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# Neurotransmission Within the Crayfish\*



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Throughout the world, there are multiple species of invasive crayfish emerging. In Europe and parts of Africa, the *Procambarus clarkii* species is of concern. In this study, fast-scan cyclic voltammetry was utilized to observe and measure neurotransmitters in real time that were present near the pericardial cavity in freely moving *Procambarus clarkii* crayfish. Crustaceans, including crayfish, utilize an open circulatory system in which their blood and extracellular tissue fluid, or hemolymph, is pumped by the heart. Within the crayfish open circulatory system, various neurotransmitters are released into their hemolymph and brought back to the heart for circulation. Their heart is located near the dorsum and is centrally positioned below the cervical groove, enabling a consistent and easy location for implantation of a carbon-fiber electrode. Fast-scan cyclic voltammetry allows for quick, accurate data that is recorded in real-time, every 100 milliseconds. Using changes of voltage in carbon-fiber electrodes, fast-scan voltammetry measures the reaction of oxidation and reduction peaks of neurotransmitters caused by the carbon surface voltage changes.

During various behaviors, such as crawling or the meral spread, histamine (HA) was detected and recorded consistently using a histamine-sensitive waveform. Within our study, results show a slight delay in the recording of histamine after a behavior. This could be due to the placement of the recording electrode and a release of histamine taking place a distance from the heart. It is believed that histamine is located in the pyloric region as well as the eyestalk in all crustaceans. Secondly, results show that the release of histamine was dependent on previous displays of aggressiveness and exertion. The display of more forceful behaviors consistently correlated with higher amounts of histamine, with a mean of  $258.86 \pm 56.75 \mu\text{M}$ . Natural behaviors, such as crawling, resulted in a lower average of  $123.51 \pm 19.70$

$\mu\text{M}$ . It was also found that a continuous behavior, such as crawling, results in a gradual decrease of histamine levels. Once the crayfish comes upon a challenge or threat and an additional behavior is portrayed, a spike in histamine will result. Lastly, histamine levels proved to steadily drop once the crayfish was left alone after a period of aggressive and defensive behavior. Our hypothesis on the role of histamine is that its inhibitory effects within the gastric mill are indeed shutting down the digestive system to allow the crayfish to move, similar to a fight or flight response.

The purpose of this study is to better understand the crayfish general physiology and to assess the role histamine plays in regulating their behavior. Future studies will look to obtain a better understanding of the role of histamine in crayfish behavior by investigating the location of histamine release. By developing a better understanding of crayfish behavior, further investigations of preventative plans can become possible.

\*This scholar and faculty mentor have requested that only an abstract be published.