

Specificities in dendritic branching pattern and spine density along the dorso-ventral axis of the hippocampus

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The hippocampus is functionally segregated along the dorso-ventral axis in rodents. The dorsal hippocampus is involved in spatial memory whereas the ventral is in emotional responses. Consistently, each region receives afferents from distinct brain regions. Furthermore, within the dentate gyrus (DG), the proximal and distal portions of granule cell (GC) dendrites receive medial and lateral perforant pathway axons, respectively, which are originating from different regions of the entorhinal cortex. Differences in dendritic morphology and spine density presumably reflect differences in activities of their partner axon termini. Here, we investigate the morphological features of the GC in the dorsal and the ventral DG, and their responses to social defeat stress as an example of emotional inputs. Visualization of single neurons by microinjection of Lucifer Yellow revealed that the branching patterns of GC dendrites are distinct between dorsal and ventral DGs; the peak of the number of intersections in Sholl analyses localized more proximal in the dorsal than in the ventral DG. Spine density of ventral DG was higher than dorsal DG. Social defeat stress was found to suppress the dendritic branching and spine densities of GCs both in dorsal and ventral DGs to similar extent. Mushroom and thin spines decreased significantly whereas stubby spines did not. The data suggest that the dendritic branching pattern and spine density of GCs are distinct between the dorsal and ventral hippocampus, but undergo uniform morphological remodeling in response to an emotional stress.