The role of behavioral diversity in determining the extent to which neuronal patterns are modulated

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Central pattern generators (CPGs) are neural networks that control the rhythmic outputs necessary for movement and flexibility. CPGs can be modulated so that organisms have the behavior flexibility necessary to adapt to changes in both their internal and external environments: for instance, to go from a walk to a run, or to digest different kinds of food. The neuromodulators that act on CPGs are typically peptides or amines that can either increase or decrease electrical output or modify action potential firing patterns.

Considerable work has been done in Professor Patsy Dickinson's lab to better understand the role of modulators in the crustacean stomatogastric nervous system (STNS). The STNS is composed of multiple ganglia that control the movement of the foregut. The STNS is modulated by neurohormones and modulators that are released locally or hormonally. Modulation of the foregut regulates the rhythmic behaviors that are responsible for foregut motion and flexibility. In another crustacean system, the neurogenic heart, modulators act on the cardiac ganglion to regulate the amplitude and frequency of contractions.

Upwards of seventy different types of neuromodulators have been identified in the STNS of decapod crustaceans. However, the specific roles of these neuromodulators as well as the reason for their abundance is undetermined. We have hypothesized that since a system is modulated according to its need for movement and flexibility, decapods that must digest a greater variety of food types will have more neuromodulation in the STNS than those with a specialized diet. This hypothesis has been supported by preliminary data that show that the opportunist-feeding crabs, *Chionocetes opilio* and *Libinia emarginata,* have higher STNS modulatory capacity than their majoid superfamily member, *pugettia producta,* which has a highly-specialized kelp diet.

Because *Pugettia* and *Labinia* are very closely related, they should not have many differences in biological function due to phylogeny; their primary distinctions are their feeding habits. For this reason, we predicted that opportunist and specialized feeders would have equal amounts of cardiac modulation.