

AB050. Neuronal response to visual contrast varies as function of the cortical layer

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Background: For years, studies using several animal models have highlighted the predominant role of the primary visual area in visual information processing. Its six cortical layers have morphological, hodological and physiological differences, although their roles regarding the integration of visual contrast and the messages sent by the layers to other brain regions have been poorly explored. Given that cortical layers have distinct properties, this study aims to understand these differences and how they are affected by a changing visual contrast.

Methods: A linear multi-channel electrode was placed in the primary visual cortex (V1) of the anesthetized mouse to record neuronal activity across the different cortical layers. The laminar position of the electrode was verified in real time by measuring the current source density (CSD) and the multi-unit activity (MUA), and confirmed post-mortem by histological analysis. Drifting gratings varying in contrast enabled the measurement of the firing rate of neurons throughout layers. We fitted this data to the Naka-Rushton equations, which generated the contrast response function (CRF) of neurons.

Results: The analysis revealed that the baseline activity as well as the rate of change of neural discharges (the slope of the CRF) had a positive correlation across the cortical layers. In addition, we found a trend between the cortical position and the contrast evoking the semi-saturation of the activity. A significant difference in the maximum discharge rate was also found between layers II/III and IV, as well as between layers II/III and V.

Conclusions: Since layers II/III and V process visual contrast differently, our results suggest that higher cortical visual areas, as well subcortical regions, receive different information regarding a change in visual contrast. Thus, a contrast may be processed differently throughout the different areas of the visual cortex.

Keywords: Electrophysiology; primary visual cortex; contrast response function (CRF); current source density (CSD)

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