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EXPERIMENTAL EVIDENCE AGAINST CUTICULAR HYDROCARBONS AS NESTMATE RECOGNITION CUES IN THE FIRE ANT *SOLENOPSIS INVICTA*.

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ABSTRACT

In ants, nestmate recognition is thought to involve a matching of chemical cues on the body surface of the intruder with the experience-derived neural template of the resident. Because cuticular hydrocarbons are the major compounds on the surface of the exoskeleton, many researchers have assumed that these are functional cues in nestmate recognition. However, even though many studies have found correlational and circumstantial evidence to support this idea, except for one recent report (on the desert ant *Catyglyphis niger)* there is actually no direct evidence that cuticular hydrocarbons function as actual cues in this process.

Recently, it has been found that cuticular hydrocarbons are exchanged among nestmates during physical contact, grooming, and trophallaxis, and sequestered in each ant's postpharyngeal gland. It is thought that this system function as a constantly updating colony-level "Gestalt organ", through which individual ants acquire the chemical profile of their nestmates and blend them with their own to create a uniform colony odor.

In the present study we designed experiments **(1)** to confirm the finding that ants circulate and blend together their collective cuticular hydrocarbon mixture and **(2)** to test the hypothesis that cuticular hydrocarbons function as nestmate recognition cues in the Red Imported Fire Ant, *Solenopsis invicta*. We applied pure synthesized hydrocarbon to the body surface of a large worker fire ant, and then isolated this 'painted ant' with smaller workers from the same mother colony. We predicted that the ants of each isolated group would spread the hydrocarbon treatment around over time to each other by trophallaxis, grooming and physical contact, producing a range of deviations from the normal colony composition of hydrocarbons. At intervals during the course of the experiments, ants were removed, 'tested' back in their mother colony to see if they were recognized as 'alien', and subsequently assayed for hydrocarbon profile. Logically, if the cuticular hydrocarbon composition functions as a nestmate recognition cue, ants with a composition which deviated from the norm should elicit an aggressive response when tested back in the mother colony (recognition as alien by former nestmates).

A variation in hydrocarbon composition was successfully produced in the experimentally treated groups. However, we found no significant correlation of aggression scores with deviation from the mean hydrocarbon composition of individual ants. These results do not support the hypothesis that cuticular hydrocarbons function as nestmate recognition cues in *S. invicta*. Other lipid compounds in the mixture, from both genetic sources (pheromones, exocrine gland secretions) and environmental influences

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(food type, soil chemistry, local ecology) are, by default, strongly implicated as the salient recognition discriminators for this species.