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A neuronal model for learning to keep a rhythmic beat.

When listening to music, we typically lock onto and move to a beat. Behavioral studies on such synchronization (Repp 2005) abound, yet the neural mechanisms remain poorly understood. Beat perception and generation involves time estimation and plasticity for a neural circuit that can adapt and learn a rhythm. In the case of music, the range of beat frequency includes 1-6 Hz. Some models of beat perception hypothesize that the brain contains an array of self-sustaining entrainable oscillators, which resonate when forced with periodic stimuli, i.e. musical rhythms (Large et al. 2010). In contrast, our approach, in the simplest case, assumes a single beat generator neuron (BG) which can change its intrinsic frequency and phase to match that of an external rhythm, say a metronome. Our model implements an error correction scheme and includes counting of naturally occurring gamma frequency cycles to estimate time intervals. The model quickly learns new rhythms, within a few cycles as found in human behavior. When the stimulus is removed the BG continues to produce the learned rhythm in accordance with a synchronization continuation task.