

Title: Chemosensory Feedback Mediates Olfactory Organ Grooming in Spiny Lobsters

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Introduction: The spiny lobster, *Panulirus argus*, uses its olfactory organ – arrays of sensory hairs called aesthetascs on the antennules – to detect food, predators, and conspecifics. With a stereotyped antennular grooming behavior, spiny lobsters keep the aesthetascs clean and free of biofouling. Another function of antennular grooming is to distribute secretions of tegumental glands onto the aesthetascs where they form a surface coat. The amino acid L-glutamate elicits antennular grooming but the biological reason for this is unknown. It is hypothesized that the amino acids that leak from the aesthetascs through breaches in the surface coat elicits antennular grooming.

Methods: To test this hypothesis, two quantitative behavioral experiments were performed. The first was to determine which chemicals besides L-glutamate elicit antennular grooming. All natural L-amino acids and more than thirty related compounds were tested on sixteen individually housed lobsters, each with L-glutamate as positive control and artificial sea water as negative control. The number of antennule wipes was quantified for three minutes and by calculating the mean number of wipes for all experimental animals. The second experiment was to determine if elimination of the aesthetasc surface layer causes antennular grooming. In eleven lobsters, one antennule was exposed to papain for surface coat digestion and the number of wipes of each antennule was counted for ten minutes immediately afterwards.

Results: In the first experiment, it was found that in addition to L-glutamate, L-alanine, glycine, and trimethylamine-N-oxide elicit statistically significant grooming, but the other compounds including supernatant from microbes isolated from fouled antennules did not. In the second experiment, it was found that the papain-treated antennule was groomed significantly more often than the untreated one.

Conclusion: Since L-alanine, glycine, and L-glutamate are among the amino acids leaking from aesthetascs, the results support the hypothesis that antennular grooming is elicited by the efflux of amino acids. This interpretation is corroborated by the results of the second experiments showing that digestion of the aesthetasc surface layer directly elicits antennular grooming.