*]. However, since they focused on only sensing and processing external stimuli, the locomotion which is appeared was extremely simplified. In modeling *C. elegans*, the motor control system with respect to locomotory responses have to be considered as well as the internal processing system. Consequently, we propose a computer model of *C. elegans*, which includes the nervous circuit model for processing external stimuli and the kinematic 12-link body model for locomotion control. Although the *C. elegans* processes many kinds of stimuli, we focus on gentle touch stimuli. In this presentation, we will explain in detail both of a nervous circuit model for touch stimuli and a kinematic model of the body. Also, some properties of our model, particularly those related to the taxis for touch stimuli, will be discussed through the simulation results.