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# Layer specific development of neocortical pyramidal to fast spiking cell synapses

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## Abstract

© 2016 Voinova, Valiullina, Zakharova, Mukhtarov, Draguhn and Rozov. All cortical neurons are engaged in inhibitory feedback loops which ensure excitation-inhibition balance and are key elements for the development of coherent network activity. The resulting network patterns are strongly dependent on the strength and dynamic properties of these excitatory-inhibitory loops which show pronounced regional and developmental diversity. Therefore we compared the properties and postnatal maturation of two different synapses between rat neocortical pyramidal cells (layer 2/3 and layer 5, respectively) and fast spiking (FS) intemeurons in the corresponding layer. At P14, both synapses showed synaptic depression upon repetitive activation. Synaptic release properties between layer 2/3 pyramidal cells and FS cells were stable from P14 to P28. In contrast, layer 5 pyramidal to FS cell connections showed a significant increase in paired pulse ratio by P28. Presynaptic calcium dynamics also changed at these synapses, including sensitivity to exogenously loaded calcium buffers and expression of presynaptic calcium channel subtypes. These results underline the large variety of properties at different, yet similar, synapses in the neocortex. They also suggest that postnatal maturation of the brain goes along with increasing differences between synaptically driven network activity in layer 5 and layer 2/3.

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## Keywords

Development, Excitation, Interneurons, Neocortex, Synapses