

New ways for experimentalists and modelers to look at CPGs

Allen Selverston (UCSF)

Abstract: The central pattern generators (CPGs) of invertebrates have features that make them uniquely profitable for examining the cellular mechanisms underlying rhythm generation and pattern formation. Early ideas about hard wired circuits have been replaced by circuits that demonstrate a high degree of flexibility in response to neuromodulators and sensory feedback. Identified neurons and synapses, a hallmark of invertebrate CPGs, are now thought to have a range of conductances and strengths permitting degenerate solutions to neuronal computations. These advances will have significant impact on modeling studies, a necessary component of CPG research. To illustrate this, I will demonstrate how standard modeling techniques were used to examine the dynamics of a three neuron network in the lobster stomatogastric ganglion. Neurons were connected with asymmetrical synapses similar to the LP-PD-PY network. Considerable insight was gained regarding the relative roles of intrinsic bursters, networks and hybrid circuits as the basis for rhythmogenesis and pattern formation. The results also provided some insight into the robustness-flexibility dilemma. Other models have started to examine networks with variable parameters and suggest how clusters of different conductance parameters can lead to similar patterns of activity. Finally I will suggest future research trends for the analysis of invertebrate CPGs that incorporate new molecular techniques.