Critical period plasticity of axonal arbors of layer 2/3 pyramidal neurons in rat somatosensory cortex: layer-specific reduction of projections into deprived cortical columns.

Abstract:
We examined the effect of whisker trimming during early postnatal development on the morphology of axonal arbors in rat somatosensory cortex. Axonal arbors from populations of layer 2/3 pyramidal neurons in the D2 column were labeled by lentivirus-mediated expression of green fluorescent protein. Axonal projection patterns were compared between untrimmed control animals and animals with all whiskers in A-, B-, and C-rows trimmed (D- and E-rows left intact) from postnatal days 7 to 15 (termed from here on DE-pairing). Control animals had approximately symmetrical horizontal projections toward C- and E-row columns in both supra- and infragranular layers. Following DE-pairing, the density of axons in supragranular layers projecting from the labeled neurons in the D2 column was higher in E- than in C-row columns. This asymmetry resulted primarily from a reduction in projection density toward the deprived C-row columns. In contrast, no change was observed in infragranular layers. The results indicate that DE-pairing during early postnatal development results in reduced axonal projection from nondeprived into deprived columns and that cortical neurons are capable of structural rearrangements at subsets of their axonal arbors.