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Burst firing regulates correlated activity in neurons

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Understanding how sensory information is encoded by populations of neurons is complicated by the fact that neurons display variability in their responses to repeated presentations of the same stimulus. A further complication comes from the fact that these variabilities can be correlated. In fact, the role of correlations in neural variabilities (noise correlations) has been the focus of much debate in recent years as even a small amount of correlation between a pair of neurons can have dramatic effects on information transmission by neural populations [1]. Recent experimental evidence has shown that burst firing can modulate the amount of noise correlations displayed by neural populations [2]. Here we investigate the role of intrinsic bursting dynamics in model neurons receiving correlated input. These model neurons transition from a tonic firing regime to a bursting regime as the amount of depolarizing current is varied. We find that, given an input correlation c, the output correlation R between neural pairs in the network is less when both neurons are in bursting regime than when they are in the tonic regime. Our theoretical results are supported by experimental results obtained from a slice preparation. We show that intrinsic burst dynamics can decorrelate neural populations and therefore regulate their information transmission properties.

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