Role of native pyrokinins in modulating the cardiac ganglion in the American Lobster, *Homarus americanus*

Justin Dong, Class of 2024

Central pattern generators (CPGs) are neural networks that produce rhythmic motor patterns independent of sensory input and drive important patterned motor behaviors such as heart rate, breathing, and locomotion (Cooke 2002). Neuromodulators like peptides, small strings of amino acids, allow for cellular communication and play key roles in the control of CPGs' behavior by altering the physiological response of the neural network.

The cardiac ganglion (CG) is the CPG of the American lobster (Homarus americanus) heart. A known modulator of the CG system of the American lobster is pyrokinin. Pyrokinins are a family of neuropeptides, characterized by the conserved carboxyl (C)-terminal motif FXPRLamide. My research builds upon previous research in the Dickinson lab to analyze the effects that pyrokinins have on the CG (Dickinson 2015). While previous research mainly focused on the impact non-native pyrokinin had on the CG, my research analyzed the effects of six newly discovered pyrokinins native to the American lobster.

Following the same methods as previous research, I conducted recordings of the whole heart of the lobster rather than just the CG. Lobsters were anesthetized in ice before the process of removing the heart. After removal, the heart was immediately placed in saline and one of the two posterior arteries was cannulated and connected to a perfusion system. The cannulas were inserted until they passed through the heart valve to ensure that saline consistently entered the lumen of the heart to keep it contracting. An additional stream of cold saline was run over the heart to maintain temperature. The five anterior arteries were tied together to a force transducer to record the amplitude and frequency of contractions. Before experimentation began, the heart was given 50 minutes to stabilize. Pyrokinin solutions were then perfused through the cannulated artery for 10 min. After each pyrokinin application, the heart was washed out with saline for at least 50 min.

Of the six new native pyrokinins I tested, none individually caused any significant change in the amplitude or frequency of contractions. Only through a combination of all six pyrokinins was there a significant increase in amplitude of the contractions. However, in my research, a non-native pyrokinin, PevPk2, also did not cause any significant changes in contractions despite previous research finding substantial increase in both amplitude and frequency of contractions (Dickinson 2015). My findings suggest that there could be external factors that influence the expressions of pyrokinins such as season and molt state. Furthermore, because only the combo caused significant change, perhaps a higher concentration or mixture of peptides is needed to elicit a response. My findings raise more questions about the complex role pyrokinins and other peptides have on the CG and the more general CPG system.

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