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Robust Motion Processing in the Visual Cortex AUDREY SEDERBERG, JULIA LIU, MATTHIAS KASCHUBE, Princeton University — Direction selectivity is an important model system for studying cortical processing. The role of inhibition in models of direction selectivity in the visual cortex is not well understood. We probe the selectivity of an integrate-and-fire neuron with a noisy background on top of a deterministic input current determined by a temporal-lag model for selectivity, including first only excitatory inputs and later both excitatory and inhibitory input. In this model, postsynaptic potentials are fully synchronous for the preferred direction and maximally dispersed in time for the null direction. Further, any inhibitory inputs lag excitatory inputs, as Priebe and Ferster have observed (2005). At any level of input strength, the selectivity is weak when only excitatory inputs are considered. The inclusion of inhibition significantly strengthens selectivity, and this selectivity is preserved over a wide range of background noise levels and for short stimulus durations. We conclude that inhibition likely plays an essential role in the mechanism underlying direction selectivity.

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