Octopamine regulates social behaviors between genetically unrelated ant queens.

Satoshi Koyama, Shingo Mastui, Toshiyuki Satoh, Ken Sasaki

Queens of arborial ant, *Polyrhachis moesta*, facultatively perform multiple colony-founding after nuptial flight, even though queens are usually genetically unrelated to each other. However, only single queens remain in a mature colony. It is known from previous studies, that queens in a founding colony perform trophallaxis (food exchange) with other queens more often than those in mature colonies. The queens in mature colonies show more aggressive behavior to other queens. To reveal the physiological mechanism of this behavioral change in the queen, biogenic amine titer in brain of queens of founding and mature colony were measured. We found that octopamine titer in brain of queens in mature colonies was significantly higher than those in queens of founding colonies. Thus, in a second experiment, we orally administrated octopamine to queens in a founding colony and kept two queens together under dark condition. Octopamine treated queens performed trophallaxis and allogrooming significantly less often and for a shorter period than control queens. Conversely, there was no significant difference in avoidance of the other queen. We observed aggression behavior in only one pair of octopamine treated queens, which occurred five times between the pair and lasted 75 min in total; no aggression behavior was observed in control queens. These results suggest that an increase of octopamine in the brain decreases the level of cooperation among queens of *P. moesta*. Our study gives new insight into physiological mechanism of cooperation in social insect.