Abstract View

IS ATTENTIONAL GAIN MODULATION OPTIMAL AT GAMMA FREQUENCIES?

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Coupled networks of cortical interneurons synchronize in the gamma frequency range (30-80 Hz) when activated by glutamate or acetylcholine. The firing rate, f, of cortical output
neurons in response to sustained depolarizations mimicking excitatory afferents, increased with the level of input synchrony S of the interneurons. The firing rate versus depolarization (f-I) curves for different values of S can be approximately rescaled into each other over a broad drive range. Modulating synchrony is, hence, a mechanism for
multiplicative gain modulation. The dynamic range R quantified the strength of the gain modulation. R=(firing rate for maximum synchrony)/(firing rate for minimum synchrony). R attained its maximum value when the period was of the same order as the inhibitory synaptic time constant -- the gamma frequency range. The model results were confirmed experimentally using the dynamic clamp technique to inject inhibitory conductance wave forms in rat cortical neurons in vitro. Based on the model and in vitro results we propose that selective attention induced changes in the gamma frequency range synchrony of inhibitory networks result in multiplicative gain modulation with a large dynamic range of excitatory cells in cortical output layers.

Citation:
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