Mechanisms underlying variable responses to isoforms of the neuropeptide C-type allatostatin (AST-C) in the American lobster, *Homarus americanus*

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Central pattern generators (CPGs) are neural networks that produce steady, rhythmic patterned outputs that activate particular muscles and consequently create repeated rhythmic movements (Dickinson et al., 2006). CPGs generate rhythmic motor outputs and control breathing, locomotion and any repetitive movement (Dickinson et al., 2006). The cardiac ganglion (CG) is a model CPG, which controls the contraction of the neurogenic heart of the American lobster, *Homarus americanus* (Cooke, 2002). In the absence of any other inputs, the CG produces unchanging rhythmic beats (Cooke, 2002). The pattern of the heartbeat is susceptible to change depending on the environment, and this flexibility is a homeostatic necessity. A major mechanism that drives those changes is the presence of neuromodulators, many of which are peptides (Christie, Stemmler, & Dickinson, 2010).

The neuropeptide C-type Allatostatin (AST-C) modulates the cardiac neuromuscular system of the American lobster. Currently, three isoforms of AST-C are known: AST-C I, ASTC-II and AST-C III (Dickinson et al., 2018). Research suggests that all three AST-C peptides usually lead to decreases in CG contraction frequency when perfused through an isolated lobster heart (Dickinson et al., 2018). However, all three isoforms can induce a wide range of responses in contraction amplitude, which variably increase or decrease (Dickinson et al., 2018). The underlying mechanisms responsible for the array of responses to AST-C peptides in different animals are unknown. For example, the differences in receptor distributions, ion channels underlying the responses or quantities of available second messengers could cause varying increases or decreases in contraction amplitude.

We hypothesize that the variation in response to AST-C peptides is due to differences in AST-C receptor expression levels in the cardiac ganglion among lobsters. This summer, my research consisted of recording the response of each lobster heart to perfusion of AST-C I and AST-C III. I cannulated the posterior artery and connected the anterior arteries to a force transducer, which allowed me to measure the frequency and amplitude of the heartbeat. I isolated RNA from dissections of the brain, hypodermis, eyestalk ganglia, cardiac muscle and cardiac ganglion to determine the receptor distribution in individual animals. These cardiac ganglia samples are in the process of being sequenced using Illumina RNASeq. These data will allow us to map the receptor transcripts onto a preexisting cardiac ganglion transcriptome to determine if differences exist among lobsters with varying physiological responses.

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Joint project with Audrey Muscato and Madeline Rolph

Funded by the NSF (IOS-13544567, IOS-1353023) and NIH INBRE (8P20GM103423-12)

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