

Does the crayfish tail fan sense chemicals?

Crayfish depend on sensilla, small cuticular structures occurring all over their bodies to acquire information about their outside environment. Sensilla contain sensory neurons that are either mechanoreceptive or chemoreceptive. The tail fan of crayfish houses numerous sensilla that contain mechanoreceptor neurons and their activation by animals approaching from behind elicits a tail-flip escape response. However, the ultrastructure of some of the tail fan sensilla suggests that they contain both mechano- and chemoreceptor neurons. Crayfish often move and burrow backwards. Thus, from an evolutionary perspective, it would be advantageous to possess chemoreception on the tail fan. In addition, *Emerita anologa*, a crustacean closely related to crayfish, is known to have bimodal mechano- and chemoreceptive sensilla on its tail fan. The goal of this experiment is to determine if sensilla on the tail fan of the crayfish *Procambarus clarkii* house chemoreceptor neurons. We hypothesized that the crayfish tail fan contains sensilla with chemoreceptor neurons and that the application of simple chemical stimuli (saline with different pH values) changes the frequency of action potentials in neurons of abdominal ganglia that receive sensory input from the tail fan.

Electrophysiology and immunohistochemistry were used to test the hypothesis. Extracellular electrophysiology recordings were taken from the abdominal nerve cord between the 5th (A5) and the 6th (A6) abdominal ganglion while chemical stimuli (saline solutions of pH 7, 8, and 10) were applied to the tail fan. Antibodies against tyrosine tubulin labeling all neurons and against OET-07, a chemoreceptor protein expressed in olfactory receptor neurons of lobsters, were used to label sensory neurons in the tail fan.

In our ongoing experiments, we observed (light) labeling of some sensory neurons of tail fan sensilla by the OET-07 antibody supporting the hypothesis that these are chemoreceptor neurons.

Furthermore, the responses of individual neurons in the abdominal nerve cord showed a decrease in firing as the pH increased, indicating the presence of chemoreception.

Although it is not likely that a crayfish will encounter extremely basic pH values in its environment, we propose that the basic pH activates chemoreceptors that could be used to sense other chemicals that a crayfish may encounter in its environment.