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Titel des Beitrags: Spatial organization of neuronal population responses in layer 2/3 of rat barrel cortex.

Abstract: Individual pyramidal neurons of neocortex show sparse and variable responses to sensory stimuli in vivo. It has remained unclear how this variability extends to population responses on a trial-to-trial basis. Here, we characterized single-neuron and population responses to whisker stimulation in layer 2/3 (L2/3) of identified columns in rat barrel cortex using in vivo two-photon calcium imaging. Optical detection of single action potentials from evoked calcium transients revealed low spontaneous firing rates (0.25 Hz), variable response probabilities (range, 0-0.5; mean, 0.2 inside barrel column), and weak angular tuning of L2/3 neurons. On average, both the single-neuron response probability and the percentage of the local population activated were higher in the barrel column than above septa or in neighboring columns. Within the barrel column, mean response probability was highest in the center (0.4) and declined toward the barrel border. Neuronal pairs showed correlations in both spontaneous and sensory-evoked activity that depended on the location of the neurons. Correlation decreased with increasing distance between neurons and, for neuronal pairs the same distance apart, with distance of the pair from the barrel column center. Although neurons are therefore not activated independently from each other, we did not observe precisely repeating spatial activation patterns. Instead, population
responses showed large trial-to-trial variability. Nevertheless, the accuracy of decoding stimulus onset times from local population activity increased with population size and depended on anatomical location. We conclude that, despite their sparseness and variability, L2/3 population responses show a clear spatial organization on the columnar scale.