Modeling of adaptive behaviors in crickets

Insects provide good model systems to investigate neuronal mechanism underlying adaptive behavior (Fig. 1). Aggressive behavior of male cricket is released by cuticular substances on the body surface of male cricket and the aggression levels escalate until one of male crickets evacuate from the fighting. This agonistic behavior establishes social status between two male crickets (Fig. 2). We have been investigated how animals behave in the social population. Cricket agonistic behavior must be a good model system to understand the mechanism of social status formation. Here we perform mathematical modeling of the male-male interaction among cricket population to investigate how animals organize sociality (Fig. 3). Individual interaction among crickets was simulated by constructing artificial cricket model (Fig. 4). This model was constructed by observation of cricket behaviors in a population and probability P of a behavior pattern was given where P is dependent on a component of time decay and memory which we determine as α. Using this simulator we examine the effect of social population on the crickets behaviors. When the population of cricket was low density, fighting behavior showed rather random pattern. When the population was middle density, only one of crickets did beat other crickets to keep dominant status. When the population was high density, almost all crickets always moved to avoid interaction. This modeling could simulate mechanisms underlying social behavior in insects and that in turn must help us to understand neuronal mechanisms underlying adaptive behaviors.

Keywords: artificial cricket, sociality, social behavior

References

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Fig. 1 Fighting behavior of male crickets

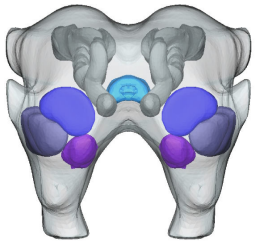

Fig. 2 Image of Cricket Brain

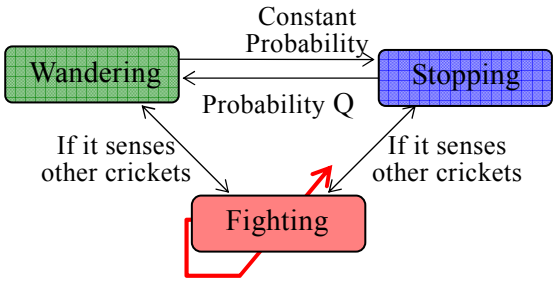

Fig. 3 Finite automaton model of cricket's behavior

Fig. 4 Simulate of Artificial Crickets