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Imprecise whisker map in the neonatal rat barrel cortex

Mitrukhina O., Suchkov D., Khazipov R., Minlebaev M.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2014 The Author. The somatosensory barrel cortex in rodents contains a topographic map of the facial whiskers where each cortical barrel is tuned to a corresponding whisker. However, exactly when this correspondence is established during development and how precise the functional topography of the whisker protomap is at birth, before the anatomical formation of barrels, are questions that remain unresolved. Here, using extracellular and whole-cell recordings from the barrel cortex of 0-to 7-day-old (P0-7; P0=day of birth) rat pups in vivo, we report a low level of tuning to the principal whisker at P0-1, with multiple adjacent whiskers evoking large multi- and single-unit responses and excitatory postsynaptic currents in cortical neurons. Additionally, we found broad and largely overlapping projection fields (PFs) for neighboring whiskers in the barrel cortex at P0-1. Starting from P2-3, a segregated whisker map emerged, characterized by preferential single whisker tuning and segregated whisker PFs. These results indicate that the functional whisker protomap in the somatosensory cortex is imprecise at birth, that for 2-3 days after birth, whiskers compete for the cortical target territories, and that formation of a segregated functional whisker map coincides with emergence of the anatomical barrel map.

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Keywords

Development, EEG patterns, Electrophysiology, Neonatal rat, Somatosensory cortex