Structural basis for the role of inhibition in facilitating adult brain plasticity

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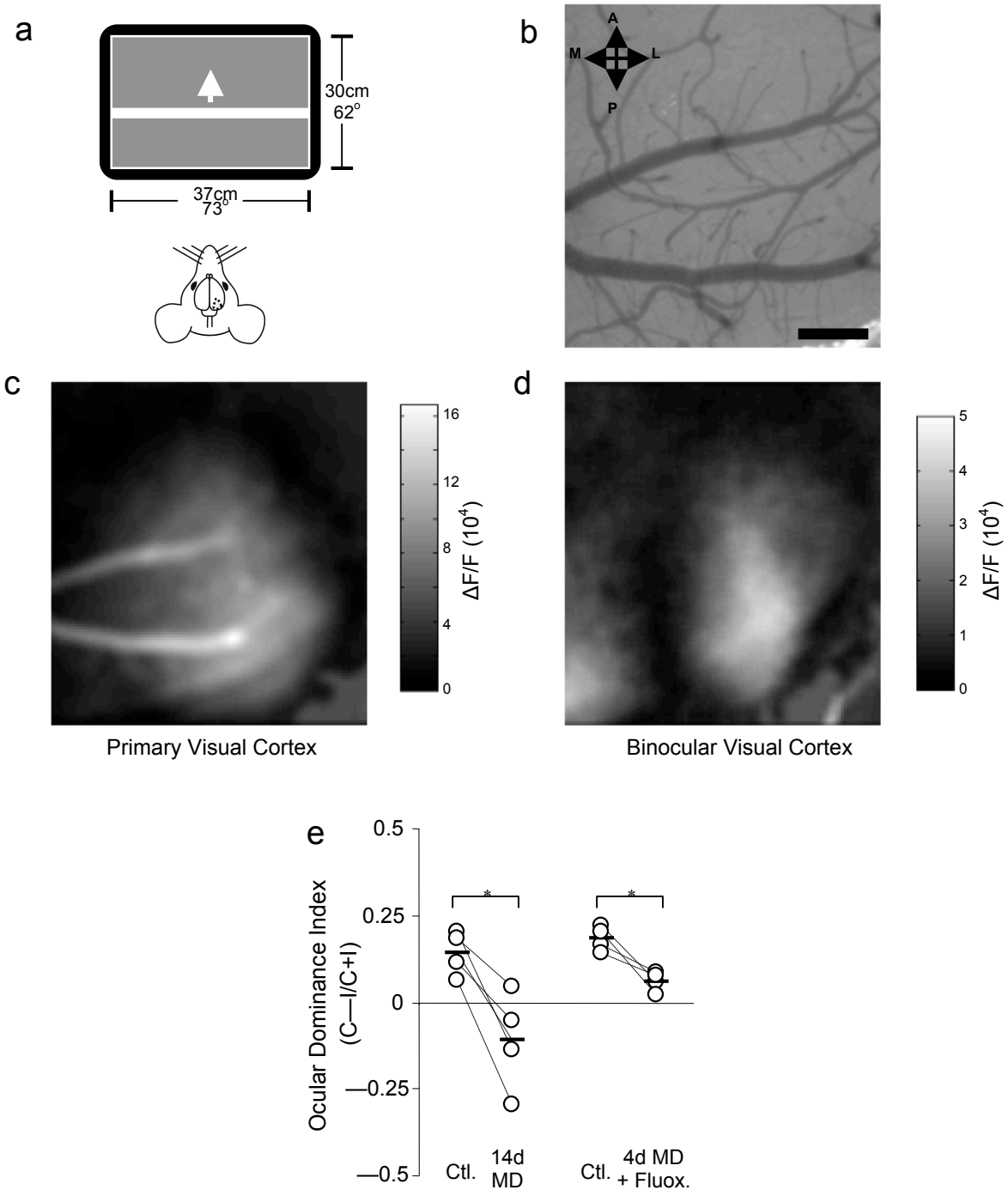
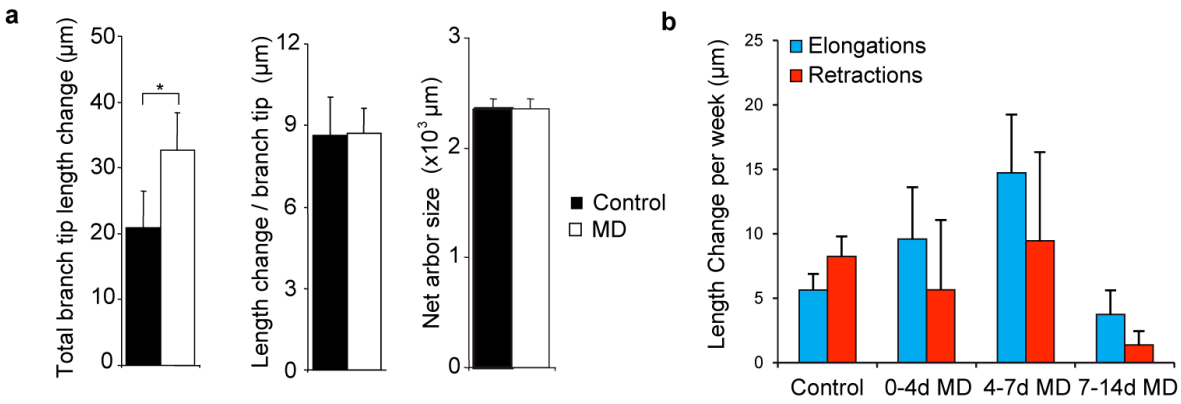
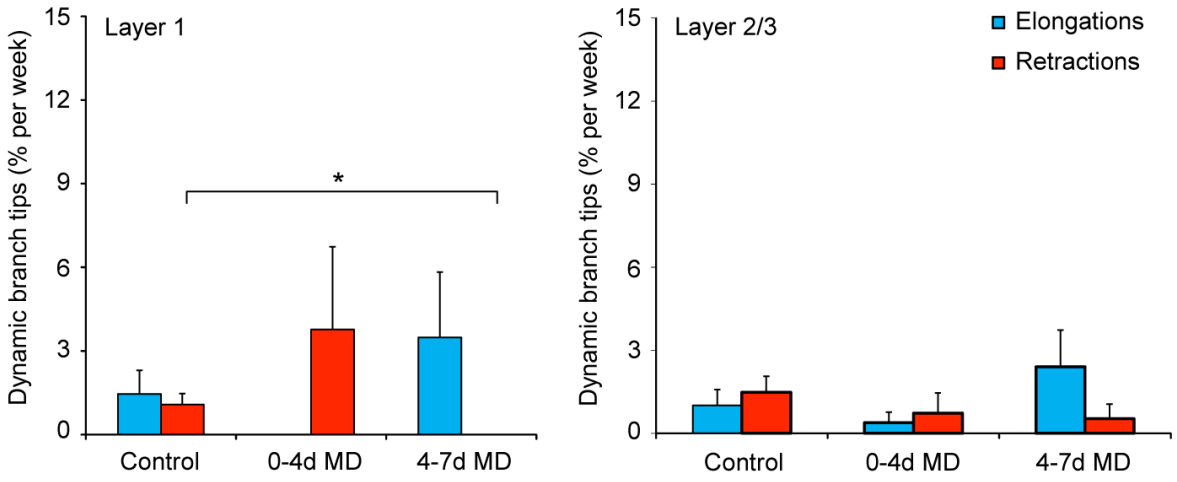
SUPPLEMENTARY FIGURES 1-6



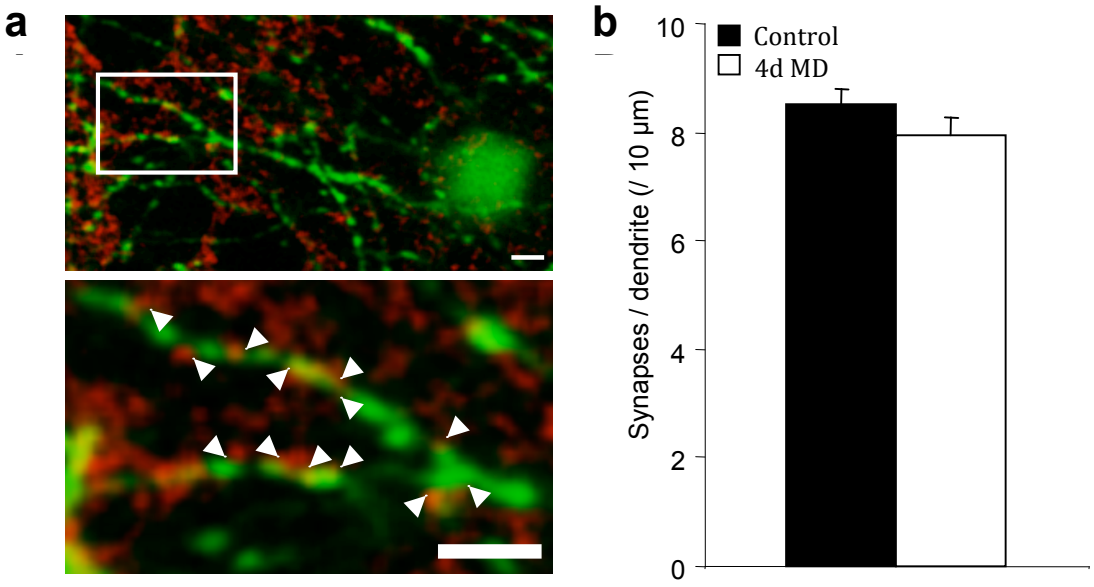
Supplementary Figure 1. Optical Mapping of Intrinsic Signal (a) Schematic of upwards drifting horizontal bar presented as visual stimulus for eliciting intrinsic signal responses in visual cortex. (b) Cortical blood vessel pattern of the region of interest. Scale bar: 200 µm. (c and d) Map of cortical responses measured as changes in reflectance upon visual stimulation to (c) both eyes, identifying primary visual cortex and (d) the ipsilateral eye, identifying binocular visual cortex. (e) Ocular dominance index for mice before and after a 14-day monocular deprivation (14d MD) (left) or 4-day MD (4d MD) with fluoxetine treatment (right). Individual mice are denoted with open circle. Black bar indicates average values per condition (14d MD; n = 4 mice, 4d MD + Fluoxetine; n = 4 mice) (* $p < 0.05$).



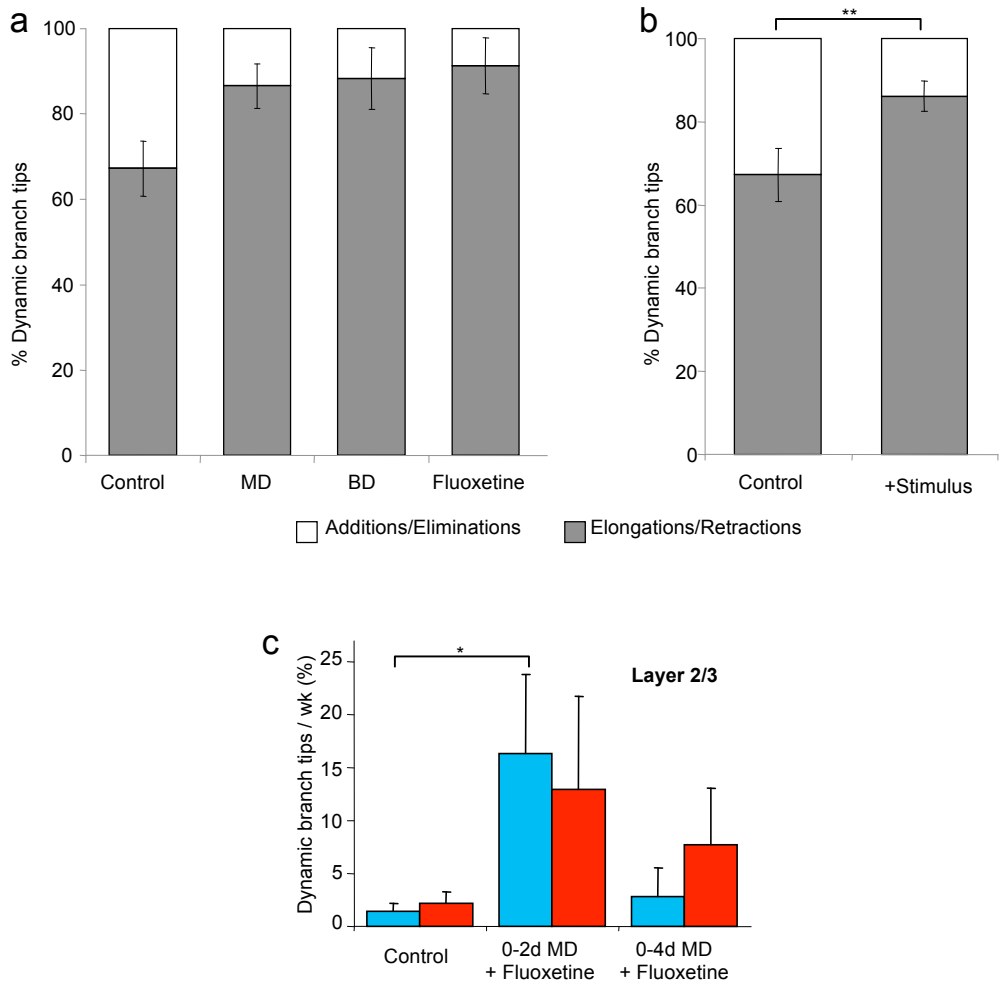
Supplementary Figure 2. Monocular Deprivation in Binocular Visual Cortex Increases the Number of Dynamic Branch Tips, But Preserves Overall Branch Tip Length (a) Quantification of branch tip length changes in binocular visual cortex before and during monocular deprivation: total branch tip length change per cell (left), length change per branch tip (middle), and overall change in net arbor size (right) (b) Total branch tip elongations vs. retraction length (right) in binocular visual cortex before and during monocular deprivation. (* $p < 0.05$). Error bars, s.e.m.



Supplementary Figure 3. L2/3 Elongations and Retractions are Balanced in Monocular Visual Cortex during MD. Rates of dendritic branch tip elongation (blue) and retraction (red) in L1 and L2/3 of monocular visual cortex, before and during monocular deprivation. (n = 12 cells from 12 mice, L1: 196 branch tips. L2/3: 291 branch tips) (* $p < 0.05$). Error bars, s.e.m.

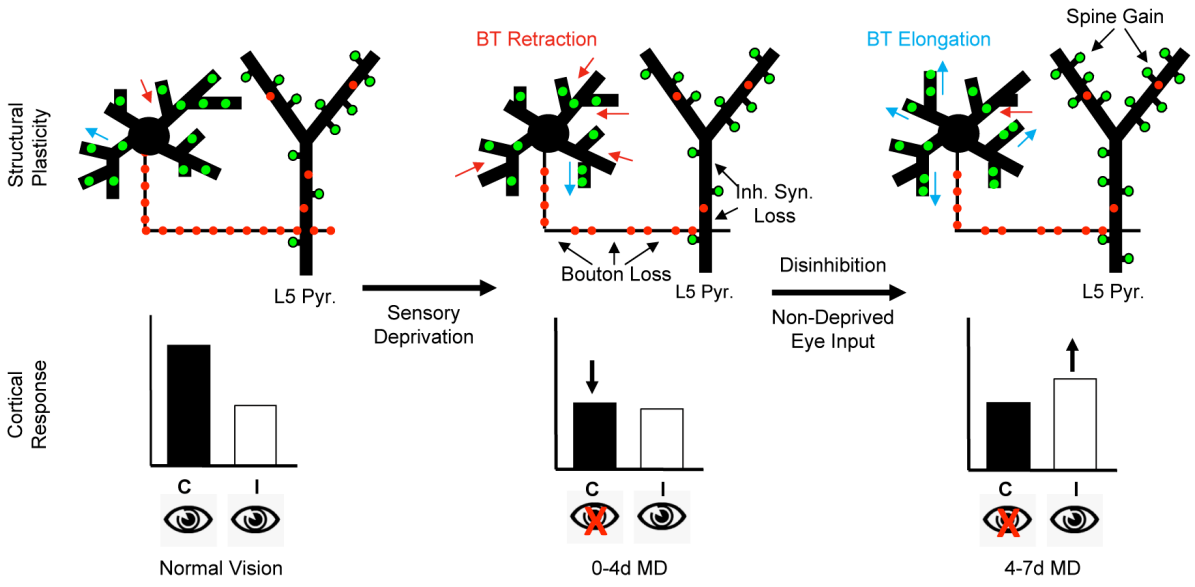


Supplementary Figure 4. Monocular Deprivation Does Not Alter Excitatory Synapse Density on Stable Interneuron Dendrites (a) Stable dendritic branch segments of GFP-labeled superficial L2/3 interneurons in binocular visual cortex (in green) after immunohistochemical staining of excitatory pre-synaptic terminals by VGlut1 (in red). Examples of putative excitatory dendritic synapses are indicated with white arrows (bottom panel). (b) Quantification of excitatory synapse density in control mice versus mice after 4d MD (control; n = 5 mice, 14 cells, 3770 synapses, 4d MD; n = 5 mice, 11 cells, 1971 synapses). Error bars, s.e.m. Scale bars: 5 µm.



Supplementary Figure 5. Branch Tip Dynamics During Fluoxetine Treatment

(a) Comparison between elongations/retractions of existing branch tips versus additions/eliminations of entire branch tips during monocular deprivation, binocular deprivation, and fluoxetine treatment in binocular visual cortex. (b) Comparison between elongations/retractions of existing branch tips versus additions/eliminations of entire branch tips across all visual or pharmacological stimuli presented in (a). (n = 44 cells from 42 mice, Mann-Whitney *U*-test, ** $p < 0.02$). Error bars, s.em. (c) Rates of branch tip elongations and retractions in L2/3 from 0–2d MD and 2–4d MD during fluoxetine treatment. (control; n = 8 cells from 8 mice, 115 branch tips, 0–2d MD and 2–4d MD + fluoxetine; n = 9 cells from 8 mice, 138 branch tips, Mann-Whitney *U*-test, * $p < 0.05$)



Supplementary Figure 6. Model for Local Structural and Synaptic Changes During Adult Ocular Dominance Plasticity. Sensory deprivation resulting in an initial depression of the deprived eye response leads to an initial period (0–4d MD) of increased interneuron branch tip (BT) retractions (red arrows) accompanied by the loss of inhibitory axonal boutons and inhibitory synapses on apical dendrites of L5 pyramid neurons. The resulting disinhibition coupled with non-deprived visual input contributes to the potentiation of the non-deprived eye response, L5 dendritic spine gain, and increased interneuron branch tip elongations (blue arrows) (4–7d MD) that eventually restores inhibition and limits further plasticity (>7d MD). Overall, due to a balance between the initial retractions and subsequent elongations induced by MD, net overall arbor size is unchanged despite the increase in number of dynamic events.