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**Title:**

Differential Resilience to Perturbation of Circuits with Similar Performance

**Abstract:**

Experimental work on the crustacean stomatogastric ganglion (STG) has revealed a 2-6 fold variability in many of the parameters that are important for circuit dynamics. Theoretical work shows that similar network performance can arise from diverse underlying parameter sets. Together, these lines of evidence suggest that each individual animal, at any moment in its life-time, has found a different solution to producing “good enough” motor patterns for healthy performance in the world. This poses the question of the extent to which animals with different sets of underlying circuit parameters can respond reliably and robustly to environmental perturbations and neuromodulation. We use both experimental and computational methods to study the effects of temperature, pH and neuromodulation on the pyloric rhythm of crabs. While all animals respond remarkably well to substantial perturbations, extreme perturbations that produce system “crashes” reveal the underlying parameter differences in the population. Moreover, models of homeostatic regulation of intrinsic excitability give insight into the kinds of mechanisms that could give rise to the highly variable solutions to stable circuit performance.