

A computational model of mechanisms controlling experience-dependent reorganization of representational maps in auditory cortex

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Cortical representations of sound can be modified by repeatedly pairing presentation of a pure tone with electrical stimulation of neuromodulatory neurons located in the basal forebrain (Bakin & Weinberger, 1996; Kilgard & Merzenich, 1998a). We developed a computational model to investigate the possible effects of basal forebrain modulation on map reorganization in the auditory cortex. The model is a self-organizing map with acoustic response characteristics mimicking those observed in the mammalian auditory cortex. We simulated the effects of basal forebrain modulation, using parameters intrinsic to the self-organizing map, such as learning rate (controlling the adaptability of map nodes) and the neighborhood function (controlling the excitability of map nodes). Previous research has suggested that both parameters can be useful for characterizing the effects of neuromodulation on plasticity (Kohonen, 1993; Myers et al., 1996; Myers, Ermita, Hasselmo, & Gluck, 1998). The model successfully accounts for experimentally observed effects of pairing basal forebrain stimulation with the presentation of a single tone, but not of two tones, suggesting that auditory cortical plasticity is constrained in ways not accounted for by current theories. Despite this limitation, the model provides a useful framework for describing experience-induced changes to variations in the excitability and adaptability of cortical neurons produced by neuromodulation. *Cognitive, Affective, & Behavioral Neuroscience*, 2001, 1 (1), 37-55.