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# Amplification of asynchronous inhibition-mediated synchronization by feedback in recurrent networks

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Theoretical studies of synchronized oscillatory acitivity in the cortex have proposed that principal neuron synchrony can be mediated by short-latency, rapidly-decaying inhibition. However, in the olfactory bulb, the inhibitory granule cells produce long lasting, small amplitude, asynchronous and aperiodic inhibitory input and thus the narrow time window that is required to synchronize spiking does not exist. Instead, it has been suggested that correlated output of the granule cells could synchronize uncoupled mitral cells through stochastic synchronization (SS) [1]. Almost all work on SS presumes that the correlation is imposed and fixed. Building on theory that we and others have developed [1,2], we show that increased synchrony in the mitral cells could produce an increase in granule cell activity for those granule cells that share a synchronous group of mitral cells. Common granule cell input increases the input correlation to the mitral cells and hence their synchrony by providing a positive feedback loop in correlation. Thus we demonstrate the emergence and temporal evolution of input correlation in recurrent networks with feedback. We explore several theoretical models of this idea, ranging from spiking models to an analytically tractable model. The results obtained are used to motivate the investigation of activity in recurrently connected cortical networks containing excitatory pyramidal, inhibitory fast spiking and asynchronously releasing cholecystokinin-releasing GABAergic interneurons.

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