The contributions of peptides, elastic ligaments, and arteries to stretch feedback in the heart of the lobster, *Homarus americanus*

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When the heart of the American lobster (*Homarus americanus*) contracts (systole), the blood, also known as haemolymph, exits the heart out of seven major arteries. At this time, the arteries as well as the six major ligaments known as alary ligaments are stretched. When the heart relaxes (diastole), haemolymph (blood) enters the heart through six valved openings in the hH D U W ¶ V V X U I D F H. Energy stored in the arteries and alary ligaments is used to restore the heart back into its relaxed configuration. This stretch causes the interior muscles of the heart to become stretched, which provides feedback to the cardiac ganglion, triggering the heart to contract again. It is hypothesized that most of the stretch receptors that provide feedback to the cardiac ganglion are in the posterior section of the heart, as that is where the cardiac ganglion lies (Burger 1953).

The heart of *H. americanus* is easy to study *in vivo* and provides an excellent model for stretch feedback, as the invertebrate system is simple but similar to the more complex stretch systems of vertebrate hearts. The Johnson-Dickinson lab has studied how these hearts maintain stability while still allowing for change, namely through modulation with neuropeptides. Past research on *H. americanus* has measured the heart across three major dimensions: the longitudinal dimension, which extends from the most posterior end to the most anterior end, the anterior transverse dimension, which extends across the anterior side of the heart from left to right, and the posterior transverse dimension, which extends across the posterior side of the heart from left to right.

This research has mostly been performed on isolated hearts that have been removed from the carapace and from stretch imposed by ligaments and arteries. This summer I performed experiments *in vivo* with an intact lobster heart. By marking the heart with charcoal to indicate the ends of my three major dimensions and utilizing Physics Tracker software, I measured the change in length from systole to diastole, the stretch across each dimension, and heartbeat frequency. I performed a series of tests that exposed beating lobster hearts to control saline or saline with 10^{-9} M SGRN.

Absolute and relative length changes vary across the heart (Figure 1) with the greatest relative length change occurring longitudinally. SGRN increased length changes, but surprisingly, not in all dimensions.

L/length in systole) before, with, and after SGRN for the longitudinal, anterior transverse, and posterior transverse dimensions of a O R E V W H U ¶ V K H D U W 2 Y H U D O O S

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References:

Burger, JW, Smythe, CM. (1953) The general form of circulation in the lobster, *Homarus*. Journal of Cellular Physiology 42: 369-383

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