Does the need for flexibility in movements drive neuromodulatory capacity?

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Central pattern generators (CPGs) are small neural networks that generate rhythmic outputs, which control rhythmic behaviors such as locomotion and respiration (Dickinson 2006). The rhythmic outputs of CPGs need to be able to adapt to changes in the internal and external environment (e.g. a giraffe changing from a walk to a run when it sees a lion). Neuromodulation can allow for these changes in rhythmic output, thus allowing behavioral flexibility (Dickinson 2006).

The crab stomatogastric nervous system (STNS) is one model that can be used to study CPGs. Bursts of action potentials (nerve impulses) from the neurons in the STNS control the muscle movements of the stomach. The CPG that I focused on is the pyloric pattern, which controls the movements of the pylorus (the portion of the stomach that filters food). The core pyloric pattern is made up of bursts of action potentials from LP, PY, and PD neurons. For simplicity purposes, the names of neurons have been abbreviated. The left portion of the figure below illustrates this bursting pattern. Each vertical line is an action potential and a collection of them is considered a burst.

Previous research found that crabs with a low need for flexibility in diet have a low neuromodulatory capacity, while crabs with a high need for flexibility in diet have a high neuromodulatory capacity (Dickinson et al. 2008).

Dickinson PS. 2006. Neuromodulation of central pattern generators in invertebrates and vertebrates. Curr Opin Neurobiol. 16(6)6: 04-614.
Dickinson PS, Stemmler EA, Christie AE. 2008. The pyloric neural circuit of the herbivorous crab *Pugettia producta* shows limited