Sensory experience alters specific branches of individual corticocortical axons during development.

Sensory experience can, over the course of days to weeks, produce long-lasting changes in brain function. Recent studies suggest that functional plasticity is mediated by alterations of the strengths of existing synapses or dynamics of dendritic spines. Alterations of cortical axons could also contribute to functional changes, but little is known about the effects of experience at the level of individual corticocortical axons. We reconstructed individual layer (L) 2/3 pyramidal neurons filled in vivo in developing barrel cortex of control and partially sensory-deprived rats. L2 axons had larger field spans than L3 axons but were otherwise equivalently affected by deprivation. Whisker trimming over approximately 2 weeks markedly reduced overall length of axonal branches in L2/3, but individual horizontal axons were as likely to innervate deprived areas as spared ones. The largest effect of deprivation was instead to reduce the length of those axonal branches in L2/3 oriented toward deprived regions. Thus, the location of a branch relative to its originating soma, rather than its own location within any specific cortical column, was the strongest determinant of axonal organization. Individual axons from L2/3 into L5/6 were similarly altered by whisker trimming although to a lesser extent. Thus, sensory experience over relatively short timescales may change the patterning of specific axonal branches within as well as between cortical columns during...
development.