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Inhibitory Synapses Are Repeatedly Assembled and Removed at Persistent Sites In Vivo

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At present, it reveals that approximately 30% reside on dendritic spines, rather than on the dendritic shaft. Inhibitory synapses on dendritic spines are always adjacent to an excitatory synapse on the same spine and can directly shunt excitation onto that synapse. Yet, it is unknown how rapidly inhibitory synapses on dendritic spines or shafts can be assembled or removed in vivo, and how such changes in inhibitory synapses relate to changes in neighboring excitatory synapses. In this article, the authors used three-color labeling and spectrally resolved two-photon microscopy to monitor in parallel the daily structural dynamics of excitatory and inhibitory postsynaptic sites on the same neurons in mouse visual cortex in vivo. They found that dynamic inhibitory synapses often disappear and reappear again in the same location. The starkest contrast between excitatory and inhibitory synapse dynamics was on dually innervated spines, where inhibitory synapses frequently recur while excitatory synapses were stable. They also found that monocular deprivation shortened inhibitory synapse lifetimes and lengthens intervals to recurrence, resulting in a new dynamic state with reduced inhibitory synaptic presence. In summary, they observed a new, reversible type of synapse dynamics, unique to inhibitory synapses, which could provide flexible, input-specific gating of stable excitatory connections.