LAMINAR ORGANIZATION OF THE CORTICAL REPRESENTATIONS OF VIBRISSAL TEMPORAL INFORMATION.

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The cortical column is often considered as a basic unit involved with a single thalamocortical computational task. However, our results suggest that columns in the barrel cortex are involved in at least two thalamocortical computations in parallel. Single and multi units were recorded from four cortical layers of the barrel cortex of anesthetized rats: L2/3, L4, L5a and L5b. Layer 4 units were separated to "barrel units" and "septa units". Groups of whiskers were stimulated by air-puffs and single whiskers by mechanical deflections during steady-state (3s of constant frequency + 2s inter-train interval) and frequency-modulated (40% at 0.4Hz) stimulation periods. We found that neurons in different layers represent the temporal frequency of the stimulus differently. Typically, the input frequency was represented by amplitude in Layers 4 (barrels) and 5b (the "lemniscal" layers) and by latency in layers 2/3 and 5a (the "paralemniscal" layers). Both these coding schemes resulted in a spike-count representation. These representations were highly consistent in the input layers, 4 (barrels) and 5a, while layers 5b and 2/3 exhibited some variability in response type. Preliminary results indicate that layer 4 septa neurons responded similarly to layer 5a neurons. These results indicate that neurons of the same cortical column represent stimulus features differently, according to the source of their afferents. This suggests that thalamocortical loops of different pathways, although terminating within the same cortical columns, perform different computations.
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