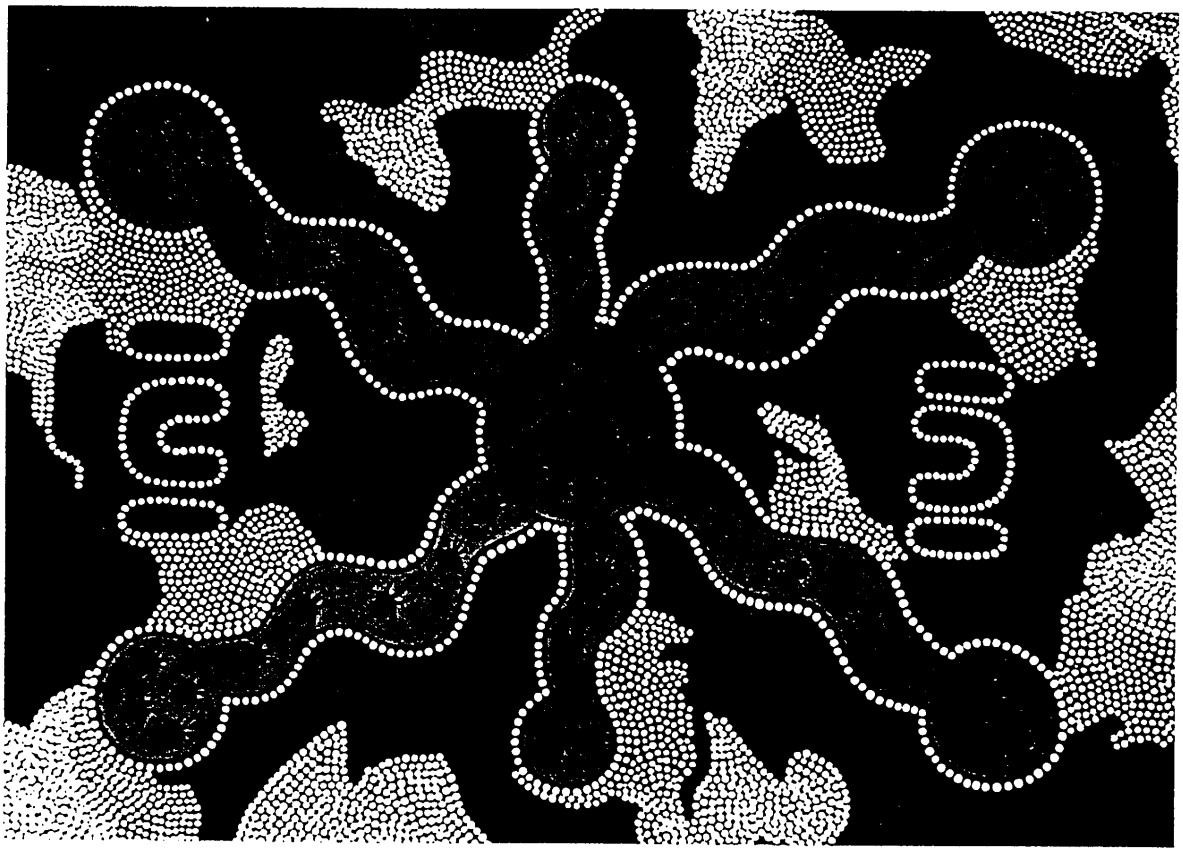
Social Insects
at the turn of the Millennium



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THE POSTPHARYNGEAL GLAND HYDROCARBONS AND THE EVOLUTION OF BEHAVIORAL MODALITIES FOR OBTAINING A UNIFORM COLONY ODOR IN ANTS

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The colony specific odor generally carried by ants on their body is the result of a continuous exchange between the postpharyngeal gland (PPG) and the epicuticle. Although hydrocarbons have long been suspected to serve as recognition cues, direct evidence to that effect was lacking. By assaying the ants' behavior in dyadic encounters we present here the first direct evidence that PPG hydrocarbons, are responsible for nestmate recognition in the ant *Cataglyphis niger*. Purified hydrocarbons, but not other lipids, applied to one of a pair of live nestmates or alien ants, significantly modified the aggressive behavior in the direction that was expected if hydrocarbons do indeed function as recognition discriminators.

Effective nestmate recognition in large colonies necessitated the evolution of mechanisms for exchange of recognition cues to ensure the formation of a uniform colony odor. In formicine ants trophallaxis seems to be a major mode of cue transfer. In this study we have investigated hydrocarbon exchange between nestmates in two species that do not perform trophallaxis: *Aphenogaster sinilis* (Myrmicinae) and *Pachycondyla apicalis*. (Ponerinae), and compared it with that in the formicine ant *C. niger*. Hydrocarbon exchange and the behaviors associated with it, e.g., trophallaxis, allogrooming and body contact, were followed during dyadic encounters between prelabeled and unlabeled normal or mouth blocked nestmates. In all of these species, the PPG was involved in hydrocarbon exchange to a degree that was correlated with social interactions. The lowest rate of exchange was exhibited by *P. apicalis*, mostly through body contact and only occasional allogroming. In contrast, exchange in *A. sinilis* was largely mediated by intensive allogrooming but this was lower than that found in *C. niger*. We hypothesize that PPG evolved as a "gestalt organ" early in ants and that cue exchange was limited allogrooming. In some formicine ants (e. g. *C. niger*) trophallaxis replaced allogrooming to a large degree as a mode of cues exchange. Whether the driving force for the evolution of this behavior was food exchange or cues exchange, is an open issue.

Keywords: NESTMATE RECOGNITION, HYDROCARBONS, POSTPHARYNGEAL GLAND