Inhibitory connectivity defines the realm of excitatory plasticity

Recent experiments directly support the long-held hypothesis that changes in the synaptic architecture underlie the encoding of information for long-term storage. However, they also demonstrate substantial volatility of the excitatory connectivity in the absence of any learning. This challenges the hypothesis that stable synaptic connections are necessary for long-term maintenance of the acquired information. Here we measure ongoing synaptic volatility and use theoretical modeling to study its consequences on cortical dynamics. We show that in the balanced cortex, the patterns of neural activity are determined by the inhibitory connectivity, making them robust to the ongoing volatility that does not break the balance between excitation and inhibition. By contrast, learning-induced plasticity, which transiently breaks this balance, readily and substantially reorganizes the activity patterns. These results imply that the inhibitory connectivity, rather than the excitatory one, stably maintains information over long periods of time in the volatile cortex.