

Bowdoin College

Bowdoin Digital Commons

Marine Lab Student Papers and Projects

Student Scholarship and Creative Work

8-2014

Pyrokinin peptides' effect on the stomatogastric nervous system in the American lobster, *Homarus americanus*

Xuan Qu

Follow this and additional works at: <https://digitalcommons.bowdoin.edu/marinelab-student-papers>

Recommended Citation

Qu, Xuan, "Pyrokinin peptides' effect on the stomatogastric nervous system in the American lobster, *Homarus americanus*" (2014). *Marine Lab Student Papers and Projects*. 22.
<https://digitalcommons.bowdoin.edu/marinelab-student-papers/22>

This Article is brought to you for free and open access by the Student Scholarship and Creative Work at Bowdoin Digital Commons. It has been accepted for inclusion in Marine Lab Student Papers and Projects by an authorized administrator of Bowdoin Digital Commons. For more information, please contact mdoyle@bowdoin.edu.

Pyrokinin peptides' effect on the stomatogastric nervous system in the American lobster, *Homarus americanus*

Xuan Qu, 2017

Mentor: Patsy Dickinson

Central pattern generators are networks of neurons that produce rhythmic and repetitive outputs. These outputs control behaviors such as walking, breathing and digestion. In the American lobster, central pattern generators control the behavior of muscles in its foregut, which allows the digestion of a variety of food types. The stomatogastric ganglion (STG) is a bundle of about thirty neurons in the foregut of American lobsters. It has been studied extensively since each one of the neurons in it is both identifiable and produces simple patterned outputs. The analysis of American lobster's stomach behaviors and the neural mechanisms controlling them could provide general insights into how rhythmic motor patterns for locomotion are produced.

A large number of the neurons in the STG are modulatory neurons that use neuromodulators for at least part of their synaptic receptions. These neuromodulators are released by neurons and cause long-lasting changes in the synaptic efficacies of the targets. At present, many types of neuropeptides have been identified within the crustacean stomatogastric nervous system. The pyrokinins are members of one peptide family, PBAN. PBAN peptides all share the common C-terminal pentapeptide FXPRL-amide, in which X can be S, T, G, N, or V. Previous studies, using immunohistochemistry, have found that there are pyrokinin peptides present in both the STG and the cardiac ganglion (CG) of American lobsters. My research tests five different kinds of pyrokinin peptides, including PevPK1 (DFAFSPRLamide) and PevPK2 (ADFAFNPRRLamide) from the shrimp *L.vannamei* (Torfs et al., 2001; Ma et al., 2010), CabPK1 (TNFAFSPRLamide) and CabPK2 (SGGFAFSPRLamide) from the crab *C.borealis* (Saideman et al., 2007; Ma et al., 2009) and Conserved Sequence (FSPRLamide) from the lobster, *H.americanus* (Ma, et al, 2008). Conserved Sequence, the only pyrokinin identified in the American lobster so far, is highly conserved among many other pyrokinin peptides. Therefore, it is believed to be just a fragment with the complete sequence yet to be identified. Thus, we predicted that it might produce a weaker effect on the STG.

Previous studies on the pyrokinin peptides have shown that in crabs, CabPK1, CabPK2 and LeucoPK (identified in an insect), all had a virtually identical effect on the CG, suggesting that the differences among these pyrokinin peptides are not important and the receptors for these peptides are the same. However, research done by Bowdoin students in 2011-2012 showed that among PevPK1, PevPK2, CabPK1, CabPK2, and Conserved Sequence, all but Conserved Sequence (not yet tested) had strong effects on the STG. However, only PevPK2 had an effect on the CG. My goal for this summer research was to determine whether or not there are differences between the responses of the STG to the different peptides in order to further determine the cause for the differences between the responses of the CG and those of the STG. The results from the extracellular recordings from the identified neurons in my research have shown that none of the five kinds of pyrokinin peptides affect the pyloric rhythm, which controls the pumping and filtering of food through the pylorus in American lobsters. They all, however, excite the gastric mill rhythm, which controls the movements of the teeth that grind up the food before it is transferred into the pylorus. Moreover, there is no significant difference among the effects of these five kinds of pyrokinin peptides. Conserved Sequence, which was predicted to produce a relatively weaker effect, proved to produce virtually identical effect as four other kinds of pyrokinin peptides. Future research will focus on studying the differences between the STG and CG to determine the cause of the varied responses between them.